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## **Japan Earthquake and Tsunami of 2011: A Case Study**

### **Introduction**

An earthquake with a 9.1 magnitude was recorded in the northern part of Japan's Honshu island in the Tohoku region on March 11, 2011. The earthquake, the strongest ever recorded in Japan, caused a tsunami with waves of up to 40 meters high, or about 130 feet.<sup>5,7</sup> Thousands of people died due to the event, which also destroyed homes and infrastructure, and caused a meltdown of nuclear reactors.<sup>5</sup> Estimates of the death toll appear to range from 15,000 up to nearly 20,000 people<sup>7,8</sup>

### **Facts of the Case**

This natural disaster is commonly known as the 2011 Tohoku earthquake and tsunami and the Great East Japan Earthquake. The earthquake began on Friday, March 11, 2011, at 2:46pm local time and lasted for about six minutes total.<sup>8</sup> Just half an hour after the tremor, the tsunami waves reached Japan's coast.<sup>7</sup> In a trio of studies published after the event, researchers found that a large slip in two tectonic plates—the Pacific and the North American plates—led to the tsunami, due to a layer of clay on the Pacific plate.<sup>2</sup>

The earthquake and tsunami caused significant damage and devastation. Beyond the deaths, there were more than 123,000 houses destroyed, and nearly one million more were damaged.<sup>7</sup> More than 450,000 people lost their homes.<sup>5</sup> The costs and overall destruction caused by the event were immense. There was an estimated cost of \$220 billion in damages in Japan, with additional costs in other countries.<sup>7</sup> Additionally, the event impacted the Fukushima Daiichi Nuclear Power Plant by causing damage to the cooling system; this led to a meltdown of three nuclear reactors, and consequently, a release of radioactive materials.<sup>5,8</sup> While primarily affecting Japan, the massive damages and recovery required after this event highlights the worldwide impacts.

### **Epidemiological Aspects of the Event**

Some studies describe epidemiological aspects of the event, however, there are not many sources that break down the various components. One account that separates the death tolls in the areas that were most affected by the earthquake and tsunami shows that 65.2% of the total deaths in those areas represented people who were 60 and older, while 6.5% of those who died in those areas were under the age of 19 years old.<sup>6</sup> The figures also show that 92.4% of the deaths were due to drowning from the tsunami, and a very small segment of deaths were from being crushed or burned.<sup>6</sup> The source showing this data does not include the analytical approach, nor the limits. It can be assumed, however, that the data and subsequent evaluation were limited by the fact that there were people still undiscovered by the time of the analysis. Additionally, this data does not include the entire scope of regions affected. There were studies done in particular topic areas, as well. For example, a cohort study of more than 56,000 first responders to the earthquake and tsunami evaluated factors related to long-term post-traumatic

stress disorder. The study found that personal experience of the disaster and age were among the risk factors for probable PTSD.<sup>4</sup>

### **Management of the Event**

There was a comprehensive public health response to the earthquake and tsunami, dictated by existing protocols. The response and management efforts included an emergency management meeting at the national level of the Japanese government, where an emergency was declared.<sup>10</sup> Government departments took varying roles, and the main highways in the affected region were designated for the sole use of emergency response purposes. There were other actions to create interim housing, dispatch responders to put out fires, and control the nuclear situation, among other things. Several papers and evaluations of the emergency response and management have highlighted perceived shortfalls in the response. For example, a Harvard presentation describes “deep dissatisfaction” with the response, including what the presenter describes as weak coordination, slow response, and underutilization of certain private sector and other resources, among others.<sup>3</sup> There are many lessons to be learned from the management of such a large-scale disaster. It appears that the event was effectively managed, but the response in some areas could have been quicker and more centralized.

### **Communications of the Event**

A critical communication that has been widely discussed is the initial tsunami warning issued by the Japan Meteorological Agency (JMA). The JMA issued a warning tsunami three minutes after the earthquake, at 2:49pm local time.<sup>1,9</sup> The agency faced criticism for its communication, particularly for underestimating the height of the tsunami, which has been said to have contributed to a lag in evacuation.<sup>1</sup> For example, there are some regions in which only 58% of people immediately sought a safer location, according to a study issued later by the Japanese government<sup>8</sup>. The matter highlights how early communication can be crucial in an emergency situation. While there are aspects of the warning that could have been improved, the timeliness of the warning—three minutes after the earthquake—can be viewed as somewhat of a success. Following the event, the JMA assessed its tsunami warning system, shared lessons learned, and said it planned to improve its plans to account for uncertainty.<sup>9</sup> The post-disaster evaluation provides valuable insight.

### **Summary**

The massive 2011 earthquake and tsunami in Japan altered the country’s history. The country responded quickly, although there are various areas of improvement that could have led to better management of the event. Overall, the 2011 earthquake and tsunami highlights the devastation that can be caused by one event, and how all countries must be prepared.

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