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Original Research Paper

Preparedness of health workers to face the risk of earthquake disasters in the Operating Room (OR)

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Abstract
According to Yogyakarta Province Regional Disaster Management Agency (BPBD) in the Indonesian Disaster Data and Information, ranking 1st among various disaster indices in the Yogyakarta Province. Health workers in all hospital units are important to prepare for earthquake disaster preparedness, one of which is health workers working in the operating room (OR). There has been no evaluation of preparedness in the operating room in the previous study, and as a form of preparedness evaluation in facing future earthquake disasters. The purpose of this study is to determine the preparedness of health workers to face the risk of earthquake disasters in the operating room (OR). The method employed a mixed-methods approach with a phased mixed approach, namely quantitative and qualitative in the research variables. The samples in this study consisted of all health workers in the PKU Muhammadiyah Yogyakarta General Hospital, totaling 20 people. The results of the study showed varying results on each indicator of healthcare workers' disaster preparedness in the operating room. There are several themes from the results of this study including: the concept of earthquakes, problems and solutions in operating rooms facing mass casualties, and earthquake preparedness in the operating room. This study describes knowledge about the daily habits of activities in the Central Surgical Installation (Operating Room) and illustrates the importance of a better understanding of regular phenomena so that it can be used as a basis for accurate estimates of how a hospital's operation room will face major disaster events and provide the required services.

Keywords: earthquake; health workers; hospital; preparedness

1. Introduction

Disasters are a series of phenomena that can threaten and impact people's lives, caused by natural, non-natural, and human factors. Based on the various factors that cause disasters, natural disasters are particularly vulnerable in Indonesia. Indonesia is particularly vulnerable to natural disasters due to its location at the confluence of the Indo-Australian, Eurasian, and Pacific plates. The Indonesian region, located along these plate confluences, is the home to numerous active faults and frequent earthquakes.

The Special Region of Yogyakarta is one of the Indonesian provinces with a high earthquake risk level. In fact, according to the Yogyakarta Special Region Disaster Management Agency (BPBD), in 2021 Indonesian Disaster Data and Information report, earthquakes have a disaster risk index of 195.77, ranking first among various disaster indices in Yogyakarta Province. A major earthquake struck Yogyakarta on May 27, 2006, measuring 5.9 on the Richter scale. It killed 4,626 people, injured 19,202, and damaged 92,946 residential buildings. It directly impacted the quality of life of 1.2 million residents.

The significant impact of the 2006 earthquake was due to inadequate preparedness by the government and the community for earthquakes. Preparedness is a pre-disaster activity aimed at developing operational capacity and facilities to effectively respond when a disaster occurs. The government needs to prepare the community for earthquake preparedness if another earthquake occurs.

Preparedness is not only implemented by the government within the community but also involves several other government agencies, including hospitals.

Hospitals are considered resources that must be active in the event of a disaster and a sudden increase in demand for healthcare services due to the high number of earthquake victims. Healthcare workers and healthcare providers are required to have greater disaster preparedness than others. The failure and role of healthcare workers in disaster preparedness can impact the failure of disaster victim care.

Healthcare workers in all hospital units are crucial for earthquake preparedness, including those working in the operating room. To evaluate preparedness for future earthquakes, an analysis of the preparedness of healthcare workers in the operating room is necessary. There is limited research specifically addressing the preparedness of healthcare workers in the operating room for earthquakes. A study conducted by (Lin et al., 2023) reveals the disaster preparedness among nurses in several hospital service units, one of which is the operating room. The results showed that nurse preparedness reached 46% of the 365 respondents involved in the study. The novelty of this study lies in its mixed-methods methodology, which has not been employed in previous studies.

The purpose of this study is to describe the preparedness of healthcare workers in the operating room for earthquake disaster risk.

2. Research Methods

In general, the method used in this study was a mixed methods approach, combining two types of research: quantitative and qualitative. Mixed methods research combines quantitative and qualitative research in a single activity to obtain more comprehensive, valid, reliable, and objective data. This research was conducted using a mixed method (Sequential Explanatory).

This research began with obtaining research ethics approval. The research ethics number is as follows: 00227/KT.7.4/VII/2024. This research was conducted in several stages, using a quantitative approach first, followed by qualitative data collection. Quantitative data collection employed a questionnaire on healthcare worker preparedness for earthquake disaster risk in the operating room. The qualitative approach was applied to gain a deeper understanding of healthcare worker preparedness.

The population in this study was all 19 healthcare workers working in the operating room at PKU Muhammadiyah Yogyakarta General Hospital. Quantitative sampling was conducted using a total sampling technique, with the entire population as respondents. The qualitative approach used purposive sampling. The inclusion criteria for this study were healthcare workers willing to participate, while the exclusion criteria were healthcare workers on leave. Data collection took place from July 10–16, 2024. During this time, 19 respondents were recruited for quantitative data collection using a questionnaire. Of these 19 respondents, 6 met the criteria for interviews.

The quantitative data analysis employed univariate analysis using SPSS. The qualitative data analysis used line-by-line analysis.

3. Results and Discussion

3.1. The Overview of Research Location

PKU Muhammadiyah Yogyakarta Hospital is located in Yogyakarta City. One of the services provided at PKU Muhammadiyah Yogyakarta is the operating room. The operating room is staffed by 19 healthcare workers who work in shifts.

3.2. Univariate Analysis of Preparedness Components of Health Workers' Preparedness to Face Earthquake Disaster Risks in the Operating Room of PKU Muhammadiyah Hospital Yogyakarta

Based on the univariate results, several preparedness indicators were obtained as follows:

The knowledge of 19 respondents regarding the preparedness of healthcare workers to face the risk of earthquake disasters in the operating room of PKU Muhammadiyah Hospital is as follows:

Table 1. Knowledge of Health Worker Preparedness in Facing the Risk of Earthquake Disasters

Knowledge Variable	Frequency	Percentage (%)
Moderate	5	26.3
Good	14	73.7
Total	**19**	**100**

Table 1 shows that the majority of respondents have a good level of knowledge, namely 14 respondents, while the minority have a moderate level of knowledge, namely 5 respondents.

Supporting logistics related to the Preparedness of Health Workers to Face the Risk of Earthquake Disasters in the operating room of PKU Muhammadiyah Hospital are as follows:

Table 2 Supporting logistics related to the preparedness of health workers to face the risk of earthquake disasters

Knowledge Variable	Frequency	Percentage (%)
Moderate	16	84.2
Good	3	15.8
Total	19	100

Table 2 shows that the majority of respondents (16) had a moderate understanding of supporting logistics, while a minority (3) had a good understanding.

The communication network related to the preparedness of healthcare workers for earthquake disaster risks in the operating room of PKU Muhammadiyah Hospital is as follows:

Table 3. Communication Network regarding the Preparedness of Health Workers to Face the Risk of Earthquake Disasters

Knowledge Variable	Frequency	Percentage (%)
Low	1	5.3
Moderate	15	78.9
Good	3	15.8
Total	**19**	**100**

Table 3 shows that the majority of 15 respondents had a moderate understanding of communication networks, while the minority had a low understanding (1 respondent).

The development of a transportation subsystem related to the preparedness of healthcare workers for earthquake disaster risks in the operating room of PKU Muhammadiyah Hospital is as follows:

Table 4. Development of a transportation subsystem related to the Preparedness of Health Workers to Face the Risk of Earthquake Disasters

Knowledge Variable	Frequency	Percentage (%)
Moderate	18	94.7
Good	1	5.3
Total	**19**	**100**

Table 4 shows that the majority of respondents (18) had a moderate understanding of transportation subsystem development, while a minority (1 respondent) had a good understanding.

Disaster Management Training related to Health Worker Preparedness for Earthquake Risks in the operating room of PKU Muhammadiyah Hospital is as follows:

Table 5. Disaster Management Training related to the Preparedness of Health Workers to Face the Risk of Earthquake Disasters

Knowledge Variable	Frequency	Percentage (%)
Moderate	7	36.8
Good	12	63.2
Total	**19**	**100**

Table 5 shows that the majority of respondents (7 respondents) had a moderate understanding of disaster management training, while the minority (12 respondents) had a good understanding.

Cross-sector collaboration related to the preparedness of healthcare workers for earthquake disaster risks in the operating room at PKU Muhammadiyah Hospital is as follows:

Table 6. Cross-sectoral collaboration on the preparedness of health workers to face the risk of earthquake disasters

Knowledge Variable	Frequency	Percentage (%)
Moderate	15	78.9
Good	4	21.1
Total	**19**	**100**

Table 6 shows that the majority of respondents have an understanding of cross-sector cooperation at a sufficient level, namely 15 respondents, while the minority has an understanding at a good level, namely 4 respondents.

3.3.Qualitative Analysis of Preparedness Components of Health Workers' Preparedness to face Earthquake Disaster Risks in the Operating Room of PKU Muhammadiyah Yogyakarta Hospital

3.3.1.Theme : Earthquake Concept

On the theme of the earthquake concept, respondents explained the concept of earthquakes, which can be seen in the following explanation:

"*Gempa bumi itu terjadi kayak apa ya kayak terjadi goncangan mungkin pergerakan tanah terus kemudian menimbulkan kerugian baik fisik maupun non fisik ya entah dari manusianya kemudian dari bangunan infrastuktur dan lain lain (*What does an earthquake look like? There's shaking, maybe the ground moves and then it causes both physical and non-physical losses, whether it's to humans, then to infrastructure buildings and so on)." (P6, Administrator)

In addition, respondents explained that earthquakes can be caused by tectonic or volcanic shocks, as can be seen in the following explanation:

"*Ya Menurut saya definisi bencana gempa bumi adalah insiden alam yang bersifat bentuk gempa apa ya entah itu sebabnya karena vulkanik ataukan tektonik* (In my opinion, the definition of an earthquake disaster is a natural incident that is in the form of an earthquake, whether the cause is volcanic or tectonic)." (P2, Administrator)

3.3.2. Problems and Solutions in Operating Rooms Facing Mass Casualties

The problems that often occur in the operating room when dealing with mass casualties in the operating room are illustrated in the following explanation:

"*Yang jelas semua tenaga itu harus kerja siap bekerja selama 24 jam artinya karena jumlah korban yang terlalu banyak harus siap kerja selama 24 jam dan nggak tahu dan tidak pasti kapan saya harus berhenti dan beristirahat karena saking banyaknya yang ngantri dan harus segera ditangani seperti itu dengan jumlah tenaga dan eee peralatan yang terbatas seperti itu kaitannya dengan logistik ya mungkin katanya dengan logistik itu yang jelas ikut ikut terganggu juga* (It is clear that all the personnel must be ready to work 24 hours a day, meaning that because the number of victims is too large, they must be ready to work 24 hours a day and they don't know and are not sure when they should stop and rest because there are so many people queuing and they have to be handled immediately with limited personnel and equipment like that. It is related to logistics, yes, maybe they say that logistics are clearly also affected)" (P2, Administrator)

Apart from that, the problem that arises when an earthquake occurs is the limited space available in hospitals, as it can be seen in the following explanation:

"*Ya sing jelas itu tempat tempatnya sempit memang betul-betul gitu ya terus ya kebak* (Yes, it's clear that the place is really cramped, so it's still full)" (P1, Surgical Nurse)

As an effort to meet the need for human resources that are lacking during the earthquake disaster, there needs to be an on-call system as stated in the following statement:

"*Kalau pembagian tugas untuk pelayanan di sana ya memang itu tadi harus ada ekstra on call untuk memenuhi tenaga yang membengkak kebutuhannya* (If the division of tasks for service there is true, there must be extra on call to meet the increasing need for manpower)." (P1, Surgical Nurse)

Apart from activating the on-call system, the shortage of human resources in the operating room can be overcome by getting assistance from abroad, as stated by the respondents as follows:

"*Satu tim gitu, kalau yang dari Australia itu semua, dokter anestesi dokter bedah sama penatanya sama perawatnya gitu* (One team, it was from Australia, they were anesthesiologists, surgeons, the technicians, and the nurses)." (P3, Anesthetist)

The lack of human resources in the hospital can be addressed by empowering health workers from other rooms, as can be seen in the following respondent statements:

"*Kayaknya kalau rekrutmen segera nggak mungkin, ya mungkin di mana-mana juga butuh toh jadi mungkin unit lain yang mungkin agak selow bisa membantu ikut di dalam kamar operasi mungkin dari bangsal* (It seems like immediate recruitment is not possible, well, maybe everywhere needs them, so maybe other units that are a bit slower can help in the operating room, maybe from the ward)." (P5, Pharmacist)

Another alternative used by hospitals to meet human resource needs during the earthquake is to advance shift schedules as explained by the following respondents:

"*kalau semua harus tertangani mungkin lebih itu ya nanti itu SDM saat itu dia yang tersedia dan memanggil yang terjadwal, jadi yang jadwal berikutnya bisa maju* (If everything has to be handled, maybe it will be more than that, then the HR will be the one who is available at that time and will call those who are scheduled, so the next schedule can come forward)." (P7, Administrator)

The lack of supporting equipment is also obtained from abroad, as stated by the respondents as follows:

"*kemarin katanya ada dari luar negeri ya… kayak plat plat gitu dapat bantuan kek gitu, nah itu udah bagus* (Previously, they said there were some from abroad, yeah... like plates, they got help like that, well that's good)" (P4, Surgical Nurse)

Medical equipment and medicines also received assistance to support surgical operations, with the following statement:

"*Ya itu ya itu semacam alat macam alat medis semua semua perlengkapan yang berkaitan dengan alat medis terus implan terus obat-obatan itu juga banyak yang datang itu juga gitu* (That's the equipment; all the medical equipments related to medical tools, implants, and medicines, and a lot of them come in)." (P2, Administrator)

3.3.3. Earthquake Disaster Prepareness in the Operation Room

Preparedness must be done, especially since Yogyakarta is in a risk zone for experiencing earthquake disasters, as can be seen in the following respondent statements:

"*Iya dari dari apa ya pengalaman itu bener-bener harus siap kalau ada bencana apalagi memang wilayah kita kan memang wilayah yang sering terjadi bencana* (Yes, from what we have experienced, we really have to be prepared if a disaster occurs, especially since our area is an area where disasters often occur)." (P1, Surgical Nurse)

Respondents in this study said that operating room preparedness in facing the risk of earthquake disasters is important, as can be seen in the following statement:

"*Penting sekali, penting sekali kesiapsiagaan itu dengan siap itu artinya bisa mengantisipasi hal-hal buruk seperti itu* (It is very important; it is very important to be prepared, being ready means being able to anticipate bad things like that)." (P2, Administrator)

Respondents also explained the benefits of having earthquake preparedness in the operating room, as can be seen in the following statement:

"*untuk mencegah terjadinya korban yang lebih banyak atau mengurangi dampak dari gempa itu sendiri* (to prevent more victims or reduce the impact of the earthquake itself)"

However, even though they already understand about disaster preparedness in the operating room and its benefits, the health workers in the operating room have never received previous training regarding preparedness in the operating room, as can be seen in the following statement:

"*seingat saya belum pernah ada pelatihan yang khusus mengenai masalah gempa pelatihan yang pernah ada itu adalah pelatihan K3 ataupun keselamatan kerja termasuk ada disana penanggulangan penanganan kebakaran termasuk evakuasi tatalaksana evakuasi terhadap adanya kasus kebakaran* (As far as I remember, there has never been any special training regarding earthquake problems. The training that has been available is Occupational Health and Safety (OHS) training or work safety training, including fire management, including evacuation and evacuation management in the event of a fire)." (P2, Administrator).

The operating room officer explained how the transportation system works during an earthquake, but did not specifically support mass casualty services in the operating room, as can be seen in the following respondent statement:

"…*sistem transportasi merujuk pada ambulans itu yang saya ketahui* (transportation system refers to the ambulance that I know)." (P4, Surgical Nurse)

The referral system for patients must also wait for the patient to stabilize first, because if not, it will endanger the patient, this can be seen in the patient's statement as follows:

"*kedua transportable atau tidak pasiennya itu itu paling penting juga, jangan-jangan kondisi emergency pun kondisinya emergency harus segera tapi nggak transportable percuma saja gitu nanti di jalan akhirnya tidak mungkin tidak tertolong karena tidak transportable* (Secondly, whether the patient is transportable or not is also the most important thing, don't let it be an emergency, even if the condition is an emergency, it must be treated immediately but if it is not transportable, it will be useless, later on the road it will be impossible to help because it is not transportable)." (P2, Administrator)

The referral system for patients must also wait for the patient to stabilize first, because if not, it will endanger the patient, this can be seen in the patient's statement as follows:

" *yaaa nanti kan ada tim dari tim ambulannya sendiri dari perawat yang di IGD nya, yang disini kan kalau rujuk itu lebih ke dari mereka yang dari IGD jadi ada tim khusus mereka yang tergabung mungkin dari tim itu kalau kita selama ini yang di OK(ruang operasi) kan emang kita mungkin dari unit khusus tidak dilibatkan dalam seperti itu* (Later there will be a team from the ambulance team itself from the nurses in the ER, here, if there is a referral, it is more from those from the ER, so there is a special team of them who are included, maybe from that team. If we have been in the OP (operating room), we are probably from a special unit that is not involved in things like that.)" (P5, Pharmacist)
"*ya tidak bisa, mungkin kembalikan ke bangsal nya lagi atau ke ICU (intensive care unit) tenaga ok nya kayaknya nggak nggak pernah mungkin nggak bisa juga ya* (Of course it can't, maybe return him to the ward again or to the ICU (intensive care unit). The staff is ok, I don't think so, maybe it's not possible either)" (P5, Pharmacist)

In disaster conditions, the communication used in hospitals is the telephone, as explained by respondents as follows:
"*Yang jelas yang pernah dipakai adalah telepon yang dari rumah sakit sendiri* (What is clear is that the phone that was used was from the hospital itself)."(P2, Administrator)

Apart from using a telephone, you can also use a sound system as explained to the respondents as follows: "*biasanya itu sound sistem yang ada di ruangan kan sudah ada jadi dari pusat* (Usually the sound system in the room is already there, so it comes from the center)."(P4, Surgical Nurse)

Hospital handling, especially operating rooms, in handling mass casualty cases not only involves hospitals, but also involves sectors, as can be seen in the following respondent statements: "*Mungkin maksud saya yang lintas sektor antara bukan hanya rumah sakit mungkin dengan sektor lain ya dinas sosial terus dinas apa yang semua yang terkait* (Maybe I mean cross-sectoral, not only hospitals, but also other sectors, social services, and other services that are all related)."(P2, Administrator)

The components of preparedness for earthquake disasters include several components, including knowledge, supporting logistics, communication networks, development of transportation subsystems, disaster management training, and cross-sector cooperation. From these components, based on the univariate results as follows: the majority of the level of knowledge is good, namely 14 respondents, while the minority of the level of knowledge is moderate, amounting to 5 respondents; the majority of understanding of supporting logistics is at a moderate level, namely 16 respondents, while the minority at a good level is 3 respondents; the majority of understanding of communication networks is at a moderate level, namely 15 respondents, while the minority at a low level is 1 respondent; the majority of understanding of the development of transportation subsystems is at a moderate level, namely 18 respondents, while the minority at a good level is 1 respondent; indicating that the majority of understanding of disaster management training is at a moderate level, namely 7 respondents, while the minority at a good level is 12 respondents.

This study describes the knowledge of the daily habits of activities in the Central Surgical Installation (operating room) and illustrates the importance of a better understanding of everyday phenomena so that it can be used as a basis for accurate estimates of how a hospital's operating room will respond to a major disaster event and provide the necessary services. Measuring the level of preparedness knowledge as one of the ways of receiving feedvack from employee training can be usefull reflection of the success of training program in crearing the necessary capabilities in various fields of disaster preparedness (Ghaljeh et al., 2024). Comprehensive disaster preparedness involves understanding potential challenges and developing proactive safeguards and emergency response strategies (Matsumoto et al., 2025). Daily operating room services can cause the Emergency Department (ER) to be full in providing patient care if it does not have adequate facilities and reliable resources. This is in accordance (Tanjung et al., 2024) which states that hospitals must have their own

disaster management team which has legal status through a decree approved by the hospital leadership. Hospitals play an important role in each stage of disaster (Shi et al., 2021).

Based on the interview results, data showed that inadequate human resources and logistics were one of the impacts of the surge in patients in the operating room. This certainly requires hospitals to evaluate the availability of adequate resources and logistics in the event of a disaster. Human resources, including medical personnel, health workers, and non-health workers, are crucial for preparation and mobilization in emergency health crises to increase the hospital's human resource capacity (Rostami et al., 2023). In the disaster management coordination activity component of hospital, hospital has a disaster committee whose structure consists of representatives from each installation, unit, and room, each representing theis respective daily function (Choirrini & Lestari, 2018).

In addition to human resources, logistics are also crucial in a mass casualty situation in a hospital. A hospital disaster plan is one way to organize logistics to meet the needs of patients in the hospital. Logistics is responsible for providing adequate services and support to meet all needs in the event of a mass casualty incident (Assam State Disaster Management & Authority, 2013). During the 2006 Yogyakarta earthquake, PKU Muhammadiyah Hospital received aid from other countries. This served to increase the availability of medical facilities, equipment, and other necessities needed during a disaster. Hospitals are generally unprepared in terms of financial resources for supplies and logistics, room expansion for mass casualties, and psychosocial services during disasters (Nisaa et al., 2024).

The operating room is one of the facilities used to treat disaster victims. The teams and working hours in the operating room were determined (Yılmaz & Eskandari, 2023). In addition to triage rooms, procedure rooms, and operating rooms, it is also expected that they are always in good condition, well-maintained, and ready to use according to standards. Backup equipment should be available to anticipate a surge in patients. Hospitals should have a hospital disaster management logistics system in place that is responsible for providing the necessary resources and support services in the event of a disaster. The general coordinator, human resources, and planning are responsible for coordinating the provision and management of logistics (Delima et al., 2021).

Knowledge of healthcare workers' preparedness for a surge in patients is generally considered adequate, demonstrating the importance of education on disaster preparedness. This aims to increase their knowledge of what to expect when a surge in patients occurs in the operating room. Hospital preparedness for disasters can be achieved through the establishment of a hospital disaster management organization that collaborates with various sectors, along with training for hospital staff so they understand planning and what to implement in the event of a surge in mass casualties, especially in the operating room (Kemenkes, 2024). Furthermore, the role of healthcare workers as coordinators in the disaster response phase includes both internal and external coordination. Internal coordination involves coordination within the disaster preparedness team, coordination related to staffing shortages, logistics and finances, and coordination in the process of sending the disaster preparedness team out of the hospital (Afik et al., 2018). Meanwhile, external coordination includes coordination with Muhammadiyah network hospitals, Pusbankes, and professional organizations as human resource support (Afik et al., 2018).

The establishment of a disaster management system in hospitals demonstrates that effective communication will be established in the future, allowing staff to work according to established guidelines when a disaster occurs. In the event of a severe shock, ongoing operations must be immediately halted, and the operating field covered with a sterile cloth to prevent contamination (Suzuki et al., 2014). This demonstrates the importance of team communication in the event of an earthquake. Poor communication systems exacerbate the impact of disasters on hospitals. Therefore, early preparation is essential to establish effective communication so that when a disaster strikes, staff can work according to established guidelines (Prima & Meliala, 2017).

4. Conclusion

Based on the research results, earthquake disaster preparedness involves several components, such as knowledge, logistics, communication networks, transportation, training, and cross-sector collaboration. The majority of respondents had a moderate level of understanding in various aspects of preparedness, but there were still shortcomings in terms of logistics and human resources, especially in dealing with the surge of patients in the Central Surgical Installation (OPERATING ROOM). Hospitals need to improve education, training, and a better disaster management system to be able to provide optimal services in emergency situations.

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