Infectious Disease Control in a Long-term Refugee Camp: The Role of Epidemiologic Surveillance and Investigation

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Abstract: This report demonstrates the role of epidemiologic surveillance and investigation in the control of infectious diseases in a long-term refugee camp. The applications of simple epidemiologic methods in a refugee camp on the Thai-Cambodian border are described for a one-year period. The development of a Health Information Office facilitated the collection of demographic and vital statistics data, administration of a disease surveillance system, regular monitoring of hospital and outpatient discharge diagnoses, and investigation of disease outbreaks. This office also organized community health education campaigns and disease control efforts. Examples of specific disease investigations are provided to demonstrate the utility of epidemiologic surveillance in the control of infectious disease. We conclude that simple epidemiologic methods play an important role in health planning in long-term refugee camps. (Am J Public Health 1990; 80:824–828.)

Introduction

There are currently more than 12 million refugees throughout the world. Disease and famine often accompany the movements of refugees, as health and nutritional systems are disrupted by strife. Refugee camps are generally perceived as temporary structures requiring immediate, short-term assistance. Unfortunately, persistent war in the Middle East, Afghanistan, Sub-Saharan Africa, and Southeast Asia has created refugee camps that require long-term assistance. These camps have become permanent settlements and are now home for the majority of the world's refugees. The health care problems of long-term camps differ from those of short-term camps; the primary tasks are health maintenance, nutritional support, community development, and training of refugee health workers. These tasks are often more difficult than the highly publicized crisis management necessary during the emergency phase of refugee relief operations. The permanence of these camps, combined with the difficulty in obtaining ongoing support, demands innovative planning to effectively allocate scarce health resources.

The importance of epidemiologic assessment for public health planning and resource allocation has been emphasized in emergency assistance situations. The successful use of simple epidemiologic methods has been demonstrated in the emergency phase of the Cambodian and Ethiopian refugee crises. Epidemic assessment is equally important for dealing with the health concerns of long-term camps. Effective disease surveillance and outbreak investigation can help direct public health interventions. Analysis of mortality trends and nutritional status can be used to evaluate the effectiveness of assistance programs. Knowledge of disease patterns can inform clinical practice and guide resource allocation decisions. Finally, this information may be useful in designing training programs and orienting expatriate personnel. This paper reports our experience with epidemicologic surveillance of infectious diseases in the Site 2 South encampment of Cambodian refugees on the Thai-Cambodian border.

Methods

Following the Vietnamese invasion of Cambodia in 1979, there was a large influx of Cambodian refugees into camps in Thailand. These refugees were physically, mentally, and nutritionally exhausted after nearly a decade of war and four years of hardship under the Khmer Rouge. Several reports have described the health conditions in these early camps. Ten years later there are still approximately 350,000 refugees in eight camps along the Thai-Cambodian border. Site 2, home to over half these refugees, is divided into North and South. Site 2 South has a population of approximately 70,000, or roughly 20 percent of the border refugee population.

The age distribution of Site 2 South is skewed toward the very young. Twenty-three percent of the population is under 5 years of age, and 43 percent is under 15. The camp is severely overcrowded, with only 33 square meters/person including public lands. There is no ground water in Site 2, requiring that water be brought long distances by truck at considerable expense and resulting in a chronic shortage of water for personal hygiene. The average water ration is only 20 liters/person/day, significantly below the ideal of 100 liters/person/day recommended by the World Health Organization. There is no running water, and the sewer system consists of open ditches between rows of houses. In the dry season these sewers are stagnant pools of waste. In the rainy season they quickly overflow, flooding nearby houses.

The population is totally dependent on external food supplies. The acute malnutrition rates in children under age 5 years, which were very high (>13 percent) in the acute phase of the refugee crisis, had stabilized at approximately 5 percent by 1985. The prevalence of chronic malnutrition (stunting), however, remains high. The diet consists primarily of rice and canned fish. The United Nations World Food Program supplies a food basket calculated to supply sufficient protein and calories. It is common, however, for camp residents to barter away some of their food aid on the black market, gaining variety at the cost of nutritional value. The persistence of significant malnutrition despite the provision of adequate protein and calories arises in part from this use of rice as the primary market exchange commodity; a phenomenon exacerbated by severe under-employment.

Humanitarian assistance for these refugees is provided through the UN Border Relief Operation (UNBRO), which supports and coordinates several voluntary agency health service programs in the camps. The American Refugee Committee has the responsibility for providing curative health services for Site 2 South; their hospital and two
outpatient clinics are the only curative health facilities serving Site 2 South. Maternal child health services, including antenatal screening, routine immunizations, and growth monitoring, are provided by a separate voluntary agency and are not covered by this report.

The hospital has dirt floors and lacks electricity or refrigeration. There are five wards: adult medicine, surgery, pediatrics, obstetrics, and a feeding center for severely malnourished children. During the year described by this report, the hospital had an average daily census of 223 patients. All wards are staffed and supervised by Cambodian health workers, nurses, midwives, and medical assistants. The expatriate staff, consisting of three nurses, two doctors, and a midwife, serve primarily as consultants and teachers. Laboratory facilities are limited to malaria smears, ova and parasite examinations, Gram and Acid Fast stains, hand-spun urinalyses, and colorimetric hemoglobin determinations. There are no chemistry, serology, or microbiologic culture facilities available. A mobile radiologic facility is available one morning a week.

A Health Information Office was developed by the American Refugee Committee to coordinate epidemiologic surveillance and investigation. This office was staffed by Cambodian and expatriate epidemiologists working closely with hospital and outpatient clinic staff, community leaders, and community service providers. The responsibilities of the epidemiologists included: collection of demographic and vital statistics data, administration of a reportable disease surveillance system, compilation of hospital and outpatient discharge diagnoses, outbreak investigation, and facilitation of clinical studies. The office also organized community health education campaigns and served as a source of information for the many programs involved in health promotion activities in Site 2.

Vital Statistics

Demographic data, obtained from the Cambodian camp administration, were derived from a family registration system maintained for the purpose of distributing relief materials. Monthly figures reflected population changes resulting from births, deaths, in-migration, and out-migration. This information was used as the basis for vital statistics. The receipt of additional relief supplies served as a powerful incentive to complete birth registration. Monthly consultations with the Buddhist monastery operating the camp’s only crematorium, and the Khmer Moslem Association, served as a mechanism for death verification. Names and ages of deceased individuals were recorded, but reliable information concerning the cause of death occurring outside the hospital was typically unavailable. This method of death ascertainment was generally complete; however, some underreporting of neonatal deaths may have occurred because of the occasional practice of burying very young infants.

Reportable Diseases

The Health Information Office also administered a program to allow the prompt identification of diseases requiring immediate public health interventions: cholera, diphtheria, tetanus, measles, pertussis, encephalitis, dengue hemorrhagic fever, rabies, polio, typhoid, meningococcal meningitis, and sexually transmitted disease. The occurrence of any of these conditions was to be reported to the office within 24 hours, along with atypical presentations of more common diseases (e.g., the occurrence of malaria in a child). Reports of incident tuberculosis and leprosy cases were investigated by a separate program. Given the extremely high prevalence of tuberculosis in Southeast Asia, a comprehensive program for the management of this disease had been developed previously, and is reported elsewhere in

Hospital Discharge Data

At the time of hospital discharge a senior Cambodian medical assistant or midwife, in consultation with an expatriate health professional, recorded a discharge diagnosis. This diagnosis was entered into a log book in each ward, along with the patient’s age, sex, name, and address. Precarious security conditions and emergency camp relocations have prevented the development of a permanent medical record system. Hence, the ward log books provided the only data available for retrospective analysis. Diagnostic accuracy and complete reporting were encouraged by random review of charts by clinical supervisors. Unfortunately, the volume of patients seen in the outpatient facilities (average monthly visits >18,000) prohibited complete recording of outpatient diagnoses. On Monday of each week all outpatient diagnoses were recorded and reviewed. During disease outbreaks, the office attempted to identify all outpatient cases, conducted home visits, and was involved in public educational campaigns targeted at curtailting the spread of disease.

Analysis

The results reported below were drawn from the activities of the Health Information Office, June 1987—May 1988. Population figures for January 1, 1988 were used in the computation of age-specific mortality and hospitalization rates. Analysis of the monthly population totals indicated that the population increased steadily throughout the year, and that this mid-year estimate was within 1 percent of the actual annual population average. By applying proportions from 1988 UNBRO demographic data to these population figures, estimates for specific age intervals were obtained.

Results

Vital Statistics

During the study year, 3,261 births and 256 deaths were reported. The estimated crude birth rate was 46.3 per 1,000 population, the crude death rate 3.6/1,000 population. The infant mortality rate (infant deaths/1,000 live births) was estimated to be 27.3. The estimated under-5 mortality rate (deaths in children under-5/1,000 live births) was 33.4. Both the infant and under-5 mortality rates can potentially be biased by migration. During the study year there was a net in-migration of 4,024 people; however, only approximately 5 percent of these new arrivals were children under-5.

Table 1 shows the age- and sex-specific mortality rates. In general, mortality rates were low and resulted primarily from infectious diseases. Mortality rates for males were greater than those for females in the under-5 and some adult age groups. The higher mortality in male children was largely attributable to prematurity, neonatal sepsis, and acute respiratory illness.

Analysis of the cause-specific mortality rates for adults revealed the excess in male deaths to be entirely attributable to trauma or malaria. There were 11 deaths from falciparum malaria in men and none in women. Epidemiologic investigation of exposure history revealed that most cases of falciparum malaria occurred in persons who had recently been outside the camp. These were mostly men involved with military or market-related activities who were exposed to the malarial parasite in Cambodia and subsequently returned to
the camp for treatment. There was no evidence of sustained malarial transmission in the camp.

Reportable Diseases

An outbreak of dengue hemorrhagic fever in the summer of 1987 demonstrated the importance of maintaining a reportable disease surveillance system. This disease is a relatively rare, but potentially life-threatening complication of dengue. In 1987 there was a large outbreak in Thailand, with over 63,000 cases reported from 60 provinces in six months.18 Cases began appearing in Site 2 in May 1987. Figure 1 illustrates the course of this outbreak in Site 2 South. The reportable disease system allowed the Health Information Office to quickly identify the first cases of the outbreak.

Prompt efforts to control the Aedes mosquito vector included pesticide spraying of houses bordering those of index cases, larval control efforts, and an extensive community education program. The latter included the “dengue day” on which the primary school children were given the day off to collect larvae in competition for prizes. The combined effect of these efforts was to plateau the incidence of dengue hemorrhagic fever in the camp.

Only two cases of tetanus were reported, and no cases of pertussis, diphtheria, measles, or polio. The Health Information Office identified six isolated cases of meningococcal illness and promptly located and treated household and clinical contacts with antibiotic prophylaxis. No outbreaks of meningococcal illness occurred.

The Health Information Office was also involved in the control of rabies, which is endemic in the dog population of Thailand. In October 1987, a dog in Site 2 was found to have rabies, confirmed by examination of the brain at the Science Division of the Thai Red Cross Society in Bangkok. Dogs that had bitten one or more persons and were strayed, unwanted, or died during the period of observation were submitted for pathologic examination. Approximately 30 percent of dog brains submitted for pathologic analysis over the next several months were confirmed to have rabies. An investigation by the office revealed that few people sought medical attention for dog bites. The office began an extensive community education effort emphasizing the importance of post-exposure immunization. In October 1987, only four people were seen for treatment of dog bites. Beginning in November, the number of visits increased to approximately 30 per month and stayed at that level.

The Health Information Office also conducted a community survey to assess the dog population in the camp. It was determined that the dog population was comprised of mostly pet animals. Less than 20 percent of bites were traced to stray dogs, justifying an animal vaccination campaign. In the year following this campaign, none of the suspect dogs submitted for pathologic examination were found to have rabies.

Hospital Discharge Data

The vast majority of pediatric admissions were for acute infectious diseases: acute respiratory illness, skin infections, otitis media, and diarrheal disease (Table 2). Continuous monitoring of hospital discharge diagnoses provided definition of the seasonal variation of infectious diseases in the camp. Acute respiratory illness and diarrheal disease were most common in the rainy season (June—September). Skin infections were common throughout the year.

Monitoring of hospital discharge diagnoses also facilitated the early identification of outbreaks of these common pediatric illnesses. For example, there was an outbreak of acute respiratory illness in August and September. At the peak of the epidemic, the outpatient clinics in Site 2 South saw 1,361 cases of pneumonia in a 17-day period. Most cases

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Hospitalization Rate*</th>
<th>Proportional Morbidity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children (&lt;15 years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute Respiratory Illness</td>
<td>45.22 (1445)</td>
<td>34.9</td>
</tr>
<tr>
<td>Skin Infections</td>
<td>28.91 (924)</td>
<td>21.9</td>
</tr>
<tr>
<td>Otitis Media</td>
<td>9.33 (286)</td>
<td>7.1</td>
</tr>
<tr>
<td>Diarrheal Disease</td>
<td>8.56 (274)</td>
<td>6.5</td>
</tr>
<tr>
<td>Other</td>
<td>41.01 (1276)</td>
<td>30.3</td>
</tr>
<tr>
<td>Adults</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumonia</td>
<td>94.27 (3623)</td>
<td>55.1</td>
</tr>
<tr>
<td>Skin Infection</td>
<td>22.43 (862)</td>
<td>13.1</td>
</tr>
<tr>
<td>Falciparum Malaria</td>
<td>7.49 (286)</td>
<td>4.4</td>
</tr>
<tr>
<td>Unnary Tract Infection</td>
<td>6.45 (286)</td>
<td>3.8</td>
</tr>
<tr>
<td>Other</td>
<td>40.32 (1551)</td>
<td>23.6</td>
</tr>
</tbody>
</table>

*Number of cases in parentheses.
**Percent of hospitalization cases.
***Predominantly pneumonia, bronchitis, and cough.

TABLE 2—Hospital Discharge Diagnoses—June 1987 to May 1988

FIGURE 1—Estimated Cases of Dengue Hemorrhagic Fever in Site 2 South: 1987-88

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ocurred in infants or young children. Clinically, these children had diffuse pulmonary rales with occasional wheezing. Chest X-rays performed in severe cases revealed diffuse infiltrates on radiography. A viral etiology was presumed on the basis of this information. Antibiotics were used conservatively and children were carefully observed for signs of hypoxia.

A large outbreak of diarrhea was seen in December and January. Almost all cases occurred in children under two years of age, with 56 percent of the cases occurring in infants. A spot map of cases failed to reveal any specific focus of infection. Chlorine levels in the water supply were found to be adequate to prevent microbiologic contamination. Clinically, children were afebrile and had watery, nonbloody diarrhea. They were presumed to be a rotavirus outbreak and efforts focused on the education of mothers in the preparation and use of oral rehydration therapy.

The majority of adult hospital admissions were also for acute infectious diseases. The most common diagnoses were "prolonged fever," skin infections, falciparum malaria, and urinary tract infections (Table 2). The term "prolonged fever" designates a collection of infectious diseases that are not easily distinguished from the diagnostic facilities available at Site 2. It is applied when the patient has 48 hours of documented fever >38.5°C, three negative malaria smears, and no signs or symptoms suggesting localized infection. Occasionally the clinical presentation is precise enough to allow a specific diagnosis, such as scrub typhus or leptospirosis, to be made. More often the patient is treated empirically and the discharge diagnosis is simply "fever of unknown origin." Analysis of the monthly discharge diagnoses of "scrub typhus" and "fever of unknown origin," however, showed an inverse relationship, suggesting considerable variation in the convention used for assigning these diagnoses.

There was no clear seasonal variation in the incidence of prolonged fever, skin infections, or urinary tract infections. Falciparum malaria occurred principally in November through January. These are the months following the rainy season during which men leave the camp to resume fighting in Cambodia.

Discussion

The demographic indicators in Site 2 reflect the same anomalies of long-term refugee camps. The crude birth rate is very high and comparable to that seen in the least developed countries. On the other hand, the crude death rate is extremely low, lower than even in the most developed countries. (For comparison the US crude death rate is 9.) This reflects an age distribution skewed toward the very young and possibly the ready access to effective health services. Furthermore, the residents of long-term refugee camps are survivors. The more vulnerable members of a refugee population often perish during forced migration or the emergency phase of a relief effort.

The estimated infant and under-five mortality rates are middle range and comparable to those seen in countries such as Korea and Panama. They were lower than the figures reported for Thailand (infant mortality rate = 41, under-five mortality rate = 53), despite the fact that the level of health care in Site 2 is designed to be comparable to that available in surrounding Thai communities. The geographic localization of the population, the greater intensity of health services, and the absence of financial barriers make care much more accessible, however.

The ability to accurately characterize the demographics of a refugee population is important for optimal planning of humanitarian assistance efforts. For example, the high birth rate and low death rate in Site 2 indicate that, even without new arrivals, the population will expand at over 4 percent a year. Given the already overcrowded conditions in the camp, and the ill effects of overcrowding on physical and mental hygiene, long-range planning must include identifying more land on which to shelter this population. These data also underscore the need for effective family planning efforts as part of an overall program for maternal and child health. Analysis of mortality trends can identify vulnerable subpopulations and indicate specific diseases requiring control or surveillance.

The importance of maintaining a reportable disease system that can readily identify outbreaks of illness requiring immediate public health intervention is essential in the overcrowded environment of a refugee camp. This is well illustrated by the Health Information Office's experience with the 1987 dengue hemorrhagic fever outbreak. While it is impossible to know what the course of this outbreak would have been without intervention, the large number of cases seen in nearby urban areas of Thailand, where disease control efforts were more difficult to implement, suggests the office's activities may have averted a much larger outbreak. The experience of the Health Information Office in confronting rabies in the dog population of Site 2 demonstrates the role of such an office in coordinating a community response to a serious public health threat.

The successful provision of health services in a long-term refugee camp requires a strong community orientation. The training of refugee health providers and the briefing of expatriate health professionals must emphasize the public health context within which patients develop illness. The use of simple methods of epidemiologic surveillance and investigation can greatly facilitate the development of this perspective by documenting geographic, seasonal, and epidemic patterns of disease in the community. In an environment lacking the facilities for laboratory confirmation, therapy is often administered empirically based on the clinician's "best guess" as to the likely etiology. Consequently, clinicians aware of the epidemiologic patterns of disease in the community are better equipped to provide optimal care to the individual patient. The regular monitoring of hospital and outpatient discharge diagnoses by the Health Information Office allowed prompt characterization of disease outbreaks, as well as long-term or seasonal trends.

There has been little experience with epidemiologic investigation of non-infectious diseases in the camp. Occasionally outbreaks of illness have been traced to toxic ingestion of plants or black market medications. Recently, monitoring of hospital discharge data led to the recognition of a steady increase in the number of patients with trauma. Further investigation revealed a dramatic increase in suicide and domestic violence rates, symptomatic of the growing crisis in mental health in Site 2. These are late signs, however, and not adequately sensitive for surveillance activities. As experience is gained, the use of simple epidemiologic methods will be extended to surveillance and investigation of non-infectious and chronic diseases, such as hypertension and cervical cancer.

In the last several decades, the world has seen ever-growing numbers of refugees. Increasingly these refugees are
becoming “long-stayers”, living in subsistence camps for indefinite time periods. As the nature of refugee environments changes, the providers of assistance must mature and learn from their experiences. Unfortunately, refugee situations are often dominated by well-intentioned, but short-term, poorly prepared personnel operating in duplicative and loosely coordinated efforts.\cite{1,3,10} Refugee health care should not be a hobby. It requires the coordinated efforts of refugee and expatriate health planners and providers sensitive to the public health needs and resource scarcity of long-term refugee camps. Our experience demonstrates that epidemiologic surveillance and investigation have an important role in shaping the clinical and public health response to infectious disease in these camps.

ACKNOWLEDGMENTS

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**Child Vaccine Injury Claim Deadline Is October 1**

Health and Human Services Secretary Louis W. Sullivan has issued a reminder that the deadline is October 1, 1990, for a certain class of claimants who are eligible to use the recently authorized National Vaccine Injury Compensation Program. The program, which went into effect October 1, 1988, is intended to serve as a faster and less expensive procedure than a civil suit for resolving claims for certain vaccine-related injuries. Using this no-fault system, petitioners do not need to prove that those who manufactured or administered the vaccine were at fault. They must prove only that the vaccine is related to the injury. The federal program provides compensation to individuals who suffered injuries associated with one of the following vaccines: diphtheria and tetanus toxoids and pertussis vaccine (DTP); measles, mumps and rubella vaccine; oral polio vaccine; inactivated polio vaccine.

For injuries that occurred before October 1, 1988, claimants must file by October 1 of this year to use this program. Although claimants may not use the program if they file later, they still may pursue their claims in civil court. For injuries occurring on or after October 1, 1988, claimants must file within certain periods prescribed by the National Childhood Vaccine Injury Act of 1986 as amended.

As of April 5, 1990, some 263 petitions have been filed, 254 of which stemmed from injuries that occurred before October 1, 1988. Sixty awards totaling $31.5 million had been made as of April 5 under this program, with amounts ranging from $86,000 to $2.8 million.

For persons seeking information on the National Vaccine Injury Compensation Program, the Health Resources and Services Administration (HRSA) operates a toll-free hotline. The number is 800/338-2382.