Viewpoint

Disaster Relief and Initial Response to the Earthquake and Tsunami in Meulaboh, Indonesia

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Abstract

The Singapore Humanitarian Assistance Support Group deployed a team of 32 medical relief workers to Meulaboh, Indonesia to provide medical assistance for victims of the 26 December earthquake and tsunami disaster. The team was deployed at a primary healthcare clinic at an internally displaced persons' (IDP) camp and at the sole hospital's emergency and surgical departments. The team saw a total of 1841 patients, 1371 at the clinic and 446 at the hospital's emergency department, and performed surgery on 24 patients. Tsunami-related trauma cases accounted for 31.8% (142) of cases at the emergency department, 1.6% (22) of cases at the clinic, and 91.7% (22) of surgeries. This paper details the difficulties and lessons learnt by the team, including the lack of important resources for healthcare delivery. Water, sanitation, hygiene, and vector control were some of the problems faced, with the goal to provide the most effective public health for the greatest number of people given the limited resources available.

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Introduction

A massive earthquake and tsunami hit the South Asian region on 26 December 2004, killing more than 200,000 people and displacing countless more.[1] The epicentre of the earthquake was near the coast of Aceh in Sumatra, Indonesia.[2] The subsequent tsunami, one of the deadliest in history, affected more than 10 countries across 2 continents.[1]

The authors were part of the Singapore Humanitarian Assistance Support Group (HASG) that arrived in Meulaboh on 2 January 2005, via Republic of Singapore Navy ships to provide initial disaster relief. Meulaboh, a coastal fishing village, is the largest town in the province of Aceh Barat, one of the worst affected regions. The population of Meulaboh before the tsunami was about 60,000 to 80,000, and after the tsunami the population was reduced to about 40,000 to 45,000, which included about 29,000 internally displaced persons (personal communication – local government, 2005).

The HASG comprised more than 600 military and civil defence personnel, and civilian volunteers organised in naval, helicopter, engineering, logistics, and medical teams. The medical team (Singapore Medical Team) comprising 32 healthcare workers (11 doctors, 10 nurses, and 8 paramedics, 2 counsellors, and 1 public health inspector) was included because of reports of numerous casualties and the presumed increase in healthcare needs. Due to poor accessibility, the team was the first large foreign medical contingent deployed in Meulaboh even though it arrived a week after the tsunami. This paper provides the team's account, and the important lessons learnt to offer future volunteers insight to the problems during disaster relief and to enable future relief teams to function more effectively.

Impact of Disaster

The town of Meulaboh and neighbouring villages, along with most of the population, were located within a few kilometres of the coastline. The earthquake damaged buildings and roads, and the subsequent tsunami destroyed almost all structures along the coast, flooding areas up to 2 kilometres inland. The airport and land routes to other major towns had been severely damaged. Of the 2 jetties in Meulaboh, one was destroyed and the other was unable to hold heavy vehicles. Supplies during the first week were transported via helicopter or offloaded by hand from boats. The HASG cleared 2 landing points on the beaches where heavy equipment and supplies could be offloaded.

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The disaster had tremendous impact on the healthcare system. There were previously 2 hospitals in Meulaboh. The military hospital along the coast was completely devastated by the tsunami. The civilian Cut Nyak Dhien Meulaboh Hospital, located 3 kilometres inland, was unscathed, and was the sole surviving hospital in the province serving a population of a few hundred thousand. In the critical post-disaster period, there was a shortage of healthcare facilities, staff, and supplies. Of about 130 doctors and nurses working at the hospital prior to the tsunami, only 30 were available post-disaster (personal communication – Dr Haris, medical director, Cut Nyak Dhien Meulaboh Hospital, 2005). The rest may have perished, were injured, or were searching for their families. The emergency department was not functioning optimally due to shortages of staff and supplies, and the wards had insufficient beds due to damage and missing mattresses. Of the 2 operating theatres, one was fully equipped whilst the other could only handle simple procedures. Many clinics in the city were destroyed and the few clinics that opened were only able to provide minimal acute care and were inadequate in meeting the needs of the entire population.

Although many healthcare facilities were destroyed, the speedy mobilisation of healthcare teams from other parts of Indonesia such as Surabaya, Jogjakarta, Medan, and Jakarta was commendable. Once aid arrived, the Cut Nyak Dhien Hospital regained much of its function and capacity. By the end of the second week, there were about 30 humanitarian relief organisations working in and around Meulaboh. Fixed and mobile primary healthcare clinics were set up in internally displaced person's (IDP) camps and surrounding villages to increase access to healthcare.

Deployment

The Singapore Medical Team had surgical capability with 1 field operating theatre and ward, primary healthcare, and public health facilities. This configuration was as a stand-alone facility with the primary healthcare component providing general healthcare and triage for the surgical unit, while the public health component conducted disease surveillance. The team was prepared for physical trauma cases and to treat epidemics from food- and water-borne diseases. Such cases are widespread after natural disasters, with patients congregating at available health facilities.[3-5] Similar disasters also increase the risk of food- and water-borne diseases due to contamination of water sources and poor sanitation.[6-12] The risk of outbreaks is also increased when IDPs live in close proximity.[13-15]

The original plan was to deploy the team as one unit to allow different sections to augment each other. However, the hospital's surgical and emergency department needs and the need for primary healthcare in IDP camps necessitated dividing the team into 2 functional units. Individual roles had to be reshuffled, increasing the strain. The team was concurrently deployed in a primary healthcare clinic at the Kantor Bupati IDP camp from 4 to 15 January and at the hospital from 5 to 16 January 2005. The team saw a total of 1958 patients, 1488 at the clinic and 446 at the hospital's emergency department, and performed surgery on 24 patients.

Hospital

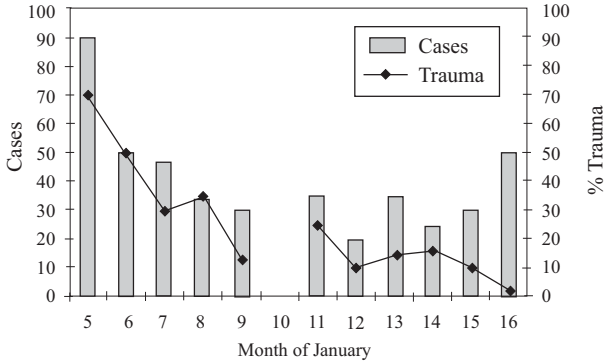
At the hospital, the Singapore team worked with Indonesian and international relief organisations, from small organisations with 3 to 4 healthcare workers to large ones such as *Medicins Sans Frontieres*, with more than 20 staff, and Indonesian organisations with more than 30. There were daily hospital meetings to ensure coordination and cooperation.

At the emergency department, cases were randomly assigned and the triage system was not fully effective in the early post-disaster period. Figure 1 shows the workload by the Singapore Medical Team. The arrival of personnel and supplies after the first week helped to reinstate the emergency department to full function and many patients sought care there, as evident from the number of cases (90) the team treated on the first day of deployment. New tsunami-related trauma cases comprised 70% (63) of all cases on the first day, and consisted of infected wounds, open fractures, gangrene, and tetanus. The number of cases treated decreased over the first 5 days and stabilised at between 20 and 50 cases per day. A total of 141 tsunami-related trauma cases were treated and the proportion decreased with time, although sporadic cases of tsunami-related trauma were seen up to 3 weeks post-disaster.

During the same period, the team treated 5 cases of tetanus. The first 2 cases treated within 2 days of the team's arrival had fully developed tetanus, including lockjaw and muscular spasms, upon presentation and died within a day. The other 3 cases seen during the second week presented early, were given anti-tetanus immunoglobulin, and recovered. Ten cases of falciparum malaria were also seen, all presenting with prolonged fever, chills, and hepatosplenomegaly.

About 40% of cases at the emergency department did not require urgent care and stretched available resources. On 16 January, the team's last day at the emergency department, the team helped construct a triage area and primary healthcare clinic adjacent to the emergency department, staffed by doctors and nurses from Operation Blessing International, to refer only urgent cases to improve the workflow.

The Singapore team also performed surgery on a total of 24 patients, of which 13 were done in the field operating



There was no deployment on 10 January due to inclement weather.

Fig. 1. Emergency department case load for the Singaporean team.

theatre, which was deployed within the hospital to augment the surgical facilities. Of the surgical cases, 12 involved wound debridement, 2 casts, 1 fracture reduction, 1 limb amputation, 1 pin insertion, and 1 chest tube insertion, and 6 wound cleaning and dressing for the earlier surgeries. One patient had extensive necrotising fasciitis of the lower limb and although wound debridement and antibiotics were given, died from sepsis. The other patients recovered after hospitalisation.

Primary Healthcare

The Kantor Bupati IDP camp, a typical makeshift camp, was a double-storied government building used as a temporary shelter. With a listed population of about 12,000, overcrowding was a problem. The town's water supply was disrupted and water from unaffected inland wells was transported via water tankers and stored in open holding tanks. The fixed latrines were not functional, and field latrines constructed did not have adequate drainage and were insufficient for the population size (1 latrine to more than 500 people).

At the Singapore Medical Team's clinic, the trends for tsunami-related trauma were similar to those of the emergency department. No new tsunami-related trauma cases were treated after the sixth day and the tsunami-related cases thereafter were repeat consults for wound dressing and the removal of stitches. Figure 2 shows disease trends based on case proportions at the clinic. Of all consults, 27.3% were upper respiratory tract infections, 5.5% diarrhoea, and 1.6% trauma. The team diagnosed 10 cases of malaria and 3 cases of pulmonary tuberculosis, which are endemic. There were no diagnoses of meningitis, measles, dysentery, or cholera. There was a higher proportion of diarrhoea cases during the first 2 days, and spikes of upper respiratory tract infections on the 7th and 12th of January. These, however, did not persist and case proportions for possible indicators of epidemic activity remained stable.

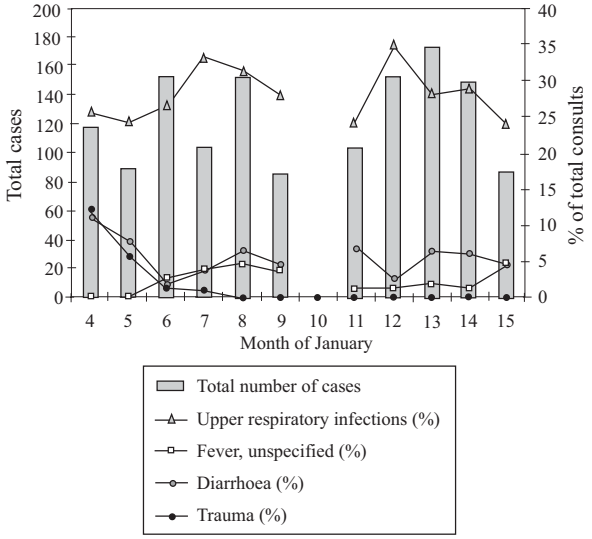


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Fig. 2. Case load at the primary healthcare clinic at Kantor Bupati.

The Indonesian authorities had planned to construct semi-permanent IDP settlements inland. By the fifth week post-disaster, the team was able to discontinue its services as the population in Kantor Bupati was relocated to a new settlement.

Lessons Learnt

In disaster relief operations, preparation is important but readiness for the unexpected and quick reaction to changes is crucial. The unexpected occurrences experienced by the Singapore Medical Team provide lessons from which future disaster relief teams can learn so as to be more effective.

In determining its configuration, the team had anticipated large numbers of trauma cases and were prepared, including having 5 surgeons and 2 anaesthetists with a mobile field operating theatre to augment existing facilities. Nine per cent of the cases seen were related to trauma and although most were minor, the few severe cases could not be operated on because of a lack of blood transfusion and intensive care facilities, which was the limiting factor. The availability of intensive care facilities would have enabled more major surgeries to be performed. The probable cause for the low proportion of trauma cases is that the severely injured had perished due to problems with timely access to care. In the trimodal distribution of trauma deaths described by Trunkey,[16,17] 50% of deaths occur in the first hour from overwhelming injuries and another 30% within 4 hours from severe trauma. The arrival of the medical teams after the first week meant that the first 2 peaks had passed and cases seen constituted a portion of the third peak including healing wounds, secondary infections, gangrenous wounds,

and unmanaged fractures. While the configuration of the team was to enable multiple functionalities, additional emergency and primary healthcare physicians would better address other needs.

The outbreak of tetanus was another important learning point because none of the relief organisations had anticipated the high incidence. The overall vaccine coverage in Aceh was less than 20% (personal communication – local government, 2005) and this, coupled with tsunami-related wounds and scavenging for belongings amidst debris, resulted in disaster. There was no anti-tetanus immunoglobulin available initially and the lack of intensive care meant that patients with fully developed tetanus could not receive supportive treatment. Efforts by the World Health Organisation were made to obtain immunoglobulin supplies.[18] Later measures included vaccinating all patients with wounds, together with mass vaccination campaigns across the province. Thorough studies of specific local health needs would have uncovered this problem, and should be performed during the preparation phase in spite of the urgency.

On the other hand, gastrointestinal disease was anticipated as it occurs commonly in floods.[19-21] Tests of 3 drinking and washing water sources using a Hach incubator and test kit showed large amounts of coliforms. Although no food- and water-borne outbreaks were encountered during deployment, complacency must not occur and surveillance must continue to ensure outbreaks are detected early and stopped. Epidemics, which account for many post-disaster deaths, can still occur due to conditions in the new IDP camps,[22,23] with 40 to 50 people in a tent and communal facilities for 2,000 people.

Although the team tried to conduct disease surveillance, this was hampered by the lack of accurate denominator and baseline data. At the Kantor Bupati, it was difficult to discern the exact proportion of patients residing within the camp, because it is loosely situated in the city amongst regular housing. This was evident by the camp's listed population of 12,000, but a quick survey by sampling families within different sectors yielded an estimate of 3,000. This problem was compounded by fluctuations in the population over time. The lack of denominator data necessitated a reliance on case proportions, time-trends, and cross-sectional comparisons, which made disease surveillance very inaccurate. There were also sources of bias in data collection such as survival bias with data collected 1 week post-disaster. Selection bias was present since the team was unable to conduct population-based studies and only recorded presenting cases. The effects of these biases were reduced by locating at prominent sites, actively informing the residents, and reducing inter-physician variability using case definitions and diagnosis codes. Surveillance by household surveys marking out population sizes and disease incidence would have been more effective in reducing biases and denominator uncertainties.

Other public health challenges included insufficient sanitation and hygiene in the camps and villages, including the discharging of waste material upstream of washing and bathing facilities, and consuming food without prior hand washing. The team advised locals on proper hygiene practices, but these practices were long-standing and difficult to change in the acute post-disaster phase. This was also reflected in vector control, where there were limited protocols. The team worked closely with vector control workers from the Centre for Disease Control, Jakarta to provide basic vector control, since malaria, dengue, and Japanese encephalitis are endemic and may spread because of flooding and overcrowding. The lack of immediate resources limited vector control efforts to specific areas such as IDP camps, hospital, and military facilities where many people lived in close proximity. Public health measures in emergencies have to be rationed to provide the greatest good for the largest population, but future initiatives should include building the regional public health infrastructure and this has to be included during preparations to ensure availability of the necessary experts and tools.

Apart from the problems, sustenance and communication were well planned and the team resided on board the naval ships or at the hospital, with security provided by the Indonesian military. Water and food were stored on the ships and distributed regularly, and transport was efficient because the logistic component of the HASG included numerous vehicles. Communication was essential as few locals spoke English but this was well anticipated and the team included many Malay-speaking members who functioned independently or as translators. Planning ensured that these potential problems were non-events and contributed to the team's success. However, planning could not circumvent necessities such as sanitation, and the team had to use available facilities.

Conclusion

The team departed from Meulaboh on 21 January as the acute phase was over and the primary objective of providing initial disaster relief was met. The team had improved local access to healthcare when few other medical teams were present. The rebuilding phase required long-term aid provided by other organisations that could commit necessary resources and time. Participation in this relief effort helped the Singapore Medical Team experience the extent of the disaster and provided invaluable lessons. Each mission brings lessons to enhance the effectiveness of future missions. Although preparation is essential, disasters always

result in the unexpected and flexibility is needed to meet the objectives.

At the time of the team's departure, life was returning to normal for the locals. Although it is difficult to envision a full return to normalcy, the resilience of the human spirit must never be underestimated.

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