

Communicable diseases monitored by disease surveillance in Kottayam district, Kerala state, India

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Background & objectives: A disease surveillance model developed in the North Arcot district, Tamil Nadu, was found to be practical, efficient, inexpensive and useful for public health action to monitor the success of ongoing interventions and to detect and intercept outbreaks. It was centred in the private (voluntary) sector with full co-operation and participation by the government sector. As Kerala state wanted to replicate this model in all districts, one district was chosen to pilot test it centred within the existing district public health system, soliciting participation from the private sector. A two-year (1999-2001) performance of this model is presented.

Methods: After elaborate preparations including the selection of 14 diseases to be reported and training of doctors in the private sector health care institutions and doctors and paramedical staff in all government health centres and hospitals, printed post cards were widely distributed. The business reply system was used so as to avoid handling postage stamps. Cards were received by the nodal officer in the district public health office and checked on a daily basis to detect disease prevalence and evidence of clustering in time and space. Swift action was taken on detecting case clustering. A monthly bulletin containing disease summaries and other useful information was freely distributed to all reporting centres.

Results: On an average, just over 100 disease reports were received every month. The most frequently reported diseases were, in the descending order, leptospirosis, acute dysentery, typhoid fever and acute hepatitis. Among vaccine-preventable childhood diseases, only measles was reported, but no diphtheria, tetanus or whooping cough. Several outbreaks were detected early and interventions applied to intercept them. The most striking example was that of cholera, the occurrence of which was detected swiftly for instituting highly successful control measures.

Interpretation & conclusions: The district level disease surveillance system centred in the government public health system has been highly successful. Disease surveillance was responsible for the government to obtain information on the prevalence of leptospirosis in the district. The reports enabled the public health officers to detect disease-clustering as the early signals of outbreaks and to take quick remedial measures.

Key words Cholera - communicable diseases - disease surveillance - dysentery - haemorrhagic fever - leptospirosis - malaria - measles - typhoid fever

Disease surveillance ought to be an important component of public health programme in every country¹. It has two essential purposes. One is to monitor the progress of ongoing interventions for disease reduction. For example, the childhood immunisation programme is

incomplete without surveillance for vaccine preventable diseases². Second, disease surveillance is essential for early detection of outbreaks in order to initiate investigations and control measures^{1,2}. A practical, relatively inexpensive and replicable model of disease

surveillance using the district as the population unit (district level disease surveillance, DLDS) was established in the North Arcot district (NAD) in Tamil Nadu during the 1980s². Medical staff working in both the private and the public (government) sectors reported selected diseases². To facilitate easy and rapid reporting of cases, pre-formatted, printed, self-addressed post cards with affixed postage stamps were used. The monthly disease summary bulletin of this DLDS was called 'NAD health information' or NADHI for short².

In the wake of the suspected plague outbreaks in 1994 in Maharashtra and Gujarat states, the Government of India appointed a committee to identify the causes and recommend control measures to detect and control any future outbreaks of plague or other communicable diseases³. This committee recommended that the 'NADHI model' of disease surveillance should be replicated in all districts of the country³. In 1998 the Ministry of Health and Family Welfare of Kerala state decided to replicate this model with some modifications, first in one district and if found feasible, to expand it to all districts of the State in a phased manner. Accordingly, DLDS was started in Kottayam district in July 1999 and experiences and findings, including the pattern, burden and seasonality of diseases as well as examples of

detection of and interventions against outbreaks, during July 1999 to June 2001 are reported in this paper.

Material & Methods

Kottayam district has a population of 1.95 million (2001 census). The adult literacy rate is near 100 per cent. It has one university, several institutions of higher education, one government medical college, and a college of health sciences (paramedical).

A group of physicians from the government medical college in the State capital Thiruvananthapuram and from several government and private hospitals met in 1998 to develop a list of diseases to be included for reporting by post card in the State. Business reply cards were used to avoid the distribution of postage stamps. The addressee was the deputy district medical officer of health, designated as nodal officer in-charge of DLDS. During June 1999, training sessions were conducted in all ten major towns in the Kottayam district. In each session, all medical officers of the local Primary and Community Health Centres, and the administrators or medical superintendents, physicians and paediatricians of all hospitals in the government and private sectors in the towns and all nearby places were invited. The

IF YOU SUSPECT ANY OF THE FOLLOWING, REPORT THE SAME DAY. DO NOT WAIT FOR LABORATORY CONFIRMATION TO REPORT.		DATE OF REPORT		
		Dt	Mo	Yr
Name of patient : Age : <input type="checkbox"/> M <input type="checkbox"/> F OP/IP No.				
Date of onset of illness : / / If child, Father / Mother				
Address: House name : House No Ward No.				
Ward / Area Name :				
Panchayat / Municipality : P.O.				
<input type="checkbox"/> Acute flaccid paralysis <input type="checkbox"/> Ac. Dysentery <input type="checkbox"/> Amoebic <input type="checkbox"/> Bacillary <input type="checkbox"/> Cholera or cholera-like disease <input type="checkbox"/> Diphtheria <input type="checkbox"/> Encephalitis <input type="checkbox"/> Fever with bleeding tendency <input type="checkbox"/> Hepatitis, Acute viral <input type="checkbox"/> Any other, specify :	<input type="checkbox"/> Malaria <input type="checkbox"/> Falciparum <input type="checkbox"/> Vivax <input type="checkbox"/> Measles <input type="checkbox"/> Meningitis <input type="checkbox"/> Pyogenic <input type="checkbox"/> Aseptic <input type="checkbox"/> Rabies <input type="checkbox"/> Tetanus <input type="checkbox"/> Typhoid fever <input type="checkbox"/> Whooping cough	FOR VACCINE PREVENTABLE DISEASE, SPECIFY: No of Doses DPT <input type="text"/> OPV <input type="text"/> Measles <input type="text"/>		
NAME OF REPORTING DOCTOR :				
CLINIC / HOSPITAL :				

Fig.1. The disease reporting card showing the list of disease to be reported and the demographic and epidemiological information to be provided for surveillance. During the two years of surveillance, leptospirosis was not included, but subsequently it was added as the 15th disease on the card.

diseases reporting system, its importance to public health, the case definitions of diseases to be reported and the details of filling up the reporting cards were described and discussed.

The district medical officer of health (DMOH), the nodal officer of DLDS and other supervisory staff in the office of the DMOH were also given training and instructions to receive the disease reports and to extract important information from them on a daily basis. Pending computerisation, the personnel used a manual method to detect disease clustering and to make daily tally of all reports. The detection of any clustering in time or space was to be investigated by the staff of the public health system in the district. Appropriate interventions to control outbreaks were assigned to the nodal officer under the supervision of the DMOH.

The disease-reporting card shows the list of diseases included for regular reporting (Fig.1). The last row was left for 'any other disease' considered important by the reporting physician. The instruction to doctors was to report the disease on the day of clinical diagnosis and not to wait for laboratory confirmation. There were two reasons for this decision. One was to avoid any delay in reporting, to balance against the inevitable but short delay in the post. The second was to prevent the possible excuse for not reporting a case for lack of laboratory evidence. We knew that access to laboratory diagnostic service was meager, relatively expensive and under-used even when available. Moreover, neither the microbiology laboratory in the medical college nor any in the private sector was enrolled in the national external quality assessment scheme, so that the results could be accepted as quality assured⁴.

A bulletin containing summary reports of diseases, outbreak alerts and other relevant information was printed on a monthly basis and mailed to every hospital in the district. Case definitions of diseases to be reported were given as a serial in the bulletins, reinforcing what was given during the training sessions before commencing the surveillance.

Results

The numbers of cases reported during the first and second 12-month periods are presented in the Table. There were only 4 cases of acute flaccid paralysis (AFP)

reported in the 2 yr, 3 of whom had already been reported to the polio surveillance medical officer. The fourth patient was an adult with an undiagnosed illness with paralysis. AFP is not included in the Table. There was no report on diphtheria, rabies, tetanus or whooping cough during the study period.

The most frequently reported diagnosis was acute dysentery. The most common disease in the 'any other' category was leptospirosis (Table). Discussion with several physicians indicated that most if not all cases of fever with bleeding tendency were also due to leptospirosis. If these two categories are added together, the total is 702, making leptospirosis by far the most frequently reported disease. Acute dysentery, typhoid fever and acute hepatitis were the next three most frequently reported diseases. Approximately a third of cases of dysentery were classified amoebic, a third as bacillary and the rest remained undifferentiated. All ages, infancy to old age, were affected.

The monthly distribution of all cases is presented in the Fig. 2. Nearly every disease, except encephalitis, showed obvious seasonal variations. A total of 174 cases of acute central nervous system (CNS) diseases (encephalitis and meningitis) were reported, for an average of 7 cases per month. January, June, August and October were months of high prevalence, but with

Table. Numbers of cases of various infectious diseases reported during the study period

Diseases	No. during July 1999 to June 2000	No. during July 2000 to June 2001	Total
Cholera/cholera-like disease	47	13	60
Dysentery, acute	322	221	543
Encephalitis	53	23	76
Fever with bleeding tendency	109	139	248
Hepatitis, acute	160	89	249
Malaria	89	54	143
Measles	96	54	150
Meningitis	75	23	98
Typhoid fever	177	89	266
Leptospirosis	233	221	454
Varicella	33	21	54
Mumps	39	47	86
Total	1433	994	2427

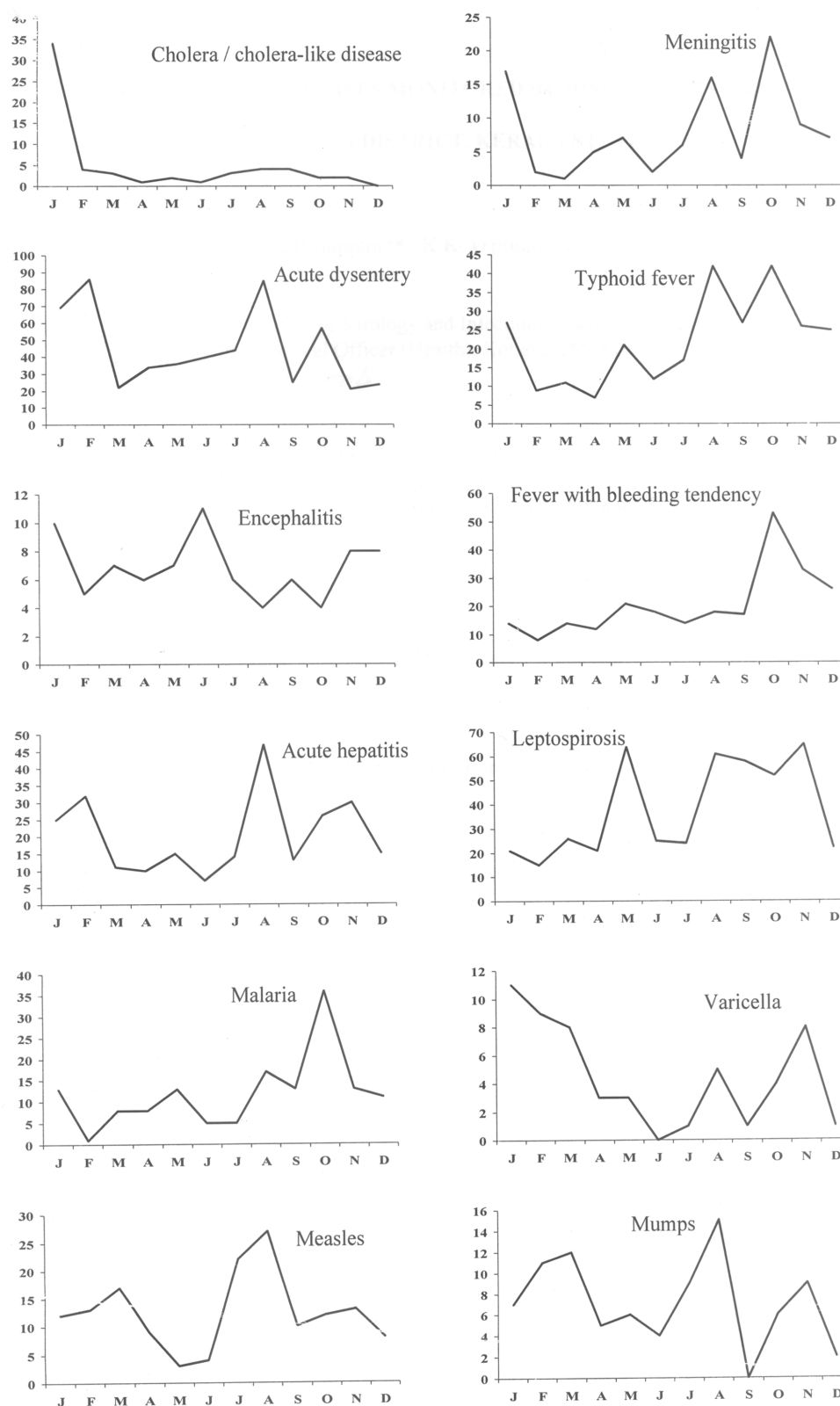


Fig.2. The monthly distribution of reported diseases, July 1999 to June 2001, in Kottayam district. The X-axis shows calendar months and the Y-axis shows the number of reported cases. The scale of the Y-axis has been adjusted to the same height even though the range of numbers varied widely. Note that acute dysentery, leptospirosis, fever with bleeding, typhoid fever and acute hepatitis were the diseases with high prevalence.

the relatively small numbers we cannot be confident of true seasonal variations. In some months 10 or more cases of encephalitis or 15 or more cases of meningitis were reported. Cases occurred in infants (meningitis) and older children, adults and the elderly (meningitis and encephalitis).

The peak of cholera in January was due to an outbreak in 2000. The first post card reporting cholera was received on January 1, 2000, followed by one report each on the next 5 days. On January 6, the nodal officer was informed of the isolation of *Vibrio cholerae* O1 in the microbiology department of the Medical College. Immediately the DMOH conferred with the district collector and district panchayat leaders, and the next day the district was declared 'cholera-affected'. A district task force and panchayat level liaison committees were established. Intensive health education efforts were undertaken, including warning against drinking water without boiling. Within a week the chlorination of 378,640 surface wells in the district was achieved. Panchayats provided the extra manpower and the health department provided technical guidance, printed information leaflets, chlorine in the form of bleaching powder, training and supervision. Together they conducted 13,670 health education meetings/classes. The supply of oral rehydration salts was streamlined through opening 7120 new distribution points. Water samples from innumerable sources and food items like clams, ice cream and locally made cold drinks were sent to the public health laboratory (in Kochi, a city in Ernakulam district). Of 1402 persons with acute gastroenteritis reporting to health care institutions in January and February of 2000, the clinical picture in 104 was typical of cholera, 71 in January and 33 in February. *V. cholerae* O1 was isolated from stool samples of 30 of them. Among the latter 3 subjects and among the rest of the cases 5 persons died. A rapid survey showed that there was no discernible epidemiological link between any two cases of bacteriologically confirmed cholera. One sample of water from a pond was positive for *V. cholerae* O1 and both O1 and O 139 were isolated from the gills of two fish. Ice used to pack fish was positive for non-cholera vibrios. The Figure shows only cases reported through the surveillance system, not those detected through investigation.

On account of high vaccine coverage, it was anticipated that no vaccine-preventable disease of childhood would

be occurring in Kerala. Indeed, no case of tetanus, diphtheria or whooping cough was reported over the two years under study. However, measles (n=150) was frequently reported. We analysed the age distribution of the 54 cases reported during January to June 2001. Of these only 11 were below 5, 15 were 6-10 yr and 28 were 10-18 yr old. The box for marking immunisation on the post card was blank for all children below 5 and for 24 older children; although this should mean they were not vaccinated, it is possible that doctors did not ask or record the information in many instances. Among the older children, 19 had been inoculated with measles vaccine.

Four post cards reporting acute hepatitis in adult residents of one panchayat (*Panachikadu*) were received during the last week of August 1999. Immediately the nodal officer arranged an investigation by the local primary health centre staff, who detected 13 more unreported cases. The families of all 17 affected persons used one source of water, a local well. Use of water from it was prohibited; water was collected for test, and the well was heavily chlorinated. The water had heavy contamination with faecal coliforms.

In January 2001, 5 post cards from one locality reported 'food poisoning'. Investigation showed that over 100 persons attending a wedding party were affected but none fatally. Curiously, only the bridegroom's relatives were involved, not the bride's. As hosts, the bride's family had served but not taken the welcome drink of fresh lemon juice. The caterer had used the easily available well water near the party hall, without realising that it had not been in use for a long time. The water was heavily contaminated with faecal coliforms.

Discussion

The major weakness in this otherwise successful surveillance system was our inability to conduct epidemiological or aetiological investigations on many of the reported diseases. There are no personnel trained in field epidemiology in the public health system. In addition, there was lack of laboratory diagnostic support service. These are not the deficiencies of the disease surveillance *per se*, but those of the existing public health system infrastructure.

Since the physicians who prepared the list of reportable diseases had not encountered leptospirosis,

and since the Director of Health Services denied information on its prevalence in the State, it was not included on the post card as a reportable disease. However, physicians did report 5 and 39 cases of leptospirosis in the very first and second months (July and August, 1999) of surveillance. In August 12 cases of 'fever with bleeding tendency' were also reported. Immediately, laboratory tests for leptospirosis diagnosis were established in the Institute. In fact physicians in the medical college had been diagnosing leptospirosis during the previous 2 yr, based on typical clinical features of the early and late phase disease and IgM antibody detected in private laboratories in a few cases. In the absence of a disease reporting system, this information remained unknown to the public health system and professional colleagues in the district and the State. Even though there were earlier publications on this disease elsewhere in the State, they remained un-noticed⁵. As in other parts of India, here also leptospirosis has been an emerging problem⁶. It was reported during every month under review, with seasonal peaks during August through November, which are the monsoon and immediate post-monsoon months. In 2000 September, experts came over from the National Leptospirosis Reference Centre at Port Blair, Andaman and Nicobar, to investigate and suggest remedial measures. Sera from 10 available febrile patients were tested and 6 were found positive in the standard microscopic agglutination test, confirming leptospirosis (Sehgal SC, personal communication). The most frequent serogroup prevalent was *Leptospira autumnalis*. Three rats were trapped in Kumarakom, a famous tourist spot in the district, and two were positive for leptospiral antibodies. A serosurvey in Kumarakom showed 16 (7%) of 221 subjects were antibody positive, confirming past infection. Of 16 goats and 6 cattle tested, only one cow was antibody positive for *L. javanica*, which is common in Tamil Nadu (Sehgal SC, personal communication). In short, Kottayam district was shown to be endemic for leptospirosis, which is an environmental risk for tourists. High prevalence of leptospirosis was also reported in May, which is pre-monsoon and it was suspected that another disease, possibly dengue fever, might have confounded the diagnosis. Dengue fever was not listed for reporting partly because it was considered rare and partly since the specificity of clinical diagnosis was considered low. Yet, in order not to miss dengue haemorrhagic fever, 'fever with bleeding tendency' was included as a reportable disease.

The peak prevalence of acute dysentery was in January-February with another high in August. Since the former is a dry period and August a rainy month, the seasonal increases do not seem to be related to rainfall. Unfortunately there was no microbiological investigation in the medical college to identify the causative pathogens of bacillary dysentery. Assuming shigellosis as the cause, it can be surmised that transmission is likely to be direct faecal contamination of food or drinking water, most probably via unclean hands or flies. We have asked the government to initiate health education for serving food in the home without touching, for example by using spoons, and to ensure that in public places food is served with tongs or gloved hands. We have also cautioned that excessive use of soap may further pollute the environment. Already the prevalence of leptospirosis indicates that alkalinity in soil has increased as the organisms survive only in alkaline pH. Unlike in developed countries where soap water goes with sewage to treatment plants, in most of Kerala wastewaters run into the ground untreated.

The magnitude of typhoid fever had not been appreciated earlier. It was reported every month, with the monthly average of 11 cases (range 2-34). The prevalence was high during August to October, months of monsoon rains. There was an outbreak of 87 cases in 1999 (August to October). An action plan of careful epidemiological studies and application of a composite intervention for its control, including judicious use of available vaccines has been proposed.

Cholera or cholera-like disease was reported in numbers ranging from 0 (9 months) to 1-4 cases (14 months), but in January, 2000 there were 33 reported cases. Since microbiological studies were not widely used to diagnose diseases, including cholera, and the purpose of surveillance included detection of early signals of spread, clinical criteria had to be applied in order not to miss cholera. Because of the fear of cholera and the connotation of having to admit poor sanitation, doctors diagnose cholera only when vibrios are detected in liquid stools. When not tested, which is more often the case, the diagnosis of acute gastroenteritis is applied to clinical cholera. Therefore we introduced the term cholera-like disease, defined as dehydrating diarrhoeal illness in any one older than 5 yr of age. The January 2000 'outbreak' was detected after six cases were reported during the first week of

January and following a telephonic report of isolation of *Vibrio cholerae* O1 in the microbiology department of the medical college. Several clinics in the district received hundreds of patients with diarrhoea during the next 4 wk. Among the several stool cultures done at the microbiology laboratory of the medical college, 30 were positive for *V. cholerae* O1. Additional samples were positive in the public health laboratory in a city in another district. A team of experts from the National Institute of Cholera and Enteric Diseases, Kolkata investigated and corroborated these findings⁷. They interpreted the epidemiology findings to suggest that a major calamitous epidemic of cholera was probably averted due to the timely intervention.

The frequency of occurrence of dysentery, typhoid fever and cholera, generally considered diseases of communities with extremely poor hygiene and sanitation, flies in the face of Kerala's reputation to enjoy very high health standards. People use multiple sources of water in the district. For example, during the cholera outbreak 378,640 wells were chlorinated. Faecal contamination as well as the entry of leptospires in well water is a possible risk factor for the high prevalence of these water-related diseases in Kerala. We have signalled to the government the urgent need for establishing investigative and analytical epidemiology and to design measures to prevent and control these diseases on an urgent basis. Such investment will have several benefits including health and economic development and is necessary to attract well-to-do tourists.

The frequency of malaria was unexpected since Kerala is considered free of malaria. Unlike for other diseases in which laboratory test was not essential, a positive blood smear was mandatory for malaria diagnosis. There was no case in February 2000 and only one case in February 2001. During August to October 2000 a total of 51 cases were reported, suggesting an outbreak.

Another unexpected finding was the 150 reports on measles. Its seasonal increases were in July and August and low prevalence in May and June. Obviously the success of immunisation against measles is incomplete and the health department has been advised to investigate at the State level the immunisation coverage and also to

explore the need for offering a second dose of measles vaccine at an appropriate age. The upward shift of age of measles is most probably due to vaccination and is clear indication that the current one-dose policy is inadequate to control it.

The government accepted the first year's performance of Kottayam DLDS as satisfactory and it was replicated in two more districts in 2000 (Alappuzha) and 2001 (Ernakulam). Based on the finding of leptospirosis in all three districts, it was included as reportable disease on the post cards printed subsequently. During 2001-2002, DLDS was extended to other districts also; thus, as of October 2002, all 14 districts in the State have established DLDS and the system was handed over to the state health department for further management. Based on the success of DLDS the government has agreed to expand the role of the Kerala State Institute of Virology and Infectious Diseases (KSIVID) to be the nodal centre to supervise district level laboratories, to train personnel in microbiology and epidemiology and to conduct outbreak investigations.

In conclusion, the post card based disease reporting has been effective as a tool of public health. It is suitable for obtaining early signals of disease clustering and also to capture any unusual disease of consequence if it occurred in a cluster. In Thiruvananthapuram district a large outbreak of mumps was detected through DLDS⁸. Thus, in the current global scene of emerging and re-emerging diseases, this surveillance system appears to be suitable for the detection of signals of unusual diseases. Since any one with access could read the post card, information cannot be kept confidential. Therefore we have suggested that the card be replaced with the foldable letter format (generally known as inland letter) so that the printed form and the filled in data are not readable without opening. Once this system is well established and physicians become habituated to reporting, the list of diseases could be revised to include additional ones of local relevance.

For those who wish to replicate this model, the success factors must be enumerated. Why should physicians voluntarily report diseases? We believe that the ease of reporting through the postal system without affixing stamps, the sense of contribution to society by witnessing

disease control measures as a result of their reporting and the regular feed back through the monthly disease summary bulletins were the factors that stimulated good participation by physicians. Eventually the existing public health law has to be revised and enforced so that disease reporting becomes mandatory.

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