

## **The impacts of 2018 earthquakes to the pediatric population in North Lombok Field Hospital, West Nusa Tenggara, Indonesia.**

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### **Abstract**

**Background:** Three devastating earthquakes hit North Lombok within 28 days in 2018. The lack of disaster preparedness system in North Lombok contributes to the challenges in providing sufficient healthcare. This study aims to describe the disease that are diagnosed in the pediatric population at North Lombok Field Hospital during 28 days after the first earthquake.

**Method:** The study uses prospective observational study of pediatric population presenting to a field hospital in North Lombok for a period of 28 days after the earthquake on August 5, 2018. Demographic and clinical information were prospectively recorded for all patients in a systematic emergency registry and nutritional status was assessed on weight for age.

**Results:** Eight hundred and thirty-six children were admitted to the field hospital for 28 days. Children younger than six years old were the highest proportion (52%). From 836 children were male (54%) and had normal nutritional status (72%) and 96 children (11%) had severely wasting. Fifty-six children were diagnosed with physical trauma and four of them died from multiple trauma. In the first and second week, respiratory tract infection was found to be the most frequent to occur among the children. Meanwhile, gastrointestinal tract infection was identified to be the most frequent disease in the third and fourth week. This study found there is no correlation between age, sex, nutritional status and frequent disease in children after earthquake ( $p > 0.005$ ).

**Conclusion:** Respiration and gastrointestinal tract infections are the most frequent-occurring diseases among children at North Lombok Field Hospital after earthquakes.

**Keywords:** Earthquake, Children, Frequent-occurring diseases.

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### **Introduction**

Indonesia's geographical, geological, hydrological, and demographical conditions render the country prone to disasters caused by either natural factor, non-natural factor, or human factor which lead to casualties and environmental damage [1]. Indonesia is an archipelago located between four tectonic plates, i.e., Eurasian, Australian, Pacific and Philippine Sea plates [1]. Indonesia also lies in the Pacific Ring of Fire where earthquakes and volcano eruptions which often occur [1]. Indonesia has at least 130 active volcanoes. Indonesia has more than 5,000 big and small rivers with 30% of which pass through densely populated areas making them prone to floods, flash floods, and landslides during the rainy season [1].

In 2018, North Lombok was rocked by 3 major earthquakes which caused substantial damage and considerable casualties. The First devastating earthquake occurred with 6,4 Richter Scale (RS) in East Lombok which impacted 3 districts of North Lombok. The second and the biggest earthquake occurred in North Lombok on August 5, 2018 with 7 RS. This earthquake gave a huge impact in all districts of North Lombok. This study

focused on the second earthquake until 28 days afterward. During our observation, there was the third devastating earthquake occurred in North Lombok with 6.9 RS on August 19, 2018. These earthquakes gave short-term and long-term impacts for the population of North Lombok. Short-term impacts cause a lot of injuries and soft tissue infections [2]. Furthermore, it increases the risk of infectious disease, damage to health care facilities and clean water supply system.

Disasters increase the potential of infectious and non-infectious diseases. Outbreaks for several diseases that subsequently may occur include diarrhoea and dysentery and acute respiratory tract infection (ARTI). Environmental health and sanitation problems are also found in disastrous conditions [3]. Non-hygienic environmental, limited water supply and insufficient latrines contribute to the vulnerability to contracting a disease and, in some cases, may lead to death due to certain diseases in disaster victims [3].

In the wake of a disaster, health problems increase among the affected population, particularly the "vulnerable" group [3,4]. According Indonesia regulation regarding disaster

management, “vulnerable” population includes: 1) infants, toddlers, and children; 2) pregnant or nursing women; 3) people with disabilities; 4) elderly [4]. In addition, Indonesia’s Disaster Management regulation on the guideline of basic needs fulfilment includes ‘ill person’ is included in the “vulnerable” group in a disaster. Therefore, vulnerable group is a priority in rescue and evacuation efforts, observation until health and psychosocial care [5]. In this study, the author aims to describe the impacts of earthquakes in North Lombok to children that receive treatment at North Lombok Field Hospital.

## Research Methodology

### Study area

North Lombok Field Hospital is located at Tanjung, center of North Lombok. The field hospital had inflatable tents and ridge tents. The field hospital had 12 areas, i.e., emergency department, children ward, 2 adult wards, operating room, labor room, ICU, NICU, outpatient department, pharmacy, laboratory and radiology department.

### Staff composition

There were 20 general practitioners, ± 100 nurses, 1 pediatrician, 1 surgeon, 2 obstetricians, 2 internists, 1 ophthalmologist, 1 anesthetist, 1 dentist, and many voluntary-based specialists and general practitioners.

### Study design

This study used observational study using observational prospective design with longitudinal approach by following the course of disease for 28 days after North Lombok earthquake on August 5, 2018. The study used purposive sampling by determining samples based on inclusion criteria, i.e., every child aged 0-18 years old who admitted at North Lombok Field Hospital during the predetermined period. Data collection was conducted through simple medical record which consisted of registration number, name, age, weight, height, complaint, diagnosis and treatment given. All patients were examined, classified and grouped according to the main diagnosis. All data were analysed using SPSS ver. 24 (IBM Corporation).

### Ethics approval

This study was approved by Regional Committee for Medical and Research Ethics in North Lombok (070/012/bappeda/I/2019). Individual consent for information to be entered the emergency registry was waived by the ethical committee. Because of emergency situation, a procedure for oral information and consent was taken from the legal guardians for the patients under the age 18 years.

## Results

In 28 days after the earthquake on August 5, 2018, 836 children were admitted to North Lombok Field Hospital. Out of 836 children, 448 (54%) of them were male and 388 (46%) were female. Half of the admitted children were in 1-5 years

age group 432 (52%) followed by children older than 5 years old 271 (32%) and under 1 year old 133 (16%). Out of 836 children, most of them had normal nutritional status 602 (72%) and only 96 (11%) children had severely wasting (Table 1).

Table 1. Children characteristics.

Characteristics	1st Week n (%)	2nd Week n (%)	3rd Week n (%)	4th Week n (%)
<b>Sex</b>				
Male	95 (56)	138 (47)	111 (60)	104 (55)
Female	75 (44)	155 (53)	73 (40)	85 (45)
<b>Age (years)</b>				
< 1	41 (24)	38 (13)	29 (16)	25 (13)
1–5	79 (47)	144 (49)	104 (56)	105 (56)
6–18	50 (29)	111 (38)	51 (28)	59 (31)
<b>Nutritional status</b>				
Normal	127 (75)	187 (64)	144 (78)	144 (76)
Wasted	23 (14)	35 (12)	29 (16)	35 (18)
Severely wasted	14 (8)	65 (22)	7 (4)	10 (6)
Overweight	6 (3)	6 (2)	4 (2)	0 (0)
Total (836)	170	293	184	189

There were 56 children (7%) diagnosed with physical trauma and 780 (93%) without physical trauma. Out of 56 children with physical trauma, 4 (7%) of them died on arrival due to multiple trauma. In the first and second week, respiratory infection was the most frequent-occurring disease, while in the third and fourth week; gastrointestinal tract infection was the most frequent-occurring disease (Table 2). Based on SPSS using Kruskal-Wallis, the study found no correlation between age, gender, nutritional status and disease appearing after earthquake ( $p > 0.005$ ).

Table 2. Total numbers frequency per week of diagnoses categories.

Characteristics	1st Week n (%)	2nd Week n (%)	3rd Week n (%)	4th Week n (%)
Respiratory Tract Infection	63 (37)	141 (48)	46 (25)	49 (26)
Gastrointestinal Tract Infection	39 (23)	68 (23)	99 (54)	106 (56)
Skin Infection	16 (9)	41 (14)	8 (4)	12 (6)
Physical Trauma	26 (15)	17 (6)	8 (4)	5 (3)
Ocular Disease	1 (0,5)	0 (0)	1 (0,5)	0 (0)
Neurologic Disease	2 (1)	1 (0,5)	1 (0,5)	0 (0)
Other	23 (13,5)	25 (8,5)	21 (12)	17 (9)

## Discussion

An earthquake is the shaking of the earth because of sudden movement/displacement of rock layers in the earth skin caused by tectonic plates movement [6]. Earthquakes always hit suddenly, causing destructive and mass panic [6,7]. According to 2016 data from Emergency and Disaster Reports, an earthquake is the biggest destructive disaster and flood in the second place [7].

In this study, half of the admitted child patients were under six (52%), followed by patients older than 5 years old (32%). Several assessments showed no correlation between age and

disaster. All age groups have the same risk of impact from disaster [8,9].

Earthquake does not only cause huge damage to the environment, but also to the community, particularly to the health systems [7,10]. There are 3 phases that occur after a disaster. Phase 1-impact phase (day 1-4). In this phase, the victims are moved, rescued, and early therapy for injuries caused by disaster was performed. The character of problem faced in this phase are hypothermia, fever, disease, and dehydration. Phase 2-post-impact phase (day 4-week 4). In this phase, infectious diseases start to occur. There are transmitted through water, food, air, and vector. Diseases transmitted through water and food include cholera, bacterial dysentery, cryptosporidiosis, rotavirus, norovirus, salmonella, typhoid, and paratyphoid, giardiasis, hepatitis A and E and leptospirosis. Meanwhile, the diseases transmitted through air include virus (influenza, RSV, adenovirus), bacteria (*Streptococcus pneumoniae*, pertussis, tuberculosis, legionella, *Mycoplasma pneumoniae*), and the diseases which can be transmitted through air (measles, varicella, *Neisseria meningitidis*). Tetanus can also be found in this phase. Phase 3-recovery phase (>Week 4). In this phase, the infectious diseases that occur are diseases with long incubation period. During this period, new endemic disease and infectious disease can be a plague and epidemic in the population. In this phase, chronic diseases in adults such as hypertension, diabetes and asthma can also cause problem [10].

Based on those phases, this study found that in the early phase of disaster, injury and soft tissue damage were the first health-related problem. Infectious diseases then increased at end of the first week until fourth week. In those weeks, respiratory and gastrointestinal infections were the main health issues. Based on diseases transmission, the diseases that occur after disaster can be divided into overcrowding, waterborne disease, vector borne disease, and other diseases [10]. Diseases transmittable in overcrowding include acute respiratory infectious diseases to pneumonia, measles, and meningitis. Evacuation tent during a disaster is typically the source of infection transmission. Tents full of population and poor sanitation are highly suitable for infectious disease transmission through air and fecal-oral [10]. Person to person, waterborne, and foodborne transmission in earthquakes contribute moderate risk, comparable to volcanic eruption [10]. This was supported by a study on earthquakes in Haiti in 2010 with respiratory and gastrointestinal infection becoming the most common diseases until the fourth week after injury caused by earthquake [11]. This was also found in a study of Merapi eruption in Indonesia in 2010 with respiratory infection as the main problem until the second week. However, this study only followed the course of disease until the second week after disaster, thus unable to assess until the fourth week [12].

## Conclusion

Respiration and gastrointestinal tract infection became the most-occurring disease in child patients at North Lombok Field

Hospital after earthquakes. Age, sex, and nutritional status have no correlation with common disease after earthquakes.

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