

Infectious Disease Surveillance During Emergency Relief to Bhutanese Refugees in Nepal

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Objective.—To implement simplified infectious disease surveillance and epidemic disease control during the relocation of Bhutanese refugees to Nepal.

Design.—Longitudinal observation study of mortality and morbidity.

Setting.—Refugee health units in six refugee camps housing 73 500 Bhutanese refugees in the eastern tropical lowland between Nepal and India.

Interventions.—Infectious disease surveillance and community-based programs to promote vitamin A supplementation, measles vaccination, oral rehydration therapy, and early use of antibiotics to treat acute respiratory infection.

Main Outcome Measures.—Crude mortality rate, mortality rate for children younger than 5 years, and cause-specific mortality.

Results.—Crude mortality rates up to 1.15 deaths per 10 000 persons per day were reported during the first 6 months of surveillance. The leading causes of death were measles, diarrhea, and acute respiratory infections. Surveillance data were used to institute changes in public health management including measles vaccination, vitamin A supplementation, and control programs for diarrhea and acute respiratory infections and to ensure rapid responses to cholera, *Shigella* dysentery, and meningoenzephalitis. Within 4 months of establishing disease control interventions, crude mortality rates were reduced by 75% and were below emergency levels.

Conclusions.—Simple, sustainable disease surveillance in refugee populations is essential during emergency relief efforts. Data can be used to direct community-based public health interventions to control common infectious diseases and reduce high mortality rates among refugees while placing a minimal burden on health workers.

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WAR, FAMINE, and political persecution often result in the displacement of large refugee populations. Refugees and internally displaced persons, especially

those living in temporary camps, suffer from high mortality rates compared with nondisplaced persons.¹ During the 1992 to 1993 famine in Somalia, mortality rates for displaced persons living in temporary camps were more than twice as high as rates for nondisplaced persons.^{2,3} Among displaced persons, death rates for children younger than 5 years are far higher than for older children and adults.¹ In Somalia, for example, mortality rates for these children were two to four times greater than older persons living in the same communities. Risk factors can combine to produce very high

mortality, and in one extreme case during the famine in Somalia, an estimated 75% of displaced children younger than 5 years living in temporary camps died during an 8-month period.³

Common preventable infectious diseases such as measles, diarrheal disease, and acute respiratory infections (ARIs) are the most frequent causes of death among displaced persons.³⁻⁶ These infections are exacerbated by malnutrition and hypovitaminosis A. Measles and diarrheal diseases may, in turn, increase the prevalence of malnutrition, creating a cycle of infection and malnutrition. Failure to promptly identify any of these factors may result in increased mortality of displaced persons. Implementation of simple public health measures such as vitamin A supplementation, clean water, sanitation, measles immunization, and adequate nutrition can have a major impact on mortality rates caused by infectious diseases.^{5,7-9}

To be effective, these measures should be guided by reliable and timely information gathered from disease surveillance. During the emergency phase of relief operations—periods when mortality rates exceed one death per 10 000 persons per day¹⁰—disease surveillance must reliably and rapidly identify causes of death so that specific public health measures can be implemented. Unfortunately, surveillance is often neglected during relief efforts because resources and personnel are diverted to areas that are perceived to be of greater need.

From February 1991 to January 1993, more than 73 500 Bhutanese of Nepalese ethnic origin entered refugee camps in the Jhapa and Morang districts of southeastern Nepal because of ethnic persecution in Bhutan. In this article, we de-

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scribe the implementation of a simple infectious disease surveillance system used to monitor the relief effort and identify major public health problems in Bhutanese refugee camps in Nepal.

METHODS

Background

From February 1991 through June 1992, six Bhutanese refugee camps, with populations ranging from 5000 to 18 000, were established in the eastern Terai region, a tropical lowland area of Nepal along the Nepali-Indian border. In June 1992, the Office of the United Nations High Commissioner for Refugees (UNHCR) through its implementing agency, Save the Children Fund–United Kingdom (SCF-UK), established preventive and curative health care services for these camps. With the assistance of the Centers for Disease Control and Prevention (CDC), SCF-UK established a program of infectious disease surveillance in July 1992 to determine cause-specific and age-specific morbidity and mortality trends. Disease surveillance personnel were employed by SCF-UK and trained by CDC consultants.

The refugees lived in 5 m × 10 m split-bamboo huts with heavy plastic tarpaulin roofs. Housing supplies were provided by UNHCR through its implementing agency, Lutheran World Federation, Geneva, Switzerland. In addition, Lutheran World Federation provided water and sanitation for the camps. Water was initially obtained from tube wells that were 3 m to 5 m deep and were replaced by deep borehole wells (greater than 100 m deep). Sanitation consisted of pit latrines that were often shared by more than one family.

Surveillance System Structure

Each camp had several health units for primary care and one health center for referrals of more serious cases. In each camp, a Nepali or Bhutanese public health assistant collected and summarized clinic-based morbidity and community-based mortality data. These data were forwarded each week to the public health relief coordinator responsible for public health activities in the six camps.

Mortality Surveillance

A Bhutanese mortality reporter in each camp collected mortality data from surviving family members and reported data daily to the public health assistant. To encourage reporting, families of the deceased were offered free funeral shrouds and assured that reports would not result in decreased food rations. Surveillance was established for six major disease syndromes with public health

importance because of their perceived frequency or responsiveness to intervention (Table 1).

To uniformly identify the most likely cause of death, a verbal autopsy was performed by the mortality reporter. A verbal autopsy is a technique that involves a structured interview of the family of the deceased.¹¹⁻¹⁴ Questions were asked to first identify symptoms associated with highly specific causes of death (eg, measles) and then symptoms associated with less easily identified causes of death (eg, malaria). The interviewer obtained the deceased person's name, sex, age, dates of entry into Nepal and death, and district of origin in Bhutan. To validate the content and organization of these questions, the cause of death obtained from the verbal autopsy was compared with the cause determined from more detailed family interviews and review of clinical records in a preliminary pilot study. Mortality and morbidity data were also collected from camp administrative records for April through June 1992, the period before systematic surveillance, so death rates before and after the institution of systematic surveillance could be compared.

Morbidity Surveillance

Morbidity surveillance data were collected from the health center and health units in each camp. Nepali health workers were trained to use nine simple clinical case definitions for recording surveillance data (Table 1).¹⁰ To reduce the work of reporting, only the diagnosis and age (younger than 5 years or 5 years or older) were tabulated on a daily tally sheet. Data were summarized daily by the public health assistant and reported to the public health relief coordinator weekly.

Epidemic Disease Investigations

Public health assistants reviewed morbidity summaries to identify cases of potentially epidemic diseases (eg, cholera, *Shigella* dysentery, and meningoen- cephalitis). When these specific illnesses were detected, a separate case investigation was initiated to determine the causes and magnitude of the outbreak. During epidemic investigations, the patient's name, age, sex, symptoms, results of laboratory tests, initial treatment, and disposition were collected on a separate epidemic investigation form. To reduce the work of reporting, epidemic investigation forms also served as treatment records and were based on standardized case-management protocols. To aid malaria investigations, additional information (entry date into Nepal, onset of symptoms, and thick blood smear result) was sought from persons being screened by blood smear examinations for malaria parasites.

Table 1.—Clinical Case Definitions of Diseases Monitored in a Mortality and Morbidity Surveillance System Established in Bhutanese Refugee Camps, Nepal, 1992

Disease	Definition
Mortality	
Measles	Rash, conjunctivitis, coryza, and cough within 2 weeks of death
Acute respiratory infection (ARI)	Fever, cough, and rapid breathing at time of death, without evidence of measles
Diarrhea	More than four stools per day at time of death (no distinguishing between bloody, choleric, or simple) without evidence of measles or ARI
Malaria	Fever and shaking chills at time of death without evidence of measles, ARI, or diarrhea
Died in childbirth	Mother who died within 7 days of giving birth
Injury	Death within 2 weeks of a traumatic injury
Other or unknown	A death that does not meet any of the above criteria
Morbidity	
Simple diarrhea	More than four stools per day, but no blood in stool or rice-water diarrhea
Dysentery	More than four stools per day, gross blood seen by a health care worker, and accompanied with fever
Suspected cholera	Profuse, watery (rice-water) diarrhea in persons older than 12 years and associated with vomiting or leg cramps but no blood in stool
Moderate/severe ARI	Fever, cough, rapid breathing (50 or more breaths per minute)
Suspected malaria	Fever and periodic shaking chills
Measles	Fever, cough, rash, conjunctivitis
Suspected hepatitis	Jaundice (specifically, yellow eyes), dark urine (looks like cola drink)
Suspected meningitis or encephalitis	Fever, with new seizures, confusion and/or coma in a patient older than 5 years with a blood smear that tested negative for parasites
Injury	Traumatic injury
Unspecified	Patient who does not have any of the above nine problems

Statistical Analysis

By convention, mortality rates were calculated as the average number of deaths per 10 000 persons per day using the weekly starting population as the denominator population.¹⁰ For time periods longer than 1 week, rates were adjusted by the weekly population estimates.

RESULTS

Data Collected Before Systematic Surveillance

From April through June 1992, the overall crude mortality rate (CMR) was 1.5 deaths per 10 000 persons per day

Table 2.—Adjusted Crude Mortality Rates (CMRs) and Cause-Specific Mortality Rates for Six Time Periods, Bhutanese Refugee Camps, Jhapa and Morang Districts, Nepal, July 3, 1992, Through January 3, 1993

Period (No. of Days)	Cause-Specific Mortality Rate* (No. of Deaths)				CMR* (No. of Deaths)
	Acute Respiratory Infection	Diarrhea	Other†	Unspecified	
Jul 3, 1992-Aug 2, 1992 (31)	0.58 (101)	0.22 (39)	0.06 (11)	0.14 (24)	1.00 (175)
Aug 3, 1992-Aug 30, 1992 (28)	0.42 (77)	0.30 (54)	0.07 (13)	0.21 (39)	1.00 (183)
Aug 31, 1992-Sep 27, 1992 (28)	0.35 (69)	0.36 (72)	0.09 (18)	0.35 (69)	1.15 (228)
Sep 28, 1992-Nov 1, 1992 (35)	0.20 (48)	0.14 (35)	0.01 (2)	0.33 (80)	0.68 (165)
Nov 2, 1992-Nov 29, 1992 (28)	0.15 (31)	0.02 (4)	0.02 (4)	0.14 (29)	0.33 (68)
Nov 30, 1992-Jan 3, 1993 (35)	0.12 (31)	0.02 (4)	0.01 (2)	0.11 (29)	0.26 (66)
Jul 3, 1992-Jan 3, 1993 (185)	0.29 (357)	0.16 (208)	0.04 (50)	0.21 (270)	0.70 (885)

*Average number of deaths in persons of all ages per 10 000 persons per day throughout the specified time period.
†Includes the following specified causes: measles, malaria, injuries, and childbirth.

(range, 1.0 to 3.0) and the mortality rate for those persons younger than 5 years (U5-MR) was 4.6 deaths per 10 000 persons per day (range, 2.3 to 8.8). During a 3-week period from April 9 through April 30, 1992, peak CMR and U5-MR were 3.0 and 8.8 deaths per 10 000 persons per day, respectively. These high mortality rates occurred in conjunction with an outbreak of measles during April and May 1992, when 549 cases of measles were recorded in health center registers (attack rate, 1.7%). On the basis of this information, while the infectious disease system was being established, vitamin A supplementation and measles vaccination programs were initiated.

Mortality Surveillance

Systematic mortality surveillance in all camps began on July 3, 1992. During the first 6 months of surveillance, the overall CMR was 0.70 death per 10 000 persons per day and reached a peak of 1.15 deaths per 10 000 per day from August 31 through September 27, 1992 (Table 2). Crude mortality rates remained above emergency levels (1.0 death per 10 000 persons per day¹⁰) until early October 1992 (Fig 1). The overall U5-MR for the 6-month period was 1.5 deaths per 10 000 persons per day and ranged from 3.60 in July 1992 to 0.22 in December 1992.

More than 60% of the deaths were attributed to two common infectious disease categories. Of 885 deaths recorded between July 3, 1992, and January 3, 1993, 357 deaths (40%) were due to ARIs and 208 (24%) to diarrheal diseases (Table 2). Nearly all of the reduction in CMR can be attributed to a reduction in deaths caused by ARI and diarrheal disease. To reduce these specific sources of mortality, community workers were trained to identify children with ARI or diarrhea who may not be seen at health units. Children with moderate-to-severe ARI were immediately given a combination of trimethoprim and sulfamethoxazole and referred to health units for

further care. Children with diarrhea were given oral rehydration fluid prepared at oral rehydration stations in areas of the camps that were farther from health units. Community workers identified more dehydrated children and referred them to health units after rehydration was begun. From July 1992 through December 1992, the ARI-specific mortality rate was reduced 79% and diarrheal disease-specific mortality was reduced 91% (Table 2). Other specific causes of death were infrequent. From July 3, 1992, to January 3, 1993, only 25 deaths were attributed to malaria (0.02 death per 10 000 persons per day) and 13 deaths to measles (0.01 death per 10 000 persons per day). As ARI-specific and diarrheal disease-specific mortality declined, the proportion of unspecified deaths increased. From October through December 1992, the cause of death was unspecified for 46% of the deaths, although the corresponding rate of unspecified deaths did not increase (Table 2).

Morbidity Surveillance

Simple diarrhea, ARI, and suspected malaria were the leading sources of morbidity (Fig 2). The peak incidence of simple diarrhea was 25 to 35 cases per 10 000 persons per day during the rainy season in August and September 1992. The incidence subsequently decreased as new water sources became available and the seasonal rains decreased. Despite the decline in deaths from diarrheal disease from July through December 1992, simple diarrhea remained the leading cause of morbidity throughout the 6-month period. Similarly, the incidence of moderate-to-severe ARI was relatively constant during the surveillance period, but deaths from ARI decreased from July through December 1992.

Suspected malaria was commonly reported (Fig 2), although deaths attributed to malaria were rare. From August 31 through September 27, 1992,

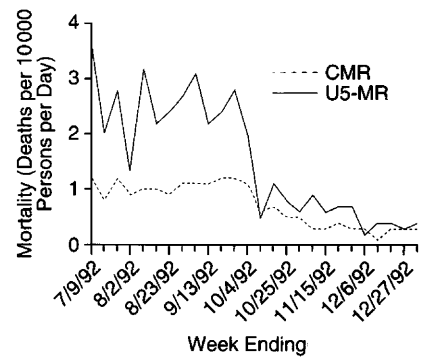


Fig 1.—Average daily crude mortality rate (CMR) and the mortality rate for those younger than 5 years (U5-MR), by week, Bhutanese refugee camps, Nepal, July 3, 1992, through January 3, 1993.

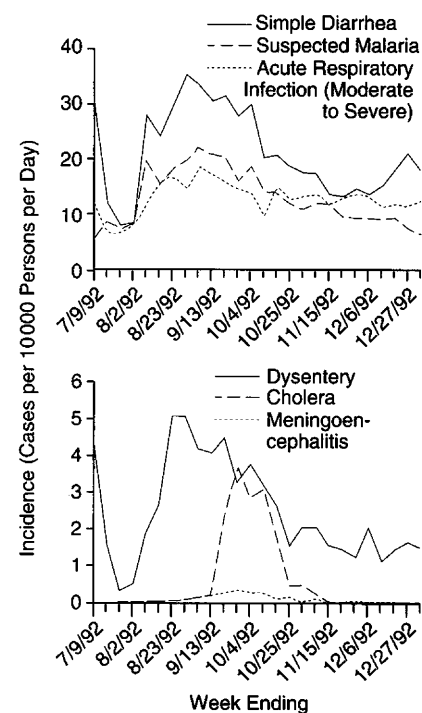


Fig 2.—Crude disease incidence for selected diseases, by week, from Bhutanese refugee health centers, Nepal, July 3, 1993.

3984 suspected malaria cases were reported through morbidity surveillance (attack rate, 5.6%). Of 5100 blood smears from persons with suspected malaria screened during this same period, 212 (4.2%) were positive for *Plasmodium falciparum* and 265 (5.2%) for *Plasmodium vivax*.

Measles incidence remained low from July 3 through November 22, 1992 (229 cases; attack rate, 0.02% per week), but doubled from November 23, 1992, through January 3, 1993 (179 cases; at-

tack rate, 0.04% per week). Despite this increased incidence of measles, the measles-specific mortality rate remained low throughout the 6 months.

Epidemic Disease Investigations

Cases of cholera, dysentery, and meningoencephalitis were first detected through the morbidity surveillance system. Although case investigations were performed to confirm the etiologic agent, identify patterns of disease transmission, and monitor disease outcome for all three diseases, only epidemic cholera was reported separately from the systematic morbidity surveillance system.

Cholera.—From August through November 1992, an outbreak of cholera occurred (Fig 2). To increase surveillance specificity during the preepidemic period, only persons 12 years and older were considered to have a possible clinical case of cholera (Table 1). After *Vibrio cholerae* was isolated from several patients who met the clinical surveillance definition of cholera, patients of any age who met the case definition were considered as cholera cases. Of the approximately 68 500 persons in the camps during the outbreak, 764 were diagnosed with cholera (attack rate, 1.1%) and 17 died (case-fatality rate, 2.2%). The early detection of epidemic cholera led to the implementation of a cholera control plan that included opening cholera treatment wards for specialized case management and isolation of patients.

Dysentery.—During the 6-month surveillance period, 3148 patients were clinically diagnosed with dysentery, and peak incidence increased to 5.1 cases per 10 000 persons per day in August 1992 (Fig 2). Before a case definition was established, attempts to culture pathogens from patients with suspected dysentery were unsuccessful, possibly because simple diarrhea had been misclassified as dysentery. After a strict case definition was established (Table 1), *Shigella flexneri* types 1, 2, and 3 were cultured from five (38%) of 13 patients with suspected dysentery. Isolates were sensitive only to nalidixic acid. New case-management guidelines for specific treatment of antibiotic-resistant *Shigella* dysentery were instituted in August 1992.

Meningoencephalitis.—Nepal has experienced epidemics of meningococcal meningitis and Japanese encephalitis during the past decade.^{15,16} To ensure early detection of these diseases, meningoencephalitis cases were closely monitored. Of 116 patients with meningoencephalitis (attack rate, 0.2%), 15 died (case-fatality rate, 13%). The clinical presentation suggested Japanese encephalitis, although laboratory confirmation

was not available. As a result, a vector-control program, including efforts to reduce larval habitat and the application of ultra-low-volume insecticide, was initiated.

COMMENT

The usefulness of surveillance data during the emergency phase of a refugee relief operation is illustrated by this experience among these Bhutanese refugees. Timely identification of morbidity and mortality trends in these camps led to immediate control measures that placed a minimum burden on health care workers. For example, to reduce measles mortality and subsequent measles-associated ARI deaths, regular measles vaccination and vitamin A supplementation programs were initiated in May 1992. Community-based programs for oral rehydration and early antibiotic treatment of children with moderate-to-severe ARI were instituted to reduce these specific causes of mortality. These programs, in conjunction with the improved nutritional status of refugees, reduced mortality rates for ARI and diarrheal diseases despite the continuing high number of clinic visits for these diseases.

The use of simple and clear case definitions in disease surveillance resulted in early recognition of several diseases with epidemic potential. Mortality from less common epidemic diseases such as cholera and meningoencephalitis is usually low compared with mortality from malnutrition and common infectious diseases in refugee populations. However, epidemics can paralyze health care services, resulting in considerable secondary mortality.¹⁷ Early detection of laboratory-confirmed cholera in the Bhutanese camps led to the implementation of a comprehensive cholera control plan, which was minimally disruptive to camp services and may have contributed to the relatively low case-fatality rate of 2.2%. Similarly, detecting malaria and suspected Japanese encephalitis cases resulted in the institution of a vector-control program that may have limited vector-borne disease transmission. Although surveillance case definitions relied on clinical criteria alone, laboratory confirmation of index cases of suspected epidemic illnesses was obtained and should be attempted whenever possible.

This refugee health surveillance system remained in place through February 1994, spanning the transition period from the emergency phase to the stable phase of the relief operation. The simplicity of this system may have contributed to its sustainability. Since health care workers in refugee settings are often overburdened with clinical duties,

elaborate surveillance systems tend to be abandoned. During the emergency phase of refugee relief, surveillance information should be limited to the most important cause of mortality and morbidity for which there are available public health interventions. Surveillance for other diseases and implementation of other public health programs can be initiated after the emergency phase ends. After mortality rates decreased below 1.0 death per 10 000 persons per day in the Bhutanese refugee camps, health-related programs were expanded to include tuberculosis control, and additional public health priorities such as micronutrient deficiencies were added to the surveillance system (see "Update").

Although this surveillance system provided uniform data during the emergency phase of this relief operation, it had several important limitations.¹⁸ Surveillance case definitions were not rigorously examined to determine their relative sensitivity and specificity. For example, our malaria case definition was nonspecific compared with definitions that use thick and thin blood smears and may not be appropriate for refugee settings with adequate laboratory support. Although verbal autopsies and the diagnostic criteria used in morbidity surveillance in stable, nonrefugee populations have been validated,¹¹⁻¹⁴ similar studies have not been performed for refugee populations. Most of these case definitions were based on widely accepted clinical criteria¹⁹ but need to be evaluated and refined to increase sensitivity and specificity for some illnesses in refugee surveillance systems. In areas where laboratory facilities are available to camp personnel, confirmatory test results should be incorporated into the case definitions to increase their specificity.

The mortality surveillance system was unable to attribute a substantial portion of the deaths to a specific cause. Although the number of unspecified deaths was low during the emergency phase, the relative proportion of unspecified deaths increased as mortality rates decreased. Although a simplified mortality surveillance system was useful during the emergency phase, additional investigations should be performed to determine the cause of unspecified deaths during the stable phase. New mortality case definitions can then be added to the surveillance system. In addition, care should be taken to ensure complete accounting of deaths; we found that provision of burial expenses increased reporting compliance. Graveyard watchers can also be used to decrease the number of "hidden" deaths.

In addition, clinic-based surveillance systems do not provide good estimates

of malnutrition prevalence or immunization coverage because of biases inherent in clinic-based surveillance. Separate population-based surveys should be regularly performed to measure nutritional status and immunization coverage in refugee settings.²⁰⁻²² From April 1992 through December 1992, SCF-UK performed periodic, cluster sample surveys and showed a significant increase in the proportion of adequately nourished children that corresponded to a decrease in mortality due to diarrheal disease, ARI, and measles.

CONCLUSIONS

This study illustrates the importance of instituting sustainable infectious disease surveillance to guide health planning for refugee populations during the emergency phase of a relief program. Timely and accurate data for decision making were provided by this system, which placed only a minimum burden on health workers. These data were used to immediately change public health management. Examples of these changes included greater emphasis on oral rehydration programs to reduce diarrhea-spe-

cific mortality in the population of persons younger than 5 years and initiation of disease control programs in response to rapid identification of outbreaks of cholera and Japanese encephalitis.

During the 4 months after initiation of disease surveillance and disease control interventions, mortality rates were reduced to below public health emergency levels. After this population entered this stable phase, resources of the relief effort were redirected to control chronic diseases.

UPDATE

Through February 1994, more than 85 300 Bhutanese refugees lived in camps in southeastern Nepal. Disease surveillance data had been continuously collected since July 1992. From October 1993 through February 1994, the CMR and U5-MR were 0.1 and 0.2 death per 10 000 persons per day, respectively. Diarrhea and ARI were the leading sources of deaths with known origins, but more than 60% of deaths were not due to any of the specified causes in Table 1. During 1993, no outbreaks of measles, cholera, or Japanese encephalitis occurred.

Malaria incidence was reduced to 0.2 case per 10 000 persons per day through institution of an insecticide-impregnated bed-net program and active case identification and treatment. Micronutrient deficiencies were added to morbidity surveillance systems in September 1993 and outbreaks of severe beriberi (peak rate, 24 cases per 10 000 persons per day), pellagra (0.7 case per 10 000 persons per day), and scurvy (0.8 case per 10 000 persons per day) were identified. Initially, persons with these deficiencies underwent clinical confirmation, but subsequent cases were identified clinically. In response to these identified outbreaks, micronutrient analysis of the rations confirmed the suspected deficiencies and the contents of the rations have been changed.

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