Dengue Hemorrhagic Fever and Natural Disaster: The Case of Padang, West Sumatra

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ABSTRACT

Introduction: The earthquake that struck Padang, West Sumatra on September 30th, 2009 was a significant turning point in the city's recent history. The aftermath and responses to the disaster were shaped by longstanding practices and attitudes towards development, and it has resulted in ongoing effects and changes to the city's health environment, including, significantly, to issues relating to vector control and the occurrence of dengue hemorrhagic fever.

Objective: Establish and document the links between the earthquake and changes to the environmental health situation in Padang.

Method: Consideration of statistics on dengue hemorrhagic fever, combined with an assessment of issues arising from the earthquake that impact on environmental health, as reported in official documents and media discussion

Result: The earthquake has resulted in significant long-term changes to the living environment, which have impacted on health issues, most notably through an increase in dengue hemorrhagic fever.

Conclusion: The importance of planning for sustainable development in the context of prevention and control of environmental disease is illustrated by natural disasters such as the Padang earthquake, and cannot be overlooked in developing regions.

Keywords: West Sumatra, disaster, dengue, development

Introduction

On September 30th, 2009, an earthquake struck West Sumatra, with its epicentre just outside the provincial capital of Padang. The province has historically experienced a great deal of tectonic and volcanic activity, but this event was the first time in recent history that a significant quake

(7.6 on the Richter scale, in this case) had occurred in very close proximity to a major population centre. In particular, there had been no such incident since the beginning of regional autonomy and the associated changes in the responsibilities of the provincial and local governments, eight years previously; this meant that the city's government lacked experience and expertise relevant to managing and responding to a disaster, with long-lasting implications for the aftermath and for the city's environmental health situation. These implications are clearly illustrated by considering the case of dengue hemorrhagic fever (DHF) in Padang.

Dengue hemorrhagic fever in Indonesia

Dengue (known as *demam berdarah* in Indonesian) may have been recorded as long ago as the year 992, and is believed to have been originally spread globally by sea travel in the 18th and 19th centuries[1]. Its prevalence dramatically increased in Southeast Asia in the years following World War II, an observation attributed to ecological disruption associated with the war and rapid urbanization[2]. As a result of changes to the living environment coupled with dramatic population growth, control of the disease has been problematic in many tropical and sub-tropical regions, including Indonesia. The dengue virus has evolved rapidly under these conditions and genotypes associated with increased virulence have spread across Southeast Asia and elsewhere[3].

There are four serologically distinct strains of the dengue virus, referred to as dengue-1, -2, -3, and -4; all four are endemic in Indonesia, including West Sumatra. All four have similar characteristics and are carried by the same vector, the *Aedes aegypti* and/or *Aedes albopictus* mosquito[4]. Infection with one of these strains confers immunity to that particular strain; later infection with a different strain often results in significantly more severe illness, and has a greatly increased chance of developing into dengue hemorrhagic fever (DHF), which can be fatal[5,6]. At present, dengue is a leading cause of excess mortality and hospitalizations, especially among children in Indonesia[7].

Research has shown that the incidence of dengue in Indonesia is strongly associated with rainfall but temperature appears to be the main indicator of severity of outbreaks[8]. A predictive model developed for the city of Makassar in eastern Indonesia uses humidity as the salient factor in determining the occurrence of outbreaks[9]. There can be no doubt that, in many parts of Indonesia, increased incidence of dengue occurs during the rainy season when these weather and climate conditions are met. However, it is also the case that local factors of various kinds seem to influence the occurrence of the disease[8], including such factors as vegetation, housing type, population density, facilities for disposal of garbage, and so forth. These local factors are of significance in the case of the city of Padang following the 2009 earthquake of interest here as the disaster resulted in major changes to the living environment in the city as well as to significant changes in land use. While dengue is a chronic problem in this area, the earthquake created a set of factors that enhanced transmission of the disease and also led to a set of circumstances in which prevention was unusually difficult.

Materials and Methods

This paper makes use of statistics on the occurrence of dengue hemorrhagic fever in West Sumatra, available from the national Ministry of Health. Statistics on various diseases are reported to provincial health departments, then compiled into annually into reports by province, which are publicly available.

Assessments of the environmental health situation in Padang are based on publicly available reports from the city's news media. Various outlets reported extensively on a range of aspects of the response and recovery efforts, and most of these reports are still available online. By considering the reports, the nature of the environmental health changes caused by the earthquake can be ascertained, and assessed from the perspective of both the public and the governmental sector.

Results

Figure 1 shows the statistics on the occurrence of dengue hemorrhagic fever for Padang in the period of January 2009 through December 2010.

Discussion

The data on reported cases of DHF shows a clear spike in late 2009, almost immediately following the earthquake. This is very likely to be directly attributable to the effects of the disaster. Significant damage was sustained to government, commercial, and residential buildings, including major shopping centres, banks, and schools[10,11]. A significant number of lots were abandoned in the following months, especially in older parts of the city. Cleanup of rubble resulting from the quake has proceeded slowly, and much of the action to clear abandoned sites has been left to owners; since many of the owners are no longer in residence, there has been little progress on this front. Water supplies were also disrupted, leading residents to collect rainwater and store large amounts of water around their homes.

These factors represent a significant change ot the living environment, resulting in a significant expansion of the available breeding locations for mosquitoes. Since the earthquake occurred very close to the beginning of the rainy season, the final result was increased mosquito activity, and increased contact between humans and mosquitoes.

The drop in reported cases of DHF in early 2010, and its relatively low level through the rest of that year, can also be attributed to a combination of climatological and societal factors. First, the fact that many public health centres were destroyed in the earthquake means that the disease may have been under-reported. Second, widespread damage to houses, roads, and facilities led to many people being unable to remain in their residences, with many relocating to the highlands of West Sumatra or other regions believed to be safer; thus, many of the areas most susceptible to

DHF may have been under-populated. Third, 2010 was relatively dry compared to 2011 and 2012, which likely resulted in a general decrease in mosquito activity throughout the year.

Recent reports and statistics indicate that DHF remains a significant challenge in Padang, and that its transmission is being facilitated by environmental changes resulting from the earthquake. The ongoing inadequacy of municipal services, including garbage collection and disposal, has been noted by various media sources, with residents estimated to be producing around 400-500 tons of garbage daily and the city's landfills only able to accommodate about 50% of this[12]. The most recent available statistics for cases of DHF show that the number of confirmed cases in 2011 is lower than for 2010 (925 in 2011, compared with 1045 in 2010), but it remains significantly higher than the average for the decade before the earthquake[13].

Ultimately, these issues can be traced to the approaches historically taken to development and infrastructure in Padang and in Indonesia in general. First, vector control has not been a priority, as the prevailing public and official perception of mosquitoes in West Sumatra is as a nuisance, rather than a public health or development issue. Second, and even more widely impactful, development policies have tended to focus on areas of technology such as electrification, communications infrastructure, and internet access. These fields are viewed as iconic of development and progress, and associated with modernity and with specific successful countries and regions, and improvements to other essential areas such as water infrastructure has often lagged behind them. Additionally, West Sumatra experiences high rainfall – approximately 400 mm per month, with an average of 17 days of rain each month[14] – and as a result has not experienced significant water shortages historically, as people were able to manage their own water to a certain extent. By the time of the earthquake, this point was less true than it had been in the past, and many residents were left entirely without water in its aftermath. Had more attention been paid to this area of infrastructure in the preceding years and decades, it is quite possible that the impact of the earthquake would have been lessened.

Conclusion

The impacts of the September 2009 earthquake are ongoing, and are likely to continue to affect the environmental health situation in Padang for the foreseeable future. The living environment has undergone significant changes which increase the likelihood of transmission of dengue hemorrhagic fever. These changes were facilitated by the lack of readiness on the part of city authorities, and the historical low priority given to some essential areas of infrastructure and general unevenness of development, illustrating the role of sustainable development in improving environmental health in developing regions.

Conflict of Interest: None.

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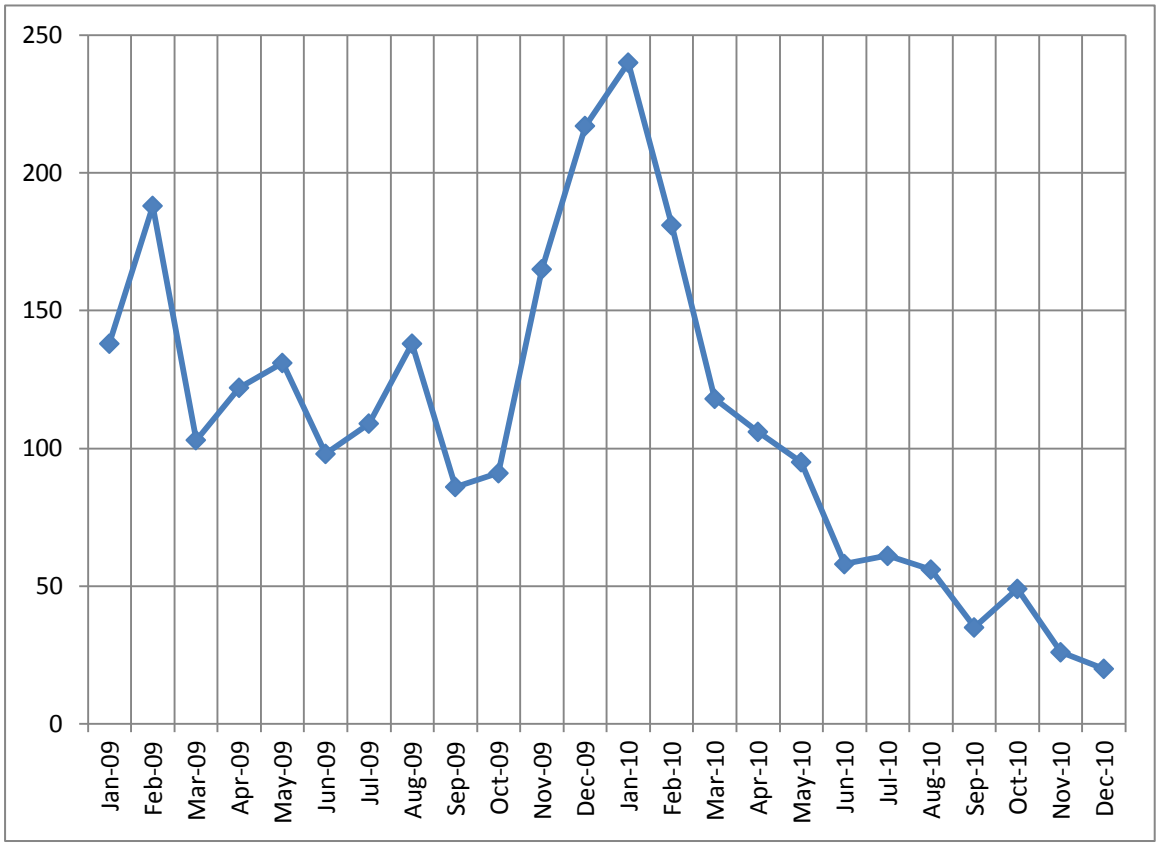

Figure 1: Reported cases of DHF in Padang by month, Jan 2009-Dec 2010