Hospital Readiness Assessment for Disasters Using the Hospital Safety Index in Several Accredited Hospitals in Yogyakarta Province

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INDEXING

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ABSTRACT

Indonesia is a disaster-prone country, so research on hospital preparedness for disasters is necessary. One of the tools to measure the readiness of hospitals in facing disasters using the Hospital Safety Index (HSI) from WHO. This study aims to determine the readiness of hospitals to deal with disasters using HSI. Research location in PKU Yogyakarta, PKU Bantul, PKU Kotagede, PKU Nanggulan, and PKU Wonosari. These PKU that have been accredited by the Hospital Accreditation Committee in Yogyakarta Province. The approach used is descriptive qualitative. The independent variable is the HSI from WHO, and the dependent variable is the Hospital Accreditation Committee (Komite Akreditasi Rumah Sakit/KARS) accredited hospital. The respondents are the person in charge of the structural part of the disaster management system. The checklist refers to the HSI form from WHO. Each statement provides three types of answers, namely low, medium, and high. All statements are a total number of low scores, medium scores, and high scores using the HSI calculator. The results of the study are that hospitals with plenary accreditation have higher HSI scores so that they prepared to face disasters than hospitals that have not been plenarily accredited.

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INTRODUCTION

Definition of disaster is a severe disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts (UNDRR, 2020). Disasters classified into...
natural disasters (drought, volcanic eruptions, tsunamis, floods, earthquakes, hurricanes and landslides), non-natural disasters (epidemics, technological failures, disease outbreaks, and modernization failures) and social disasters (terror, social conflicts between groups or between communities) (BNPB, 2007).

Around the world, from 1998 to 2017 there have been 3148 flood events, 2049 storm events, 563 earthquake events, 405 extreme temperature change events, 378 landslide events, 347 drought events, 254 forest fires, 99 volcanic events, 12 land shifting events resulted in 1,330,723 deaths and more than 3 billion victims suffered property loss (CRED UNISDR, 2018). From January 2019 to February 2020 there were 4429 disasters in Indonesia, including 1583 cyclones, 1027 floods, 849 landslides, others including 788 forest and land fires, 124 drought events, 31 earthquake events, and 20 tidal and abrasion events, and seven volcanic eruption events. The impact of damage includes the number of damaged houses up to 11,468 houses, damaged public facilities including facilities, 152 educational facilities, 128 worship facilities, and 15 health facilities, 48 offices, and 112 bridges. The disaster also claimed a total of 7,273,924 victims suffered and displaced, 3586 were injured, 114 were missing, and 587 died (BNPB, 2020).

From January 2019 to January 2020 in the province of Yogyakarta Special Region there were 900 disasters including 375 landslides, 230 building fires, 125 high winds, 77 forest fire events, 67 earthquake events not felt, 11 earthquake events felt, 9 flood events, 3 drought events, and 1 volcanic eruption, tidal wave and technology failure each (BPBD DIY, 2020). When a disaster occurs, a hospital is one of the most critical institutions because it is considered a place of protection where victims seek a safe environment during a disaster (Lakbala, 2015). However, many hospitals become dysfunctional when responding to a sudden increase in health service requests (Zhong et al., 2014b).

Hospitals need to have a plan in dealing with disasters (Hendrickx et al., 2016), (Lowe et al., 2016), (McGrady et al., 2014), (Rojek & Little, 2013), (Hosseini Shokouh et al., 2014), (Simiyu et al., 2014), (Dami et al., 2014), (Stander et al., 2011), (Aladhrai et al., 2015). Poor disaster planning quality increases the unacceptable risk exponentially (Zhong et al., 2014a). Risk assessment can also conclude conclusions about the extent of financial damage caused, for example, fires (Kearns et al., 2016), terrorist attacks, or infrastructure failure (Aiello et al., 2012). The amount of damage can be described as a function depending on the planning deficit of emergency planning (Janati et al., 2017) The worse the planning quality, the higher the number of damages for non-tolerable risks can be (Pfenninger & Guzelel, 2017). One study in Italy showed out of 15 hospitals that were evaluated, 12 hospitals were not ready to deal with potential disasters (Ingrassia et al., 2016) and one study in Switzerland showed that only 82 percent of the total 138 emergency departments in hospitals had a hospital disaster plan (Dami et al., 2014).

Hospital resilience can be defined as the organization’s ability to hold, absorb, and respond to disaster shocks while maintaining important functions, and then recover to its original state or adapt to new ones (PAHO & WHO, 2015). Hospital resilience is a comprehensive concept that includes structural components (for example, facility safety), non-structural components (for example, staff, medicines, and equipment), emergency medical functions (e.g. Continuity of medical services) and disaster management capacity (e.g plans and procedures, crisis communication, public relations) (Zhong et al., 2014a). Hospital
required to prepare a standardized tool to evaluate hospital disaster preparedness (Nekoie-Moghadam et al., 2016) and to identify explicit or minimum criteria for designing a resilient hospital (Tang et al., 2014).

Law of the Republic of Indonesia number 44 of 2009 concerning Hospitals states that each hospital should play an active role in providing health services for disasters and has a disaster management system (Depkes RI, 2009). The Hospital Accreditation Committee (KARS) is aware of the importance of efforts to improve the quality of hospitals in disaster management where hospitals are expected to be able to provide optimal services in the event of a disaster. This is stated in the National Accreditation Standards for Hospitals (SNARS) that the Hospital has conducted a self-assessment of disaster preparedness using the Hospital Safety Index from WHO (Komisi Akreditasi Rumah Sakit, 2017).

National standards must focus on disaster prevention and hospital preparedness for disasters by changing the disaster management approach (response) to disaster risk management (prevention and mitigation). Applying this policy to hospital national standards will be an effective step to improve risk perception for hospital managers (Abbasabadi, 2018). Hospital Safety Index is a tool developed by the Pan American Health Organization (PAHO) Disaster Mitigation Advisory Group (DiMAG) unit to evaluate hospital safety and prevent damage caused by disasters to health care centers (Heidaranlu, E, Ebadi, A, Khankeh, HR, Ardalan, 2015). As a measure of hospital preparedness in facing disasters, the Hospital Safety Index has widely used in various countries.

This form consists of four parts. The first part assesses the geographical location of health facilities, and the second part assesses the security elements of building structures, the third part assesses non-structural security elements and the fourth section assesses the functional capacity of the Hospital. The questionnaire then filled in with the interview method for respondents. Observations also made in the hospital environment and its surroundings. The Hospital Safety Index Form uses a qualitative method. This method implemented by giving a value/score for each classification. The statements are then categorized, namely: C = low, B = average, and A = high. The scale used has a value of 0 as the lowest value and a value of 1 as the highest value (World Health Organization, 2015).

Validity can be measured by one way ANOVA, t-test, and chi-square (Ardalan et al., 2014) (Ardalan et al., 2016) comparison of scores can also be tested with Mann-Whitney test (Djalali et al., 2013) (Djalali et al., 2014). The Hospital Safety Index from WHO expected to be able to describe the level of hospital preparedness in facing disasters to the policymakers can take concrete steps to improve hospital preparedness when disasters occur (Raeisi et al., 2018), (Tabatabaei & Abbasi, 2016).

Research conducted by Mulyasari assesses hospital preparedness to anticipate earthquakes in eight cities in Japan using the Hospital Safety Index form and vulnerability elements of hospital assessment based on PAHO and WHO. The results show that the majority of respondent hospitals fulfill functional readiness, which is useful during the emergency disaster period, while the other three pillars - structural, non-structural, and human resources - need to be strengthened (Mulyasari et al., 2013). Research by Djalali et al. (2014) compared hospital nonstructural safety to disasters in Tehran and Stockholm using a non-structural module from the Hospital Safety Index from WHO. Hospital security categorized as safe, risky, or inadequate. As a result, hospitals in Stockholm are classified as
safe, while 2 hospitals in Tehran threatened, and 3 are safe (Djalali et al., 2013). Research conducted by Jahangiri et al (2014) assessed hospitals in Tehran in terms of their structural, non-structural, and functional aspects using the Hospital Safety Index from WHO. The final Hospital Safety Index score places this hospital in the "C" category among the three existing safety classifications, which means that the current level of hospital safety is insufficient to protect the lives of patients and hospital staff during and after disasters (Jahangiri et al., 2014). One semi-experimental study in hospitals in Iran uses HSI as an indicator of hospital readiness before and after training about disaster management, functional and nonstructural safety. Findings showed that scores in most items of nonstructural and functional safety in the HSI checklist significantly increased in two hospitals after workshop and nursing performance. Before the intervention, these scores were 0.40 and 0.56 which increased to 0.57, 0.86 after training (Salevaty et al., 2015).

RESEARCH METHOD

This research is qualitative research and descriptive research design. Based on the data source, this research is field research where data took from the exploration of the hospital environment. This research was conducted in hospitals that have been accredited by the Hospital Accreditation Committee (Komite Akreditasi Rumah Sakit/KARS) in Yogyakarta province, namely PKU Muhammadiyah Yogyakarta, PKU Muhammadiyah Bantul, PKU Muhammadiyah Kotagede, PKU Muhammadiyah Nanggulan, PKU Muhammadiyah Wonosari.

<table>
<thead>
<tr>
<th>No.</th>
<th>Hospitals</th>
<th>Location</th>
<th>Accreditation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>PKU Muhammadiyah Yogyakarta</td>
<td>Yogyakarta city</td>
<td>5 stars (Paripurna/ Plenary)</td>
</tr>
<tr>
<td>2.</td>
<td>PKU Muhammadiyah Bantul</td>
<td>Bantul</td>
<td>5 stars (Paripurna/ Plenary)</td>
</tr>
<tr>
<td>3.</td>
<td>PKU Muhammadiyah Kotagede</td>
<td>Yogyakarta city</td>
<td>3 stars (Madya/ Intermediate)</td>
</tr>
<tr>
<td>4.</td>
<td>PKU Muhammadiyah Nanggulan</td>
<td>Kulonprogo</td>
<td>1 star (Perdana/ Prime)</td>
</tr>
<tr>
<td>5.</td>
<td>PKU Muhammadiyah Wonosari</td>
<td>Gunung Kidul</td>
<td>1star (Perdana/ Prime)</td>
</tr>
</tbody>
</table>

Respondents are employees who are structural members of the Hospital Disaster Management System in each hospital that has been accredited by the Hospital Accreditation Committee in Yogyakarta province and that have the knowledge and authority for disaster management activities. The authority also includes providing data and information on hospital disaster mitigation programs.

The researcher conducted the data collection from September 2019 to December 2019. The researcher conducted the measurement process of Module 2 Index of Building Structures in collaboration with the Lecturer of the Faculty of Civil Engineering, Gadjah Mada University (UGM) Ir. Suprapto Siswosukarto, Ph.D., who assigned a team of UGM civil engineering students to conduct interviews with the household facilities for hospital infrastructure and direct observation in the field.

The researcher measured Module 3 Non-Structural Index by interviewing the household infrastructure and direct observation in the field. To measure the Module 4 Management Index, researchers conduct interviews with hospital managerial departments.
that manage disasters or direct interviews with hospital directors. The parameters to be measured are obtained from the WHO Hospital Safety Index Checklist. Observation and interview data obtained are entered into the Hospital Safety Index Calculator, which is a Microsoft Excel-based program that already contains a list of HSI parameters to be measured and the weighted values of each parameter are calculated and added automatically so that the final value is in the form of a number stating the house's readiness illness in a disaster situation, where the lowest value is 0.25 and the highest value is 1. The value is then presented in the form of a bar chart to compare each hospital related to the hospital's accreditation status.

RESULT AND DISCUSSION

Safety Index

<table>
<thead>
<tr>
<th>No.</th>
<th>Hospital</th>
<th>Safety Index</th>
<th>Total Score</th>
<th>Safety Index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Structural</td>
<td>Nonstructural</td>
<td>Management</td>
</tr>
<tr>
<td>1.</td>
<td>PKU Kota Yogy</td>
<td>0.33</td>
<td>0.47</td>
<td>0.36</td>
</tr>
<tr>
<td>2.</td>
<td>PKU Bantul</td>
<td>0.31</td>
<td>0.70</td>
<td>0.93</td>
</tr>
<tr>
<td>3.</td>
<td>PKU Kotagede</td>
<td>0.11</td>
<td>0.67</td>
<td>0.37</td>
</tr>
<tr>
<td>4.</td>
<td>PKU Nanggulan</td>
<td>0.19</td>
<td>0.58</td>
<td>0.32</td>
</tr>
<tr>
<td>5.</td>
<td>PKU Wonosari</td>
<td>0.16</td>
<td>0.34</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>Rata-rata</td>
<td>0.22</td>
<td>0.55</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Based on the table, PKU Yogyakarta City in terms of the structural safety index value is 0.33, in terms of the non-structural safety index value of 0.47 and terms of managing the safety index value of 0.36. PKU Bantul in terms of the structural safety index value is 0.31, in terms of the non-structural safety index value of 0.70 and terms of managing the safety index value of 0.93. Kotagede PKU in terms of the structural safety index value is 0.11, in terms of the non-structural safety index value is 0.67, and in terms of managing the safety index value is 0.37. PKU Nanggulan in terms of the structural safety index value is 0.19, in terms of the non-structural safety index value is 0.58, and in terms of managing the safety index value is 0.32. Wonosari PKU in terms of the structural safety index value is 0.16, in terms of the non-structural safety index value of 0.34 and terms of managing the safety index value of 0.22.

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**Figure 1. Safety Index**

*Source: primary data*
From research conducted in five hospitals in Yogyakarta Province, overall the structural index value is lower than the non-structural and management index values. Even if the assessment is only based on a structural index value, all the hospitals studied will only be in the category "C", which is the most vulnerable to disasters, with recommended actions including immediate repair interventions because it is very difficult for hospital buildings to continue to function during a disaster happened and it was feared that the hospital building could not protect the patients and the hospital staff working in it.

Researchers estimate that this is because in the history of its development almost all PKU Muhammadiyah hospitals began as simple clinics that were built or occupied in existing buildings, and as the hospital grew and needed expansion, the hospital chose to buy land or buildings next door. the location of the hospital and all these expansion efforts did not take into account the effect of natural disasters on the structure of the building. This information was obtained from interviews with hospital staff regarding building structures. From one aspect this decision was taken related to efforts to continue to carry out the hospital's clinical services and possibly also because the allocation of funds was prioritized for other needs considered priority.

From various scientific literature that researchers have explored, the structure of the building has also become a major source of concern for researchers in the field of disaster preparedness. In his research on the readiness of 224 hospitals in Iran to face disasters, Ardalan said that in 2010 the Ministry of Health and Medical Education (MOH & ME) conducted a structural safety assessment in public hospitals. The measuring instrument used is rapid visual screening (RVS), which is a questionnaire method and a field survey of the building under study to assess the building's resistance to an earthquake (Lizundia et al., 2014). The results showed that the structure of about 70% of hospitals that were considered unsafe during an earthquake. Therefore, a 10-year long-term plan was established to improve the structural safety of the hospital (Ardalan et al., 2014).

The rapid visual screening was also carried out by Jahangiri in his research assessing the readiness of hospitals to face disasters and the results obtained that the structure of the hospital being studied was in a very vulnerable category, especially in the part of the building that served as a medical records office, installation unit, laboratory unit, disease infectious, clinical and inpatient departments (Jahangiri et al., 2014). Both studies illustrate the safety risks faced by staff and patients in hospitals when an earthquake occurs.

In addition to existing hospitals, Ardalan also expressed concern about the safety of more than 100 hospitals that are being built in Iran by the Ministry of Health and Medical Education (MOH & ME), Security Watch Officer (SWO), the Ministry of Road and Urban Development and the private sector. This is because Ardalan and the research team recently witnessed the destruction of the newly built hospital as in the case of the 2012 earthquake in East Azarbaijan province. Ardalan stressed the importance of Iran’s health system to increase its supervision of the application of appropriate safety principles in the construction of new hospitals with related parties (Ardalan et al., 2014).

The low score in the non-structural index is due to the inadequate and uneven allocation of hospital resources in the non-structural hospital sector. This non-structural safety index score which is still low needs to be improved because as quoted by Djalali from previous studies, the availability of medical equipment and various supplies for hospitals is
important when there is a surge in medical service needs/surge capacity (Barbisch DF, Koenig KL, Kaji A, Koenig KL, Bey T. Schultz CH, Stratton S) cit. Djalali et al., 2014). The relationship between the availability of equipment needed and performance in hospitals is also important because hospital functions will be disrupted or completely obstructed due to damage to medical equipment if safety procedures are not implemented (Adini B, Goldberg A, Cohen R et al. Cit. Djalali, et al., 2014).

The low score in the management index section at Wonosari PKU Hospital is because the disaster committee in the hospital has not yet been formed so that the hospital has not been able to make disaster-related policies and implement these policies into a solid system to regulate hospitals to behave before, during and after a disaster occurs. Safety management index scores that are still low in various hospitals need to be improved.

Table 2: Hospital Safety Index Assessment Results

<table>
<thead>
<tr>
<th>No.</th>
<th>Hospitals</th>
<th>Accreditation</th>
<th>HSI</th>
<th>Category</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>PKU Muhammadiyah Yogyakarta</td>
<td>5 stars (Paripurna/Plenary)</td>
<td>0.39</td>
<td>B</td>
<td>Intervention measures are needed in the short term. The hospital’s current levels of safety and emergency and disaster management are such that the safety of patients and hospital staff, and the hospital’s ability to function during and after emergencies and disasters are potentially at risk</td>
</tr>
<tr>
<td>2.</td>
<td>PKU Muhammadiyah Bantul</td>
<td>5 stars (Paripurna/Plenary)</td>
<td>0.54</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>PKU Muhammadiyah Kotagede</td>
<td>3 stars (Madya/Intermediate)</td>
<td>0.38</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>PKU Muhammadiyah Nanggulan</td>
<td>1 star (Perdana/Prime)</td>
<td>0.36</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>PKU Muhammadiyah Wonosari</td>
<td>1 star (Perdana/Prime)</td>
<td>0.24</td>
<td>C</td>
<td>Urgent intervention measures are needed. The hospital is unlikely to function during and after emergencies and disasters. The current level of safety and emergency and disaster management are inadequate to protect the lives of patients and hospital staff during and after emergencies or disasters</td>
</tr>
</tbody>
</table>

Source: primary data

Research shows that low hospital management performance will affect the readiness of the hospital in the event of a disaster (Djalali, Ahmadreza Castren, Maaret Hosseinijenab, Vahid Khatib et al., 2012). The total score of PKU Hospital Safety Index in Yogyakarta is 0.39 so that it is included in category B. The total score of PKU Hospital Hospital Safety Index in Bantul is 0.54 so that it is included in category B. The total score of Hospital Safety Index PKU Kotagede Hospital is 0.38 so it included in category B. Total score Hospital Safety Index PKU Nanggulan Hospital is 0.36, so it is included in category B. The total score of Hospital Safety Index of PKU Wonosari Hospital is 0.24, so it included in category C. Overall plenary accredited hospitals have higher HSI scores compared to intermediate and prime accredited hospitals, and intermediate hospitals have higher HSI scores than prime accredited hospitals.
CONCLUSION

In this study, in terms of structural, City PKU has the highest safety index value among other hospitals. In terms of non-structural and management, PKU Bantul has the highest safety index value among other hospitals. Overall plenary-accredited hospitals have higher HSI scores than intermediate and prime accredited hospitals, and intermediate hospitals have higher HSI scores than prime accredited hospitals.

It can be understood that the plenary-accredited hospital has good disaster management so that it is ready to cope with various potential disasters that will arise. Intermediate accreditation hospitals have better disaster management than primary accreditation hospitals but are not as good as plenary accreditation hospitals. This indicates that mid-level accreditation hospitals are quite prepared to face potential disasters that arise. The first accreditation hospital has the lowest HSI score, indicating that it is not ready to face the potential disasters that will arise. Of the various levels of preparedness that hospitals have in dealing with disasters, improvements can be made using priority scale, namely repairs carried out in succession starting from the most vulnerable hospitals to those that are not too vulnerable.

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