

shortages, an almost complete breakdown in communications, and badly crippled transportation capabilities. Destroyed ports and harbors could not accommodate ships, and relief had to be ferried from ships to islands using small boats. Recovery on remote islands has been slower than in other impacted communities due to a severe shortage of local resources and high import costs.

**Conclusions:** Disaster responses and management plans that address disasters occurring on remote islands must take into account the unique vulnerabilities exhibited by islands in order to be effective.

**Keywords:** disaster; islands; remote islands; special populations; tsunami

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### Injury Reporting Following the 2004 Indian Ocean Tsunami

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**Introduction:** Similar disasters often repeatedly occur in the same regions. Therefore, local medical care workers usually know what injuries to anticipate, based on past experiences. But unlike the cyclones that frequent Bangladesh or earthquakes that frequent Indonesia, the 2004 Indian Ocean tsunami was unusual and medical care workers could not draw on past experiences to anticipate injuries. This paper explores what the 2004 tsunami has taught the medical community about the nature and frequency of injuries following a tsunami.

**Methods:** Researchers working on a tsunami publication for the World Health Organization's South East Asia Regional Office collected and compared injury data reported by government sources, hospitals, and medical responders.

**Results:** The tsunami resulted in flesh wounds, fractured bones, and near-drowning cases. Near-drowning cases were unique, in that the water inhaled by tsunami victims was saline, and heavily laden with dirt, bacteria, and other contaminants. Near-drowning victims who survived beyond the first day of the disaster often developed a type of aspiration pneumonia coined "tsunami lung". Similarly, the highly contaminated water deeply penetrated flesh wounds suffered during the tsunami. Unfortunately, injury data were poorly recorded and the frequency with which tsunami survivors suffered various injuries remains poorly understood. Additionally, a tally of all injuries suffered due to the tsunami cannot be calculated, since local and national tallies are incomplete and unreliable.

**Conclusions:** The development of a standardized injury reporting method at the national and international level would help medical care workers better anticipate injured survivors' needs during future disasters.

**Keywords:** 2004 tsunami; disaster; injury; injury reporting; tsunami  
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### Oral Presentations—Migrating Populations

#### Assessing Quality through Measurement of Unmet Needs of Disaster Populations after the 2007 Southern California Wildfires

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**Introduction:** Currently, the quality of disaster response is assessed by process, not outcome measures. This study attempts to measure outcomes by directly assessing the needs of a displaced population, and how efficiently they were met.

**Methods:** Heads of households were surveyed at open Local Assistance Centers (LAC) and shelters in San Diego and Riverside counties 10–12 days after initial evacuation. The survey assessed the sheltering, food, water, healthcare, personal supplies, transportation and communication needs of the displaced population.

**Results:** A total of 162 heads of households were surveyed at three shelters and seven LACs representing 522 persons (3.3 persons/house; females = 50.8%). Households moved an average of 1.7 times during evacuation; only 20.4% stayed in a public shelter. The greatest needs (75–96%) were for public health issues—shelter, food, water, while medical care was needed by <25%. Mental health needs were uncommon, but poorly met. The needs of the affected population were met <90% of the time in all areas, but supplies such as clothing, hygiene, and household. The need for transportation and communication services also were assessed for the overall time period—18.6% needed transportation of which 40.0% were unmet. A total of 32.9% had communications needs. Of these, 39.6% were unmet.

**Conclusions:** This study attempts to assess the quality of a disaster response by measuring the outcome of needs, met and unmet, over time. Overall needs are well met, but there appears to persist a difficult population to reach. Further study is needed to validate this quality measure and to better identify the difficulty of reaching a persistently needy population.

**Keywords:** capacity building; disaster; measurement; quality assessment; wildfire

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#### Epidemiological Review of the Risk Factors of Measles Outbreaks in Displaced Populations

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**Introduction:** Measles is a highly contagious disease with a significant public health impact, especially among displaced populations. Disasters have contributed in the increase of refugees and internally displaced persons to 9.9 million and 12 million, respectively.

**Objectives:** This study describes the epidemiology and risk factors of measles in displaced populations.

**Methods:** We conducted a systematic review of literature from PubMed and the the US Centers for Disease Control and Prevention database using combinations of several keywords. After the screening, measles outbreaks with quantitative data were reviewed.

**Results:** Internal conflicts (91%) had resulted in higher displacement of populations mostly in Africa (64%). A total of 6,940 measles cases (average = 628 cases per outbreak) were recorded in the 11 outbreaks with an age ranging from 1 to 39 years. In 62.5% of the outbreaks, children between 5 and 15 years old were the most infected. 90.9 % of the outbreaks had occurred in the context of poor vaccination status (vaccination coverage: 17–57%). More than 1,717 cases may have remained unvaccinated due to the restricted target population age in respective immunization campaigns. Active case findings, together with passive surveillance, were described among tsunami victims (India) and the Burundian refugees in Tanzania, where no fatalities were observed.

**Conclusions:** This study indicates the need to extend the vaccination target age group to 15 years. A surveillance approach that focuses on the assessment of potential risk factors for measles, morbidity, and mortality may be beneficial in future interventions.

**Keywords:** disaster; epidemiology; internally displaced populations; measles; outbreak; refugees; surveillance

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## Recognition and Knowledge of Tetramethylammonium Hydroxide of the First Responders and Emergency Department Staff

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**Introduction:** Tetramethylammonium hydroxide (TAMH,  $(\text{CH}_3)_4\text{NOH}$ , CAS No. 75-59-2) is widely used in the micro-electro-mechanical industries, especially in the manufacture of semiconductors and liquid crystal displays. It was considered to be a relatively low level of toxicity when little toxicological information was available. In the past few years, there were three workers who quickly succumbed after significant TMAH contamination.

**Methods:** We arranged a training course focusing on the toxicology and emergency management of TMAH for first responders and emergency staff. Before and after the course, we tested the students about TMAH and tried to determine the differences in recognition between first responders and emergency staff.

**Results:** There were 210 students; 98 were emergency responders and 112 medical staff members. The training course was helpful to both groups of students. However, the first responders were less expected to perform well during emergency management even after the course. These groups also differs in their use of reference media while confronting hazardous conditions. The first responders favored to check the chemical file of material safety data sheet, while emergency staff consulted a poison center or the Internet.

**Conclusions:** Advanced teaching courses might benefit all emergency responders. It is better have separate courses for each profession.

**Keywords:** contamination; emergency department; first responder; training

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