



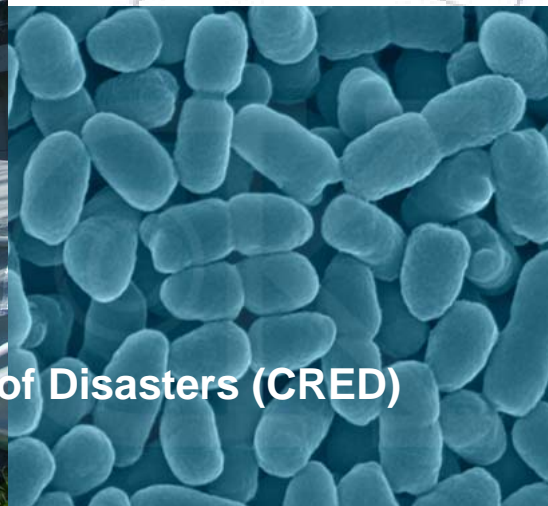
The Andaman Nicobar earthquake and tsunami 2004



Impact on diseases in Indonesia

July 2005

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Wilbert van Panhuis



Centre for Research on the Epidemiology of Disasters (CRED)

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The Centre for Research on the Epidemiology of Disasters (CRED), is based at the Catholic University of Louvain (UCL), Brussels. CRED promotes research, training and information dissemination on international disasters, with a special focus on public health, epidemiology and social economic aspects. It aims to enhance the effectiveness of developing countries response to, and management of, disasters. CRED has formal collaborations with the United Nations Office for the Co-ordination of Humanitarian Affairs (OCHA), the International Federation of Red Cross and Red Crescent Societies (IFRC). It has also received support from the Belgian government and has formed a partnership with the European Community Humanitarian Office (ECHO). It works closely with non-governmental agencies and universities throughout most parts of the world.

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*"But what of life whose bitter hungry sea
Flows at our heels, and gloom of sunless night
Covers the days which never more return?
Ambition, love and all the thoughts that burn
We lose too soon, and only find delight
In withered husks of some dead memory"*

From: "Dsespoir," (Oscar Wilde)

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Executive summary

The human impact of the tsunami on December 26 2004 was enormous: more than 175.000 people killed, almost 2 million affected and many people lost their homes. Indonesia, Sri Lanka, India and Thailand were worst hit with Indonesia bearing the greatest burden with nearly three-quarters of all dead and over half the homeless.

Communicable disease outbreaks were foreseen in the aftermath of the disaster and the large number of dead bodies gave rise to widespread fear of epidemics. Evidence from previous natural disasters however, has shown that disease outbreaks are a very rare occurrence and it is well established that dead bodies do not pose a health threat.

The objectives were 1) to describe the patterns and relative importance of major diseases as a consequence of the tsunami, 2) to compare these to the pre-existing disease profiles in Aceh before the disaster, 3) to identify key recommendations for improvement of disease control and surveillance after disasters.

A team from CRED visited Jakarta and Banda Aceh from April 11-23. Data were collected from the Central and Provincial Ministries of Health, WHO and health NGOs. In addition, the team interviewed key health officers from UN, NGO and Ministry of Health, as well as academics. A collaboration was established with the ICRC field hospital in Banda Aceh, the first operational hospital in the province after the disaster and a dataset was constructed including all consultations from January 11-31. Disease profiles are presented for cholera, tetanus, wounds and wound infections, acute respiratory infections, malaria and dengue.

Experience has shown that certain diseases (cholera, malaria, dengue), however commonly believed, are not always a priority immediately after a disaster. The number of disaster related health conditions needing emergency response, decreased by two and became negligible four weeks after the disaster. International humanitarian agencies in the health sector should start working with the MOH well within this time period.

Surveillance systems in emergencies urgently need further research and development. The WHO system set up immediately after the tsunami was a major step forward and lessons should be learnt from this experience and used to develop a prototype for future emergencies.

Guidelines for tetanus and aspiration pneumonia should be included in disaster medicine handbooks and although we have not presented findings on maternal and child health services, deliveries occurred with undiminished regularity and in worsened conditions. Humanitarian aid groups should be prepared to provide emergency obstetrics and post-natal services.

Funding for relief after natural disasters should be mindful of its sustainability. This approach is not contradictory to providing immediate relief, but requires pre-planning and technical skills. Donors should know when to stop providing emergency relief funds and transit to development strategies.

1 Introduction

1.1 The disaster

On December 26 2004, an earthquake with a moment magnitude of 9.3 occurred along Northern Sumatra and the Nicobar and Andaman Islands that resulted in the catastrophic tsunami that affected 12 countries (figure 1.1). A second earthquake took place on March 28 close to the Island Nias with a moment magnitude of 8.6^{1,2}.

The human impact of the tsunami on December 26 2004 was enormous: more than 175,000 people killed and almost 2 million affected. Many people lost their homes and had to find shelter with family, friends or in temporary settlements. Four countries, Indonesia, Sri Lanka, India and Thailand were worst hit with Indonesia bearing the greatest burden with nearly three-quarters of all dead and over half the homeless (table 1.1)³.

Table 1.1: Human impact of the earthquake and tsunami as of June 2005³

Country	Killed	Missing	Affected*
Indonesia	128 645	37 063	532 898
Sri Lanka	31 299	4 100	516 130
India	10 749	5 640	647 599
Thailand	5 413	2 932	58 550
Somalia	298		104 800
Maldives	81	21	25 000
Malaysia	68	12	4 296
Myanmar	61	10	12 500
Tanzania	10		
Seychelles	3		4 830
Bangladesh	2		
Kenya	1		
Total	176 630	49 778	1 906 603

* including homeless

The tsunami also destroyed physical infrastructure such as roads, hospitals, schools and bridges. Essential services such as health care and education broke down due to loss of staff, materials and structures. Communicable disease outbreaks, which have a devastating potential in emergency situations were foreseen in the aftermath of the disaster⁴⁻⁶. The large number of dead bodies gave rise to widespread fear of diseases and epidemics of malaria, cholera and dengue were expected.

Evidence from previous natural disasters however, has shown that disease outbreaks are a very rare occurrence and it is well established that dead bodies do not pose a health threat.

It is more important for families to recover their dead for psychological reasons than to bury them for sanitary purposes⁷.

The financial response to the tsunami was generous. To date, OCHA reports US\$ 6.7 billion pledged in total, of which US\$ 892 million for emergency flash appeals⁸. Funds will be best spent if based on experience and in evidence of impact patterns of natural disasters such as the tsunami.

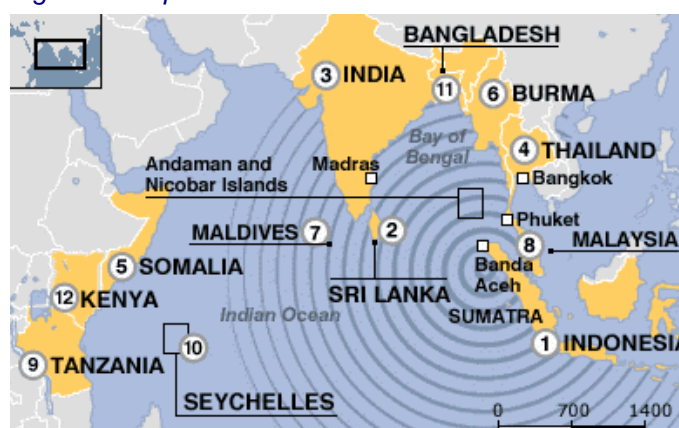
1.2 Context of this study

We undertook this study in the framework of the EM-SEANET project (see below). The aim was to undertake a broad epidemiological study of the communicable disease and health impact of the tsunami.

The sub-objectives were:

- To describe the patterns and relative importance of major diseases as a consequence of the tsunami.
- To compare these to the pre-existing disease profiles in Aceh before the disaster.
- To identify key recommendations for improvement of disease control and surveillance after disasters.

Figure 1.1: Epicenter of the tsunami: December 26 2004



A team from CRED visited Jakarta and Banda Aceh from April 11-23. Central and Provincial Ministries of Health, WHO and health NGOs provided sufficient data to allow the epidemiological profiling of the most important diseases before and after the disaster. In addition, the team interviewed key health officers from UN, NGO and Ministry of Health, as well as academics.

A collaboration was established with the ICRC field hospital, the first operational in the province after the disaster. Working closely with the medical director, Dr Joel Lagoutte and Chief nurse Mrs. Anne-Lise Røhme, a dataset was constructed including all consultations from January 11-31. This provided a unique insight into the pattern of disease distribution across time and among diagnostic groups after the tsunami.

In this report, we examine 5 disease groups selected as a function of their importance in disaster response. Although additional data and information on health impact of the tsunami as well as the disaster response and reconstruction are available, not all could be included here in the interest of brevity. Some additional graphics and maps though, are added in the annex.

The available data did not allow examination in sufficient detail of two very important aspects of health preparedness and response. These are first, surveillance systems and their adaptability to emergency conditions including key aspects such as denominators and comparability. And second, age/sex distribution of victims (survivors and deaths) as a key variable to assess mortality and morbidity risks for future programming.

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2 Cholera

2.1 Background

Cholera is a highly contagious diarrheal disease caused by *Vibrio cholerae* that is often associated with epidemics and high mortality rates, especially in children. Besides many non-pathogenic, several pathogenic serotypes have been identified (O1 and O139).

Its natural reservoir is formed by aquatic environments of oceans and lakes. The actual presence of *V. cholerae* highly depends on environmental factors such as temperature and growth of certain algae¹. It is transmitted by water and food with the potential to cause epidemics if contaminated sources are shared by large populations².

Risk factors for cholera epidemics are presence of the pathogen, water shortage, crowding and lack of hygiene and sanitation; factors more common in complex emergencies rather than natural disasters.

EMSEANET

The Centre for Research on the Epidemiology of Disasters (CRED) has a long tradition of research in natural disasters and already in 1974, it established the Emergency Database (EMDAT) that includes impact data on all reported natural disasters worldwide. It published a summary of thirty years natural disasters research in the year before the tsunami struck⁹.

One of the ongoing activities of CRED is the Emergency Southeast Asia Network (EM-SEANET), which aims for the improvement of sustainable development of regions affected by natural disasters through a network of research institutes in several countries of Southeast Asia. A strategy of this network is to standardize and disseminate evidence collected on natural disasters in order to improve the national and international response.

Among the most important outbreaks in recent years was the cholera epidemic in Goma, DRC after the Rwandan crisis in 1994 when an estimated 58-80 thousand cases and over 23 thousand deaths occurred in only one month³.

Dukoral[®] provides 70% immunity after two doses at an interval of 1-2 weeks that lasts for about a year. WHO and UNICEF indicate that oral vaccines can be used as cholera control measures⁸, but follow-up for the booster dose appeared to be difficult in the post disaster situation, when families moved around and displaced returned to their homes.

The distribution of cholera in Indonesia is summarized in figure 2.1. In recent years cholera was reported in 1998 and 1999 in Sumatra and South Sulawesi respectively and caused by *Vibrio Cholerae*, O1 Ogawa serotype⁴. Serotype O139 was reported in Indonesia in 1993, but not later⁵. Cholera was last reported in Sulawesi, 2003 (308 cases)⁶.

The last cases of cholera in Aceh (encircled) occurred only in March 1996 (O1 Ogawa serotype). With regard to the seasonality, statistics since 1993 indicate that cholera occurs in Indonesia between March and September and not in the period in which the tsunami occurred⁴. In addition, it was suggested that the temperature of coastal waters in the tsunami affected areas was too low for cholera transmission⁷.

2.2 Cholera after the tsunami

Adequate drinking and washing water was identified by all relief agencies as critical and the displaced were housed in small organized, rather than large crowded camps. These two preventive measures further mitigated the potential for cholera, which in any event was most unlikely.

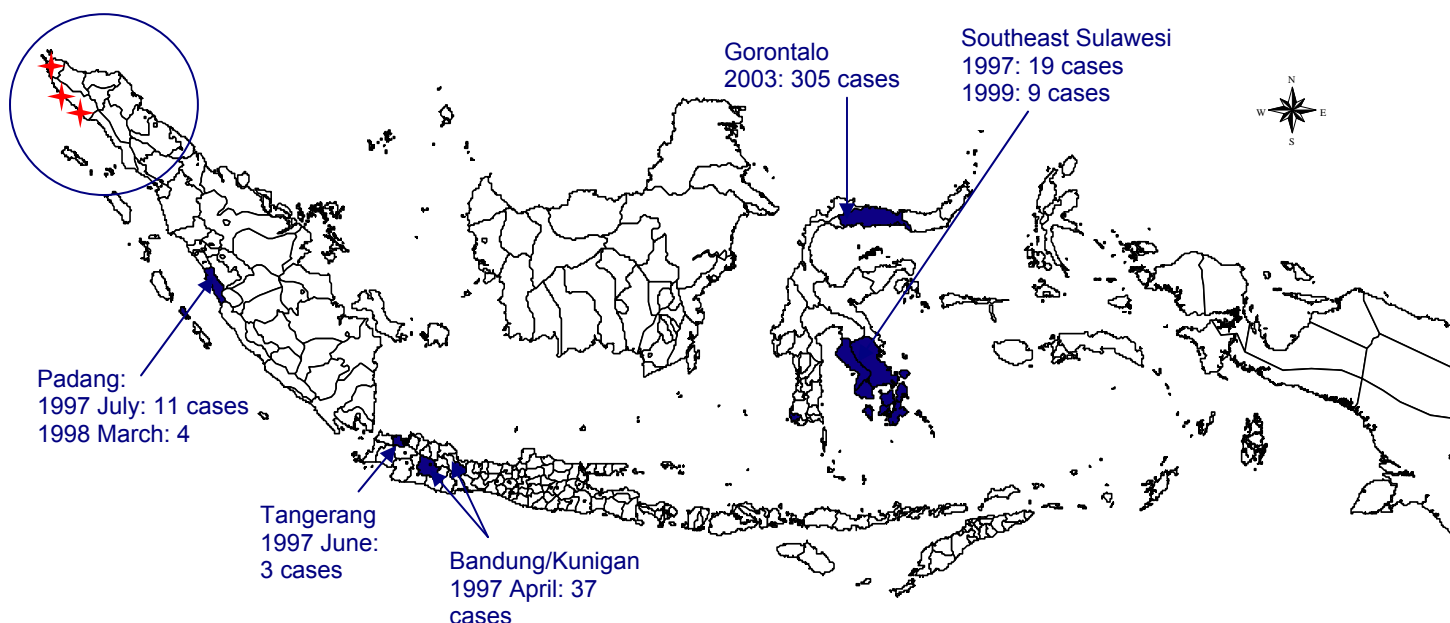
We would like to underscore that these approaches of prioritizing camp size and water quality are testimonials to the increasing professionalism of humanitarian aid.

Heightened media attention on the possibility of cholera encouraged rumors and obliged investigations. One example was a cluster of 20 suspected cholera cases in a camp in Aceh Barat district reported around January 17. Testing of stool samples revealed no cholera. No confirmed cholera was reported in the four months after the tsunami to either the WHO or Ministry of Health surveillance.

Neither were there any among 1216 diagnoses included in an analysis of consultations from January 11-31 in an ICRC field hospital in Banda Aceh.

Nonetheless, around mid April, a cholera immunization campaign was conducted using a new oral vaccine (Dukoral[®]). The campaign targeted 20,000 internally displaced in Aceh Barat, 110,000 in Aceh Besar and 30,000 in Aceh Jaya district (figure 2.1 stars). Each individual above 2 years received 2 doses with 1-2 weeks interval.

Figure 2.1: History and distribution of cholera cases in Indonesia: 1996-2004



2.3 Conclusions

There is no evidence that indicates a heightened risk of cholera epidemics following acute natural disasters in general. This was even less so in the case of Aceh, taking into account the pre-existing profile of the disease in this province. Media should be discouraged from sensational reporting that leads to ineffective use of funds.

Fear of cholera and potential development of risk factors in a chaotic situation such as that following the tsunami in Aceh is understandable but not entirely warranted. This underscores the need for strengthening professional risk assessments using epidemiological data from the affected areas.

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3 Tetanus

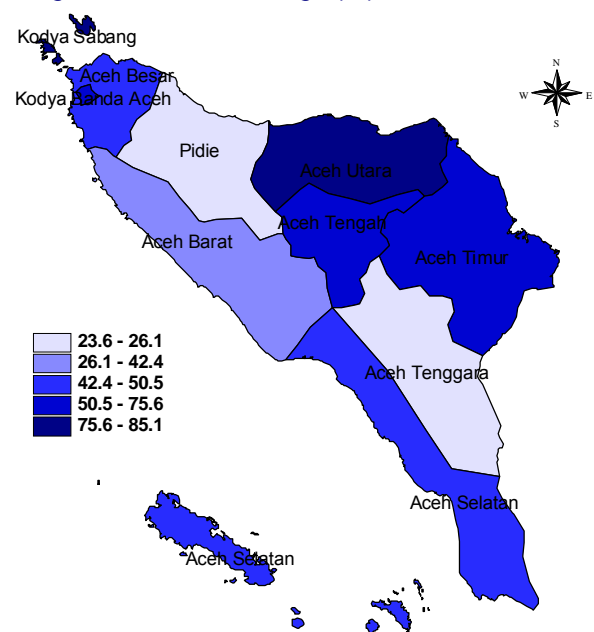
3.1 Background

Tetanus is caused by the toxin of *Clostridium tetani* which is transmitted through wounds contaminated by soil, street dust or feces¹. The disease is characterized by painful muscle contractions and may include cardiovascular instability. Case fatality rates are highest in infants and the elderly and range from 10 to 90%¹. Prevention of the disease is based on vaccination and requires a booster every 10 years to maintain immunity¹.

If a high risk wound occurs in a non immune patient, human anti-tetanus immunoglobulin or animal antitoxin is administered besides the booster dose or first dose of active immunization¹. Further treatment of tetanus cases consists of surgical debridement, antibiotic therapy with metronidazole and muscle relaxants. Intensive care treatment with artificial respiration is required if respiratory muscles are dysfunctional¹.

Vaccination rates for tetanus in Aceh are low compared to the rest of the country. In 2003, Aceh province reported coverage of 59.8% of all target children, which was the second lowest rate of Indonesia. Within the province, coverage of 2 doses of tetanus toxoid ranged between 23.6% in Aceh Tenggara and 85.1% in Sabang (North Aceh) in 2002 (figure 3.1).

Figure 3.1: TT2 coverage (%) in Aceh: 2002



Supplementary campaigns for adults are regularly conducted by the Ministry of Health and reach about 30% of the national target population. Aceh ranks among the lowest five provinces with 18,9% coverage of its provincial target (annex A1).

Normally, most cases of tetanus in Indonesia are reported from Java and Kalimantan. In 2004, 279 cases were reported in Indonesia while in Aceh province, around 30 cases occurred yearly for the last four years (annex A3). Countrywide, the case fatality rate ranged from 3.0% in 2002 to 10.1 in 2003 (table 3.1).

Table 3.1: CFR for tetanus in Indonesia: 2001-04.

Year	2001	2002	2003	2004
CFR (%)	6.55	3.03	10.1	7.76

3.2 Post - tsunami tetanus outbreak

After the Tsunami, an increase up to 102 cases was reported in January 2005 (annex). The epicurve (figure 3.2) displays the epidemic peak between January 8 and 17. Cases were reported from hospitals and health centres in Banda Aceh, Meulaboh and Sigli (North) and included patients from the entire affected area.

We examined 15 tetanus cases admitted at the ICRC hospital in the month following the tsunami (table 3.2). Most were adults and more than half the males, possibly due to higher survival of injured males or better access to health care services. More than half of the patients needed intensive care treatment with cardiovascular monitoring and in some cases artificial respiration.

Figure 3.2: Cases of tetanus in Aceh province: 2005

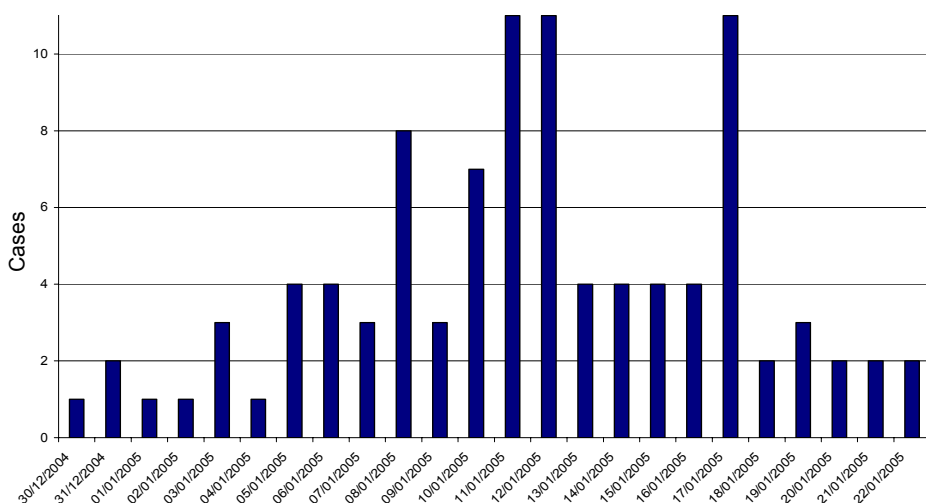


Table 3.2: Tetanus cases in ICRC hospital Banda Aceh

Cases	15
Period	January 17-27
OPD	26.6%
Ward	20%
ICU	54%
Age range	10-52 y
Average age	32.4 y
Percent male	64%
From Banda Aceh	55%

3.3 Conclusions

The risk of tetanus in natural disasters has already been observed in populations affected by hurricanes Andrew and Iniki (1992)^{2,3}. Low tetanus coverage rates in Aceh, (a statistic easily available from the MOH), indicated that the risk was significant especially as wounds and injuries are common after tsunamis, earthquakes and flash floods. Further risk of injury typically stem from the affected population removing debris from homes and searching for belongings.

This experience underlines the importance of developing emergency guidelines for tetanus and appropriate training of medical relief personnel. One hundred percent survival of tetanus patients treated at the ICRC hospital indicates that a high rate of success is possible with proper and timely care. Equipment and facilities for surgical debridement, medication and intensive care should be available or provided for immediately after the disaster, as the first cases will occur very rapidly.

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4 Trauma and wounds

4.1 Background

Wounds and injury are among the major causes of morbidity and mortality in acute natural disasters. Severe injuries are mostly reported from earthquakes and windstorms but also from flash floods and tsunamis¹.

Injuries from natural disasters typically include fractures, contusions and associated wounds that are often contaminated, resulting in superficial skin infections with common skin flora or more exotic bacteria and fungi. More serious infections of deeper tissue may occur such as fasciitis (muscle membrane infection), myositis (muscle infections) and osteomyelitis (bone infections).

Wounds open an entry port for pathogens to the blood stream and infections may rapidly progress to systemic diseases such as melioidosis or sepsis. The treatment is complicated in Indonesia by unusual pathogens and high antimicrobial resistance of more common types.

4.2 Injuries after the tsunami

From the occurrence of the disaster until May 2005, a total of 1458 injured were reported in Aceh. The trend over the 20 weeks after the tsunami shows a general decline of cases due to a shift from tsunami related to a normal injury pattern (figure 4.1).

The epicenter of this tsunami was close to the coastal areas and injuries due to collapsing buildings and floating debris were common and expected.

Also, many injuries occurred from broken glass and other sharp objects when people returned to the damaged area to clean up and repair. Gas pipes, downed power lines and electric wires were other sources of injury and have caused electrocutions and related injury in the past¹.

Analysis of data on injuries collected by the International Rescue Committee through a specific survey in Calang (Aceh Jaya district) underlines the importance of wound infections that accounted for 16.9% of all diagnoses. Most occurred immediately in the post disaster period of January 6 to 10.

Our analysis of consultations at the ICRC field hospital in Banda Aceh also indicates a similar importance of wound and skin infections (figure 4.2). Wounds, fractures and general trauma accounted for 15% of consultations by January 14 and gradually decreased afterwards. Soft tissue infections remained important throughout this period and made up 5% of all diagnoses.

The medical and nursing staff of the hospital confirmed the involvement of highly resistant and unusual pathogens in wound infections after the Tsunami.

Figure 4.1: Injury in Aceh, week 1-20 post Tsunami

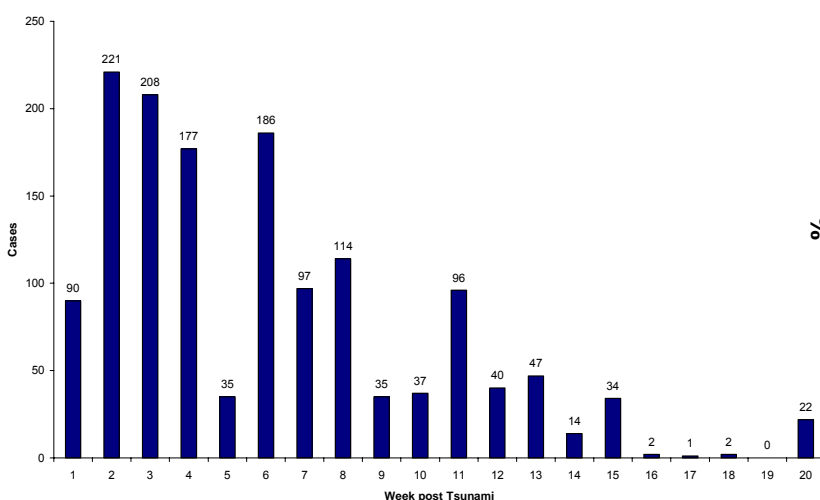
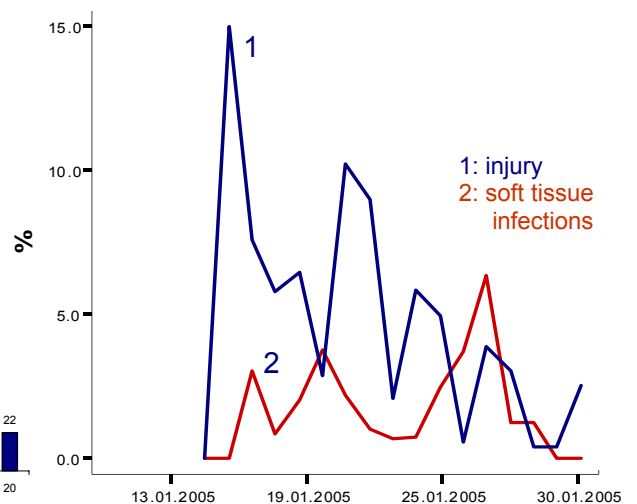


Figure 4.2: Injury and wound infections as % of total diagnosis in ICRC hospital, Banda Aceh



A case report from Australia is worth describing here. An Australian male presented to a hospital in Sri Lanka with tsunami related wounds and an extensive skin infection that appeared to be cutaneous mucormycosis. This patient was initially treated in Sri Lanka and transferred to Sydney four days later. Several debridement procedures and various antibiotics were required, as well as hyperbaric oxygen therapy. Only until the causative fungus was cultured, was adequate treatment started. The patient was hospitalized for at least 3 weeks after the diagnosis was made ².

This case illustrates the severity of wound infections in these environments and the high quality medical care that is required for the prevention of disability and mortality.

4.3 Conclusions

Acute natural disasters generally cause wounds and infections that should be anticipated. Only few reports of injury have become available for Aceh with limited distinction between specific injury and trauma such as fractures, tissue wounds, etc.

The magnitude of long term disabilities stemming from disaster-related injuries is not well examined. Useful literature on this topic exists from experiences in armed conflicts, including injury from anti-personnel mines (e.g. Cambodia and Afghanistan). This would provide insights for health response to injury and disability and consequences for reconstruction after disasters. Disaster related injuries faded off almost entirely by the fourth week of the event and therefore all interventions should be planned for within this period.

“Capacity for treatment of wound infections with highly unusual and resistant pathogens should be available in disaster frameworks”

We draw three main conclusions in this section. First, we recommend more attention to surveillance of this pathology in acute disasters considering the morbidity and mortality due to these causes. An evidence base should be built up from systematic epidemiological evaluations of future disasters.

Second, information and capacity for diagnosis, confirmation and treatment of unusual and highly resistant pathogens should be available in preparedness frameworks as there is no time to issue them after a disaster strikes. An example of improving timely and adequate treatment would be to include antibiotics for expected pathogens in the emergency health kits, which is currently not the case ³.

Finally, in-depth studies of injury and wound infections following natural disasters would contribute substantially to better medical relief after disasters. The tsunami provides an opportunity to undertake follow up research on these neglected issues.

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5 Respiratory infections

5.1 Background

In normal circumstances, respiratory infections are among the leading causes of mortality and morbidity in developing countries. In Southeast Asia these accounted for 50.4% of the infectious diseases burden in 2002 ¹.

In disaster situations, this rate is likely to increase and almost always does. Acute respiratory infections rise significantly as a direct consequence of the disaster and are an important proportion of the immediate health effects that require medical relief.

“Aspiration pneumonia would be an expected condition and should be included in training programs for emergencies”

Chronic infections (especially tuberculosis or asthma in poor communities) can already be important in the pre-disaster period and present the need for continued care.

In disasters that involve flooding and near drowning events such as the tsunami, the importance of aspiration pneumonias will increase. These are normally caused by inhalation of acid gastric content that causes chemical damage and anaerobic (*E. Coli*, *Klebsiella*) infection of the lungs, but in near drowning in tropical settings it is associated with rare pathogens, such as the ones listed in table 5.1².

Pneumonias with these pathogens are difficult to diagnose, confirm and above all to treat. Even common pathogens require highly complicated treatment in Indonesia due to antibiotic resistance³. Examples of antibiotics that are needed for these unusual bacterial and fungal pneumonias are displayed in table 5.2 and are not generally available in developing countries.

Studies on near drowning associated pneumonias clearly indicate the high case fatality rates in young, healthy persons^{2 4} and the need for timely and appropriate antibiotic treatment².

Additional information, such as fresh- or saltwater preference, is available (table 5.1) and facilitates a better risk assessment of patients from the affected areas and should be available to medical staff on the ground.

Table 5.2: Antibiotics in near drowning pneumonia

Agent	
Imipenem	Meropenem
Amphotericin B	Clindamycin
Ceftazidime	Azithromycin
Tetracycline	Vancomycin
Streptomycin	Ciprofloxacin

5.2 Respiratory disease after the tsunami

There are two main aspects of interest with regard to respiratory disease after the tsunami. First, the importance of ARI in the aftermath of the disaster was amply supported by evidence from both the ICRC patient database and the WHO emergency surveillance system.

In fact, nearly 90 percent of the total annual caseload for a typical year occurred only in the first months after the tsunami. In the province of Aceh, 8854 cases occurred in the four months after the disaster compared to 10029 for the whole year in 2003. The role of active case finding and generous availability of health services has surely played a role in this eight fold increase but it can be generally agreed that ARI did increase substantially.

Cases of acute respiratory infections decreased significantly after the first five weeks (figure 5.1) suggesting that the largest caseload occurs within a month of the disaster event.

Table 5.1: pathogens and outcome of near drowning related pneumonias²

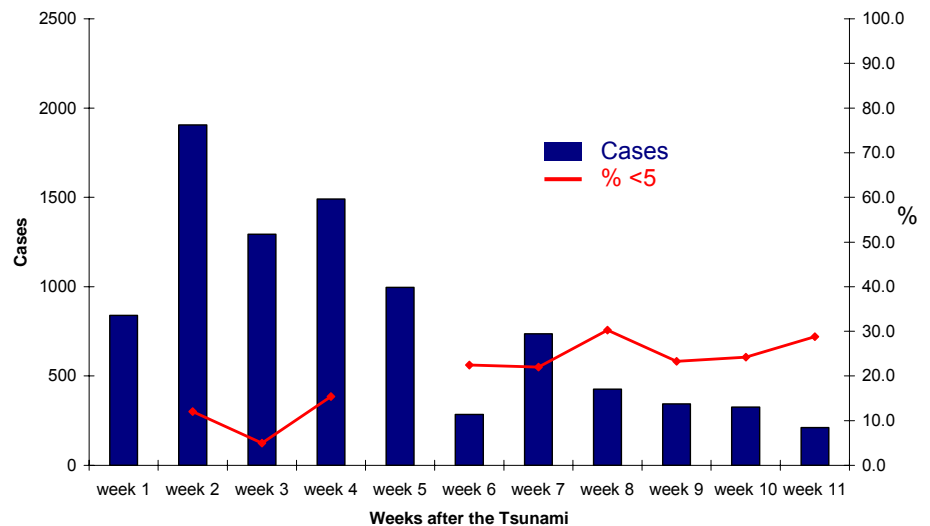
Pathogen	Freshwater	Salt water	CFR (%)	Time to symptoms
Aeromonas spp.	+++	+	63.6	< 24 hours
Burkholderia pseudomallei	++		83.3	14 days
Chromobacterium violaceum	++		0.0	> 1 month
Francisella philomiragia	?	++	20.0	5 days
Klebsiella pneumoniae		+	0.0	4 days
Legionella spp.	+		66.7	4 days-6 weeks
Neisseria mucosa		+	100.0	< 24 hours
Pseudomonas aeruginosa	+	?	50.0	5 days
Shewanella putrefaciens		+	0.0	4 days
Vibrio spp.	?	+	100.0	4 days
Streptococcus pneumoniae	++	+	100.0	< 24 hours
Staphylococcus aureus	?	?	?	
Aspergillus spp.	?	+	0.0	7 days
Pseudallescheria boydii	?	?	80.0	> 1 month

Interestingly, quite a large proportion of the cases occurred in adults. The data show that only less than a third of the cases were among children under five. No direct explanation is available for this, but it could be due to higher survival rates of adults in near drowning events.

The second point of interest in respiratory infections is the proportion of aspiration pneumonia. This was not specifically reported in the emergency surveillance system, but nonetheless mentioned by several of the attending physicians in the major hospitals providing emergency care in the weeks following the tsunami.

Figure 5.2 reports the cases treated at the ICRC hospital in the three weeks that followed the disaster. It shows a sharp decline of lower respiratory tract infections in week 2 following the disaster, which is similar to surveillance data displayed in figure 5.1.

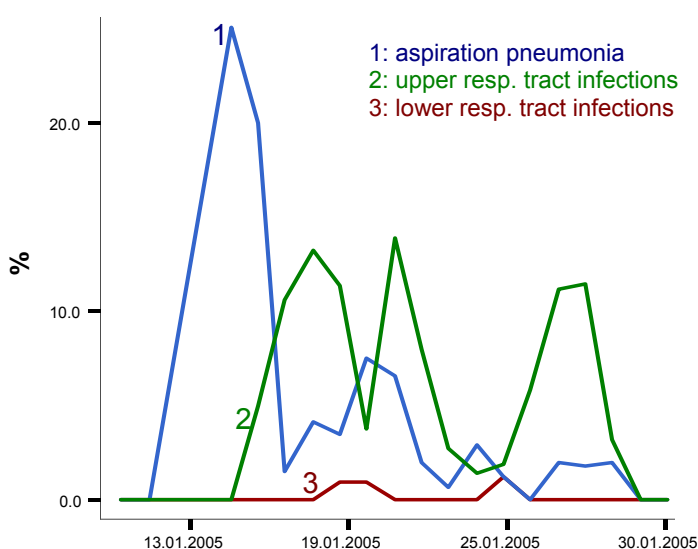
Figure 5.1: cases of pneumonia and % among children < 5: Aceh



But high alertness for uncommon pathogens should remain, as some will present with slow onset of symptoms as displayed in table 5.1.

Hospital staff confirmed that high antibiotic resistance and unusual pathogens complicated the treatment of pneumonia. Advanced antibiotic regimens such as imipenem and meropenem often had to be applied empirically from the start. Similar experiences were reported from Thailand and Australia^{5,6}.

Figure 5.2: respiratory tract infections ICRC hospital Banda Aceh: Jan 11-31



From the fourth week onward, the share of upper respiratory tract infections among all diagnoses increased, suggesting a transition to a normal disease pattern after the fourth week.

5.3 Conclusions

Respiratory infections are already among the largest contributors to mortality and morbidity in Indonesia and their impact was even increased by the Tsunami. The disaster generated submerged houses and buildings with inhalation of contaminated water by inhabitants as a consequence.

Aspiration pneumonia would be an expected condition in these circumstances and, as a rare condition, should be included in training programs for physicians and nurses preparing for international emergency response.

The correct identification of pathogens and their antimicrobial susceptibility is essential to reduce mortality, therefore sufficient diagnostic and confirmation capacity such as radiology and laboratory services should be available. Adequate antibiotic treatment regimens, as well as intensive care equipment such as ventilators and monitors, should also be at hand.

Emergency medical teams should be aware of resistance patterns in the target areas before or shortly after arrival to respond appropriately to the situation.

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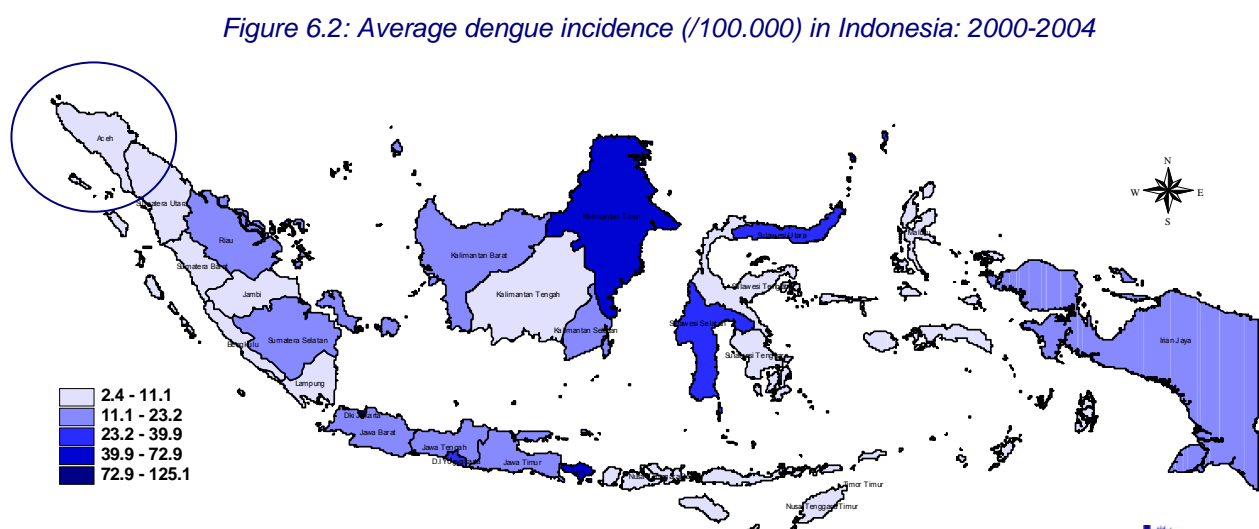
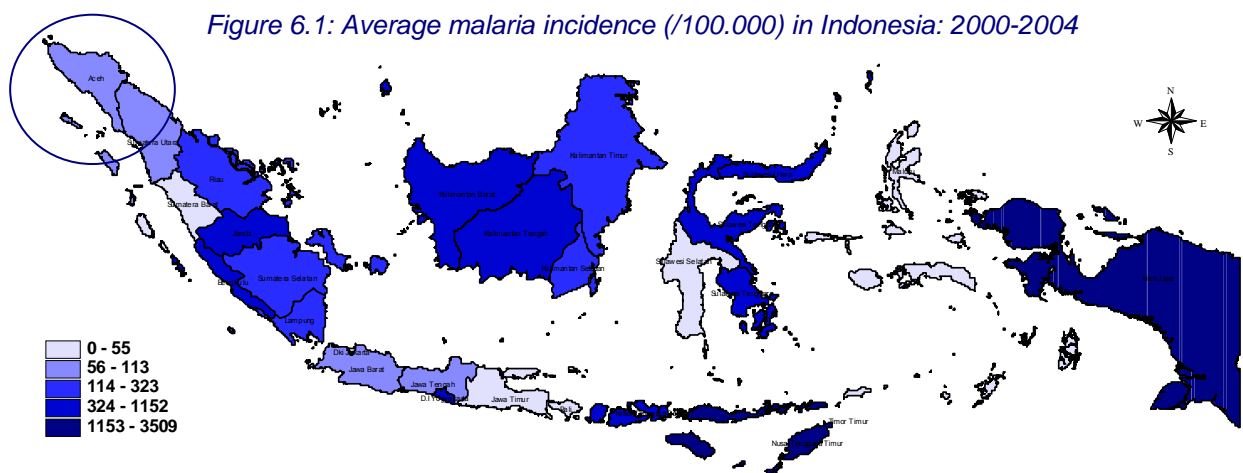
6 Malaria and dengue

6.1 Background

Malaria and dengue are the most important vector-borne diseases in Indonesia. In the years before the Tsunami (2000-2004), both diseases were endemic in most provinces and several epidemics occurred.

Aceh (encircled) has been among the least important regions in the country for malaria over the last years (Figure 6.1).

The incidence of confirmed malaria cases in Indonesia is 635/100.000 over the past four years and in Aceh the comparable figure is 98.5/100 000. The low endemicity in Aceh could be due to either a strong prevention programme in a high endemic context or a naturally occurring low endemicity of the disease. In the former case, a breakdown of prevention services due to a disaster could lead to major outbreaks. In the latter case, this would not occur.



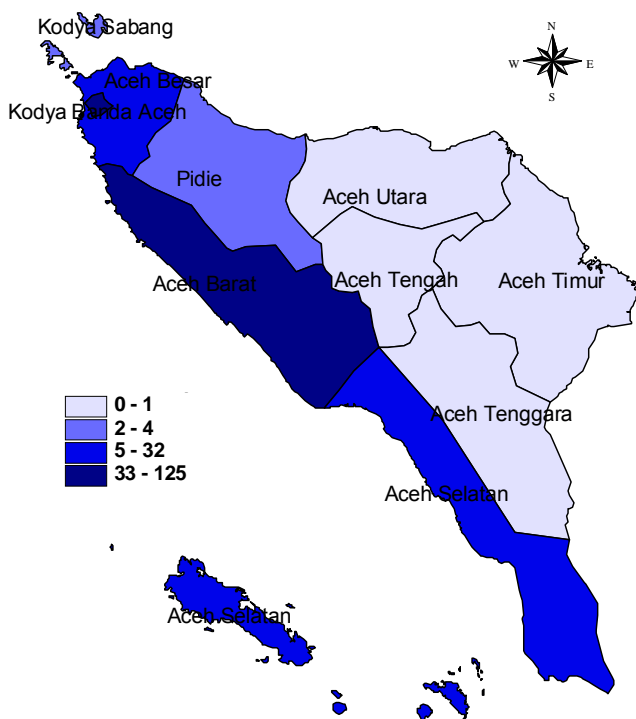
Dengue has been of increasing concern in all of Indonesia over the past decade, but especially in Kalimantan and Java as higher transmission occurs in these urban areas. Aceh is among the provinces that have reported the lowest dengue incidence over the last five years (Figure 6.2).

Within Aceh province, the highest dengue incidence is in urbanized areas of Banda Aceh, Calang and Meulaboh, which were subjected to severe tsunami damage (annex A7). Dengue cases in Aceh vary significantly by month but no cyclical or seasonal patterns are discernible (annex A8). The most recent epidemic year since the large regional outbreak in 1998, was 2004.

The risk of vector-borne diseases such as malaria and dengue after floods in highly endemic areas is significant but requires the presence of specific risk factors¹. Increased risk factors due to disasters include breeding sites, migration from and to endemic areas, reduced access to health facilities for diagnosis and treatment, and disruption of prevention and control programs.

There were no major risk factors for malaria outbreaks in Aceh. The coastal area of Aceh is a naturally low endemic region of the province with most cases occurring further inland.

Figure 6.3: Malaria incidence (/100 000) Aceh '05



Malaria is mainly transmitted by mosquitos of the *Anopheles* genus. The more effective species require stagnant fresh water for breeding. While the saline water from the tsunami turned many of the potential sites brackish and therefore non-conducive for breeding of the effective species, some less effective (*An. Sundaicus*, *An. Subpictus*) require brackish water². Thus while some vector breeding can take place in salt containing water, its contribution to malaria transmission is lowered³.

On the other hand, influx of humanitarian workers and army personnel from high endemic parts of Indonesia and the world could conceivably have imported parasites.

The dengue mosquito (*Aedes* species) breeds mainly in discarded containers and water storage jars in urban areas and much less in pools and ponds. The amount of breeding sites in debris and artificial containers created by tsunami destruction however, might increase as rainwater fills these up¹⁴.

6.2 Malaria and dengue after the tsunami

In the 4 months after the Tsunami, 987 confirmed malaria cases were reported in Aceh (monthly incidence 7.5/100 000). Most cases were in the West coast area including Banda Aceh (figure 6.3). The post-tsunami monthly incidence in Aceh is more than 10 times lower than the comparable monthly rate over the last five years (94/100 000). Although biases in the data include reduced completeness of regular case reporting directly after the tsunami disaster.

There were few cases (29) of dengue reported, and those were from the two Northern districts of Aceh Barat and Aceh Utara.

A study of patient consultations between January 11-31 at the ICRC field hospital in Banda Aceh identified 15 cases of malaria but no dengue cases. Details on this group are given in table 6.1. Most patients originated from Banda Aceh, with the majority being males and of all ages. The high percentage of males could be due to higher survival of the tsunami or easier access to healthcare than females due to social-cultural traditions. Not all cases were equally severe as less than half were admitted.

Table 6.1: Malaria cases ICRC hospital Banda Aceh

Cases	15
Time period	Jan 12-31
Age range	1.5-64 y
Average age	30.4 y
Male/female	12/3
Percent males	80%
From Banda Aceh	73.3%
Admitted	7 (46.7%)

6.3 Conclusions

Malaria and dengue are endemic diseases in many of the Tsunami affected countries. In normal situations, the number of malaria or dengue cases in Aceh is dwarfed by this number in other provinces in Indonesia such as Sulawesi or Kalimantan, causing these diseases to be of low priority in this province.

No increase in cases for both malaria and dengue were noted in Aceh in the post-tsunami period, though certain risk factors were present. Neither did we find a sound epidemiological basis for the anticipation of an increase in dengue much less an epidemic due to the tsunami. Similar conclusions were drawn in Sri Lanka and India ^{4,5}.

Despite environmental changes brought about by the tsunami, the high saline content of the water is unlikely to have increased the breeding potential of vectors. A large heterogeneity of the incidence of malaria and dengue between localities creates the need for rapid risk analysis to be undertaken before launching major disease control operations in this region.

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7 Report conclusions

Experience has shown that certain diseases (cholera, malaria, dengue), however commonly believed, are not always a priority immediately after a disaster. A quick evaluation of the existing patterns of disease should be pre-requisite before funding and launching massive response operations. In most circumstances, national and state ministries can typically provide data and pertinent advice. There is no substitution, even in emergencies, for evidence-based response.

“Certain diseases, however commonly believed, are not always a priority immediately after a disaster”

The number of disaster related health conditions needing emergency response, decreased by two and became negligible four weeks after the disaster. International humanitarian agencies in the health sector should start working with the MOH well within this time period, allowing the use of relief funds and permitting gradual integration into existing systems.

Surveillance systems in emergencies urgently need further research and development. The WHO system set up immediately after the tsunami was a major step forward and demonstrated the feasibility and the uses of such a tool. Lessons should be learnt from this experience and used to develop a prototype for the next emergency that should be applicable to both natural and man-made disasters. Priority should be given to issues such as estimation of denominators and reporting formats. For increased usefulness and sustainability, the emergency system should be designed to enable integration into the normal system once the relief phase is over.

Key national health officers should be consulted immediately after a disaster regarding the risk of outbreaks and population denominators should be established as soon as possible and monitored for changes

If military medical corps are involved, as is increasingly the case, protocols for handing over military medical services should be foreseen as part of the international preparedness plans.

“Key national health officers should be consulted immediately after a disaster regarding risk of disease outbreaks, ,

Guidelines for tetanus and aspiration pneumonia should be included in disaster medicine handbooks. Wound management is an important aspect of immediate relief and should be included as an essential component of medical training for emergency relief.

Although we have not presented findings on maternal and child health services, deliveries occurred with undiminished regularity and in worsened conditions. Humanitarian aid groups should be prepared to provide emergency obstetrics and post-natal services. In this context, we find that there are opportunities to strengthen the primary health care system for maternal care. Post emergency assistance should consider strengthening regular services as soon as possible.

“Handing over military to civilian medical services should be foreseen in international preparedness plans, ,

“Humanitarian aid groups should be prepared to provide emergency obstetric and post-natal services, ,

Funding for relief after natural disasters should be mindful of its sustainability. This approach is not contradictory to providing immediate relief, but requires pre-planning and technical skills. As we have observed in the tsunami, relief-spending levels can be significant relative to past development aid for the affected population. To spend them on one-off actions that do little to contribute to the long-term welfare of the populations is thoughtless and wasteful.

Donors should know when to stop providing emergency relief funds and transit to development strategies.

“To spend relief funds on one-off actions that contribute little to long term welfare is thoughtless and wasteful, ,

8 Annex

Figure A1: vaccination coverage of four doses tetanus toxoid: 2003

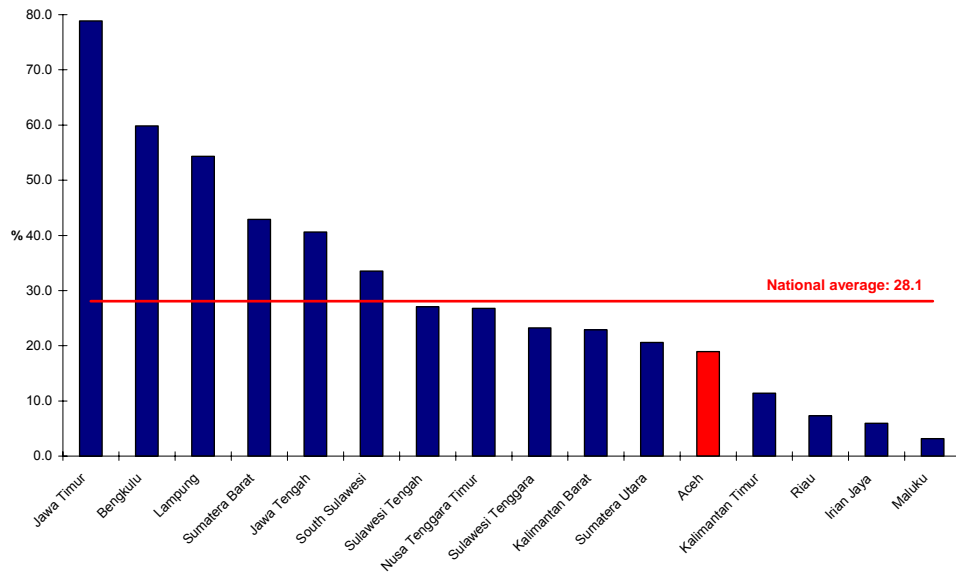


Figure A2: Average tetanus incidence (/1000 population) in Indonesia: 2001-2004

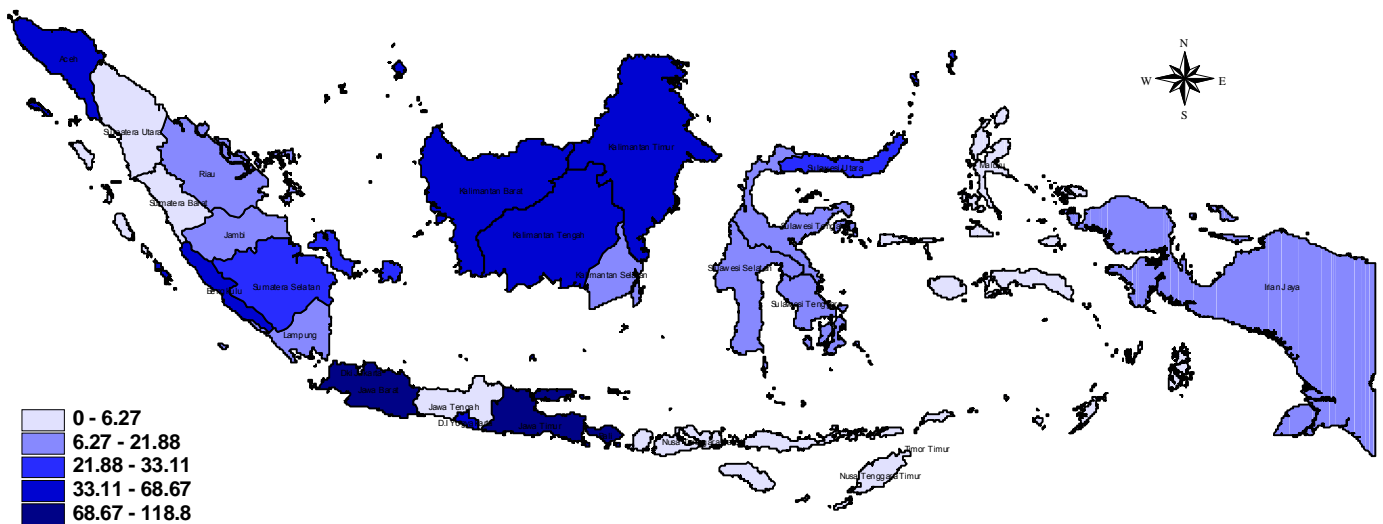


Figure A3: Tetanus cases in Aceh 2000-2005-April

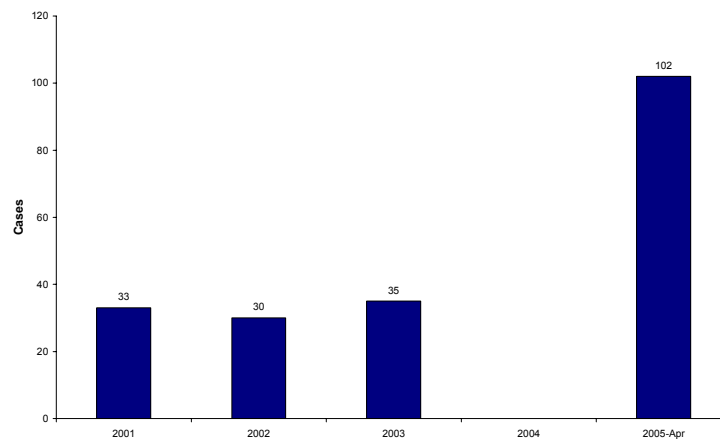


Figure A4: Average percent of suspected malaria cases tested in Indonesia: 2000-2004

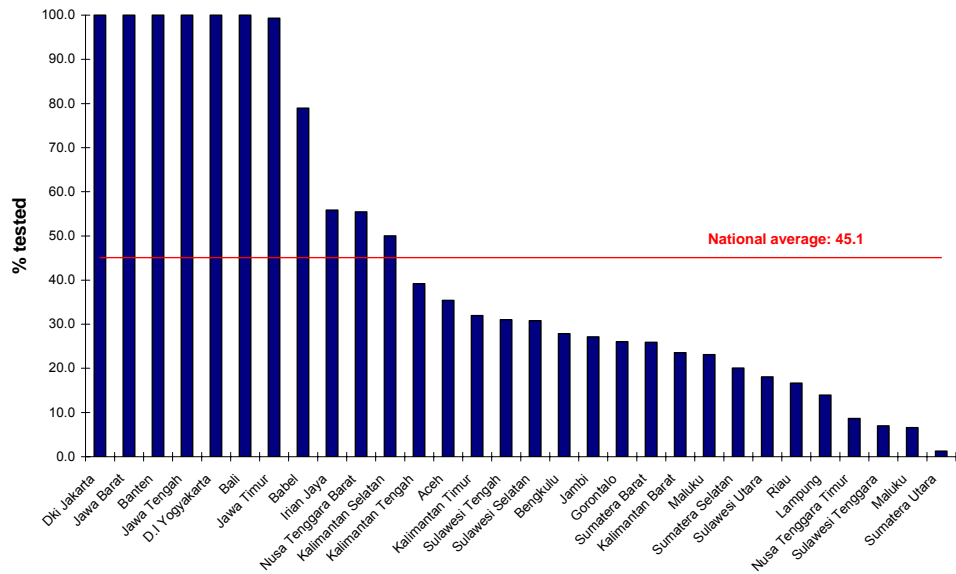


Figure A5: Average percent of malaria tests positive in Indonesia: 2000-2004

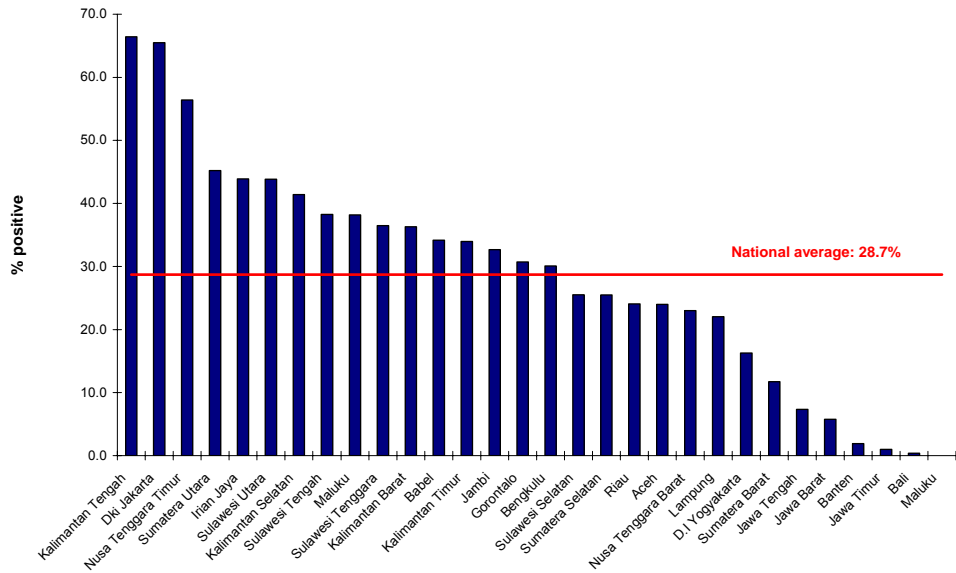


Figure A6: Incidence of malaria in Indonesia: 2000-2004

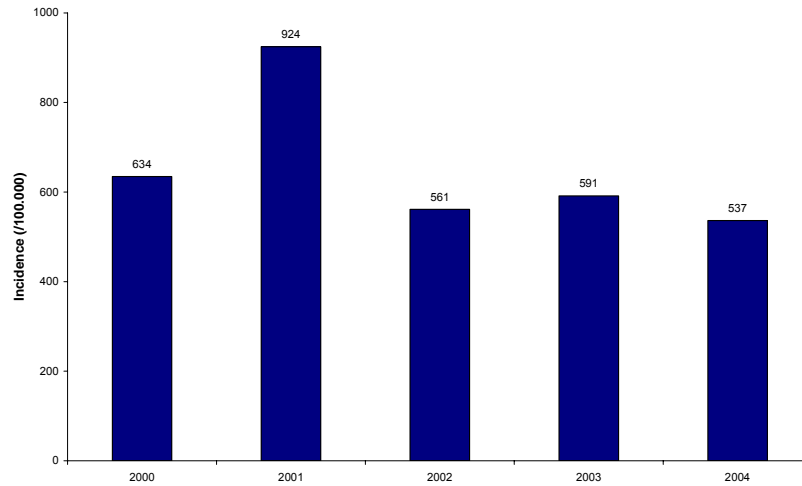


Figure A7: Average dengue Incidence in Aceh: 2000-2004 (main cities as stars)

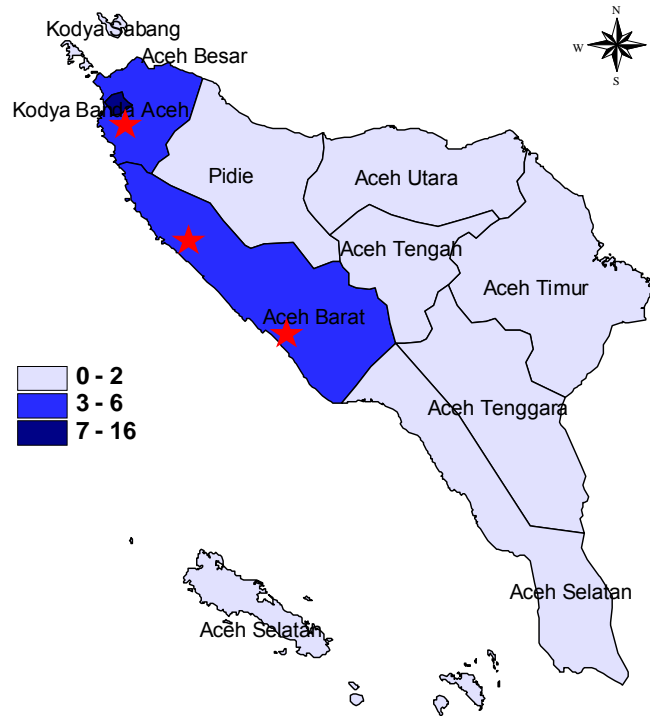
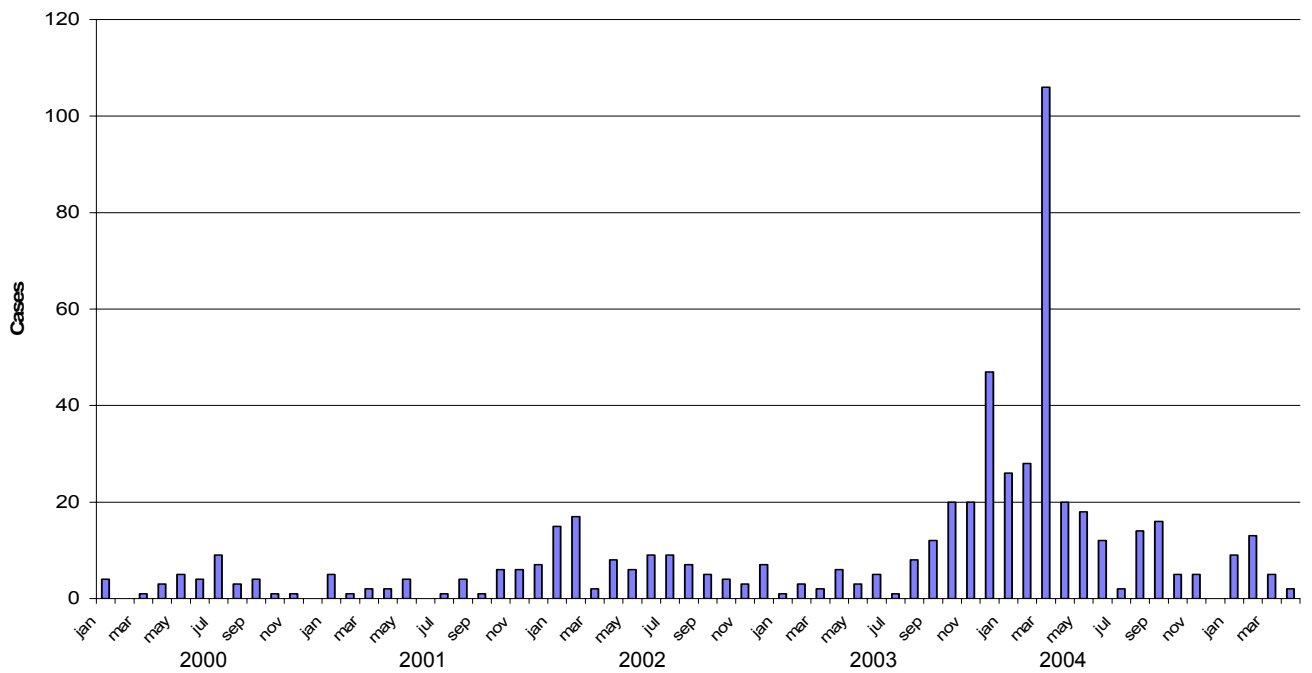


Figure A8: Dengue cases in Aceh province: 2000-2004



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