International Journal of Design & Nature and Ecodynamics
Vol. 17, No. 2, April, 2022, pp. 311-317
Journal homepage: http://iieta.org/journals/ijdne

Hospital Preparedness in Facing COVID-19 Pandemic: A Systematic Literature Review

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https://doi.org/10.18280/ijdne.170219

Received: 11 March 2021
Accepted: 25 October 2021

Keywords:
disaster, hospital preparedness assessment, COVID-19

ABSTRACT

During the ongoing global COVID-19 pandemic, the number of cases continues to increase and leads to a surge of patients who need treatment. However, many hospitals are not ready to deal with this type of emergency. This study aimed to review previous studies on Hospital preparedness in facing COVID-19 disaster. This is a Systematic Literature Review on articles collected from 4 databases, i.e., PubMed, Science Direct, Google Scholar, and Crossref by applying the inclusion criterion of articles published in English and Indonesian on qualitative and quantitative studies related to hospital preparedness. PRISMA Guideline was used for this review. Based on the application of the inclusion criterion, eight articles were considered to be appropriate for the review. Three of these articles presented good hospital preparedness, while the other five demonstrated the presence of gaps in terms of facilities, staff training, and coordination. The instruments used in the study presented in these articles were adapted from CDC and WHO and were modified to adjust them with the local condition. A comprehensive assessment on hospital preparedness is needed. Health care worker training is an important step in hospital preparedness.

1. INTRODUCTION

The COVID-19 pandemic has spread massively around the globe [1]. After almost a year, this pandemic has not ended and the COVID-19 disaster has continued to have significant impacts on mortality and morbidity rates [2, 3]. To date, the World Health Organization has recorded that from the 222 countries affected, the global incidence rate for COVID-19 has reached 78,194,947 confirmed cases with 1,736,752 deaths [4]. In Indonesia, 751,000 confirmed cases, 22,329 deaths have been recorded [5]. Patients who are confirmed to be positive for COVID-19 need to be treated in hospitals with appropriate and adequate facilities [6]. This has raised problems in all hospitals around the world, especially those located in developing countries including Indonesia, because hospitals are not able to cope with the rapid surge in patients. Thus, many patients do not receive health care services or receive non-optimum health care services. Until currently, the highest surge is seen in the needs for ICU rooms, beds, isolation rooms, and ventilators [7, 8]. Governments in all countries are making strategies for providing the necessary health care by adding the number of referral hospitals through the appointment of private hospitals, making use of other buildings to be designated as hospitals, and building new hospitals [9, 10].

In addition, the impacts of morbidity and mortality due to COVID-19 are also seen among health care workers such as doctors and nurses [11]. Some countries have reported that a certain percentage of cases is seen among health care workers, such as Indonesia (17/278; 6%). Among health care workers in Indonesia, 192 doctors, 14 dentists, and 136 nurses have died in this pandemic [12]. The lack of protective equipment and nosocomial infection have been cited as the common causes of death [13]. In addition, the spread of COVID-19 in health care workers is estimated to occur through aerosol droplets released when coughing, sneezing, or breathing when performing actions that produce aerosols [10]. Various efforts to prevent nosocomial infections have been performed; however, the incidence rate is still increasing. Therefore, hospitals that are assigned to provide services to COVID-19 patients must be able to provide health care service in a quick and safe manner to reduce the morbidities and mortalities due to COVID-19 pandemic.

The efforts for establishing a safe hospital are started by making a comprehensive Hospital Disaster Plan [14]. Hospital preparedness is important to keep the hospital services running during the provision of treatment to COVID-19 patients. Hospitals need to conduct a periodic COVID-19 pandemic preparedness assessment to communicate needs and map priority problems along with the solutions. Guidelines for assessing hospital preparedness during COVID-19 have been issued by WHO and CDC and are equipped with sample instruments that can be adopted according to the needs and conditions [15, 16]. Some researchers and policymakers from different countries have conducted survey and assessment on hospital preparedness. However, whether the assessment performed is enough to identify problems and further implement solutions and efforts to improve services and ensure that the hospitals become a safe place during the COVID-19 pandemic still needs to be elaborated. The main objective of this literature review is to analyze the preparedness level of hospitals from various countries as well as to identify the influencing factors, instruments used, and efforts made for ensuring the preparedness. Thus, the recommendations presented in this literature review will

provide appropriate assessment formula and instruments to get a good solution.

2. METHOD

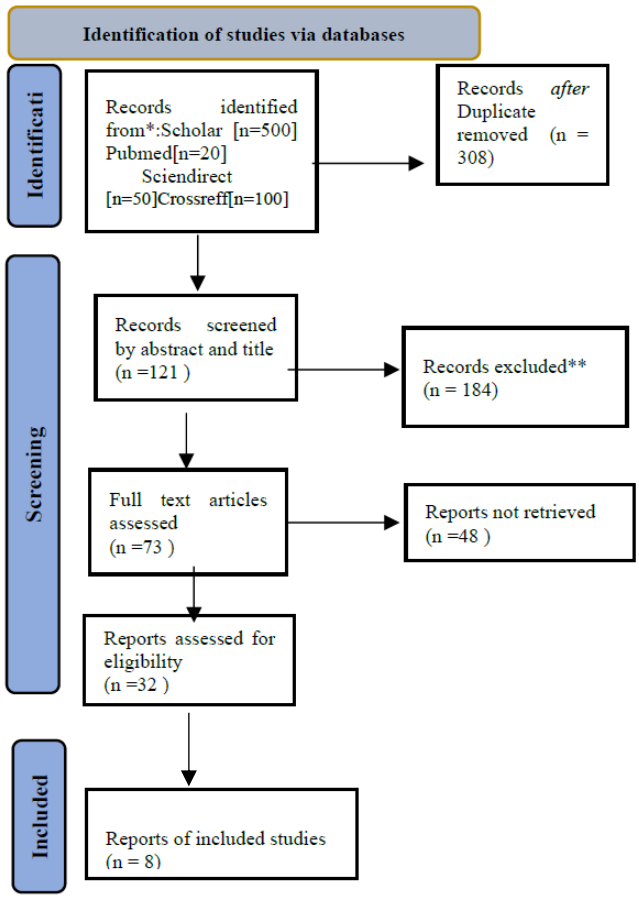

Figure 1. Flowchart of preferred reporting items for Systematic Reviews and Meta Analyses (PRISMA)

Eligibility Criteria: This study is a systematic literature review performed by searching electronic literature from academic journals using certain criteria. Literature on assessment of hospital preparedness in dealing with COVID-19 was identified using the following criteria: 1) articles related to hospital preparedness, 2) instruments used aimed to assess preparedness, 3) articles collected by using keywords, 4) articles were during 2019-2020, 5) articles were written in English and Indonesian, and 6) articles presented results of qualitative and quantitative studies. Articles that did not meet inclusion criteria were not included in the review. These included articles that were not related to hospital preparedness assessment or articles that discussed other disasters such as natural disasters and pandemics other than COVID-19. Of the 670 articles obtained, and after several stages of selection were applied, eight articles were considered to meet the review criteria. This study was performed using the integrative review based on the Preferred Reporting Items for Systematic and Meta-Analyses (PRISMA) guideline [17].

Search strategy: Sample articles were selected through search using the Publish of Perish software on Google Scholar, PubMed, Science Direct, and Crossref databases from 2019 to 2020. The keywords used were Hospital Preparedness, evaluation, survey, assessment, COVID-19 (Figure 1*)*.

Quality assessment: The quality assessment in this study used the standard criteria by testing using the Joana Briggs Institute (JBI) method, resulting in eight (8) articles included in the review.

2.1 Study design

The approach used in this study was to review articles that assessed hospital preparedness in dealing with COVID-19. This study involved 8 studies, in which 7 of them applied quantitative methods on various health worker respondents [18-24] including doctors, nurses, pharmacists, and other staff. One study used a qualitative mix-method approach with in-depth interview [19].

Respondents and Methodology:

Focus population of the study was health facilities such as hospitals from several regions in Nigeria, Nepal, Japan, Indonesia, Yemen, Amhara (Middle East), Idaho (US), and Ethiopia There was only one study performed in clinics as a comparison. In the assessment conducted in clinics, different assessment technique was used, including different instruments and item criteria. Most of the remaining studies assessed preparedness in several hospitals, but one focused only on one hospital. Most of the hospitals studied were local public governments with some performed in private hospitals and NGOs. Data collection was performed through the hospital staffs who worked in the hospital (Table 1).

3. RESULT

The results of this integrative article review are summarized in several charts. These presented findings on assessment of hospital preparedness in dealing with COVID-19, Instruments used, influencing Factors, and efforts made to improve the preparedness (Table 2).

3.1 Preparedness

In the review of the results of preparedness, there were (n = 5) studies that revealed the lack of preparedness in hospitals for dealing with COVID-19, i.e., Zawiah et al. [19], Desu et al. [21], Hamal et al. [22], Kanwar et al. [23], Tagashira et al. [24]. The lack of preparedness was seen in the available ICUs, beds, AAIR, ventilators, essential medical supplies, testing capabilities, and PPEs such as masks, face shields, staff training, SOP, and the absence of body temperature measurement point for patients and visitors when entering hospitals. In terms of staff safety, there was a lack of routine tests, quarantine for positive staff, and changing rooms. There was inadequate number of waiting rooms separate examination rooms, and holding areas. Water supply, electricity, and laboratory were also inadequate. Other studies (n = 4) presented good result from the assessment, such as hospital is in the sufficient level, an average indicator of >50%, good communication, good surge capacity (addition of ICU and isolation rooms, beds), good IPC, sufficient logistics, routine staff training, established coordination with the government, availability of a task force team, routine staff training, good waste management, and good staff knowledge.

Table 1. Location, population, design and method

Author	Title	Location, Population, and Design	Method
Salako et al. [17]	Evaluating the Preparedness of Child Health Facilities and Health Care Providers to COVID 19 Pandemic	Nigeria, 148 pediatric health care workers, cross-sectional	Quantitative
Erungan et al. [18]	Preparedness of the Bhakti Wira Tantama Army Hospital Semarang in Facing The Covid-19 Outbreak	Indonesia, 23 health care workers from 1 hospital, Descriptive	Quantitative and Qualitative (In depth Interview)
Zawiah et al. [19]	Assessment of Healthcare System Capabilities and Preparedness in Yemen to Confront the Novel Coronavirus 2019 (COVID-19) Outbreak: A Perspective of Healthcare Workers	Yemen, 18 Hospitals, GPs, specialists, pharmacists, nurses, administratiostaff, laboratory assistants, consultant (296), descriptive	Quantitative
Gyanwali et al. [20]	Assessment of Preparedness and Readiness of Government of Nepal designated COVID Hospitals and Clinics to Respond COVID-19 Pandemic	Nepal, 93 clinics and 30 hospitals, descriptives	Quantitative
Desu et al. [21]	Hospitals preparedness for COVID 19 disease prevention and care in Eastern Amhara region, Amhara, 2012 E.C.	Amhara, nurses from 30 public hospitals, cross- sectional (Regression Model)	Quantitative (Observasi Virtual)
Hamal et al. [22]	Perspective of Doctors for COVID19 Pandemic Readiness in Government Hospitals of Nepal	Nepal, 56 anesthesiologists in 5 public hospitals, cross-sectional	Quantitative
Kanwar et al. [23]	A Survey of COVID-19 Preparedness Among Hospitals in Idaho	Idaho, nurses for infectious diseases in 44 hospitals, Cross-sectional	Quantitative
Tagashira et al. [24]	A survey of preparedness against coronavirus disease 2019 (COVID-19) in hospitals in Tokyo, Japan, with healthcare personnel with COVID-19 and in-facility transmission	Japan, 284 staff members in 53 hospitals, descriptive	Quantitative

Table 2. Instrument, data collection and preparedness

Author	Instrument	Data collection	Preparedness
Salako et al. (2000) [17]	Questionnaire modification	Online survey	Good preparedness, good staff knowledge, good facilities, training conducted regularly, adequately complete facilities.
Erungan et al. (2000) [18]	Hospital Readiness Checklist	In-Person Interview	Hospital was in sufficient level, average indicator >50%, good communication, good surge c (addition of ICU and isolation rooms, beds), IPC was good, adequate logistics
Zawiah et al. (2000) [19]	Development questionnaire consisting of 5 sections validated by 4 Independent Providers	Online survey	Hospital level was very poor (lack of ICU space, beds, AAIR, deficits of essential medical supplies, testing capabilities, and PPE) Public hospitals had lower preparedness than private hospitals and NGOs Almost all did not receive isolation SOP training No financial support for hospitals, there was no body temperature measuring point for patients and visitors when entering the hospital in public hospitals compared to private hospitals and NGO hospitals
Gyanwali et al. (2000) [20]	Modification Questionnaire (expert panel)	Interview by phone	Good preparedness, there had been coordination with the government. Task force was established, staff training, good waste management
Desu et al. (2000) [21]	Modification Questionnaire	Virtual interviews	A total of 16 hospitals were not prepared, staff training was are lacking, masks were not sufficient, isolation rooms were lacking, SOP for screening visitors and patients was not in place. Quarantine for positive staff is inadequate, waiting rooms and separate examination rooms were lacking, holding areas were still lacking, water supply and electricity were good, except in clinics
Hamal et al. (2000) [22]	Adoption questionnaires from the CDC and WHO and	Online survey	Some hospitals were not prepared, ventilation and oxygen were sufficient, lack of negative pressure insulation room, no area to don and remove PPEs A bit of training for staff
Kanwar et al. (2000) [23]	Development of Questionnaire	email (Survey monkey)	Preparedness varies, The average hospital facility was good, except for eye protection. Staff training was carried out, IPC Committee was in place, Staff Protection was good Command system existed; PPE was adequately available
Tagashira Yasuaki et al. (2000) [24]	Development of Questionnaire	email	Not enough preparedness There were gaps in the implementation of various plans and protocols for staff training, risk communication, surge capacity, laboratory capacity, and infection control in hospitals.

3.2 Data collection and instrument

In collecting data, almost all studies performed online data collection through social media such as Facebook, WhatsApp, [19] email [17] and survey monkey [24]. Some also used virtual observation. The study in Japan conducted their initial data collection by reviewing publications on open-access websites or hospital websites and then confirmed the information by email. Questionnaires were sent to respondents. Based on the objective of the study, for the study that was conducted on pediatric hospitals, questionnaires were distributed to pediatric health care workers. Meanwhile, in studies on public hospitals, questionnaires were sent to anesthetists and infection prevention officers. Almost all instruments used were developed by involving expert panels such as epidemiologists and disaster experts from both the government and independent parties. There were hospitals that used instruments directly from the WHO or CDC, such as the Hospital Readiness Checklist, or indirectly used such instruments with modification according to the needs of the study. All instruments included demographic data and hospital facility data related to pandemic needs such as data on isolation rooms, AIIR, and PPEs including masks, hazmat suits and face shields.

3.3 Factors affecting preparedness

From articles that mentioned factors that affect hospital preparedness to face the COVID-19 pandemic, there was a significant relationship between staff knowledge and preparedness (OR = 1.1) [17]. Knowledge of COVID-19 infection such as familiar with the symptoms especially in pediatric patients still need to be improved. Other variables included in the studies where the period of the hospital had been established (r = 0.25), distance between the hospital and the city (r = 0.1), location of hospital (r = 0.125), experience in handling outbreaks, and government funds related to hospital preparedness, including funds from government authorities (r = 352) [21]. In another study, the comparison between government and private hospital on facility competency parameters proved significant differences for disaster preparedness (r = 0.008) [19]. The type of hospital also significantly linked to the Infection Preventive Program. Indicators used for the preparedness in the studies were communication, service continuity, surge capacity, human resources, logistics, surveillance, essential support services, case management, IPC, laboratory services, waste management, death body handling, coordination, task force team, guidelines/SOPs, and coordination.

4. DISCUSSION

This integrative literature review analyzed 8 articles on studies conducted in different countries, including developing countries and developed countries, i.e., Idaho, Japan, Indonesia, Nepal and Yemen to explore hospital preparedness from different perspectives. One study assessed pediatric hospital services in several regions because the researchers would like to understand the silent infection in pediatric patients. Other studies assessed the preparedness of hospitals and clinics specifically designated by the government for COVID-19 because the preparedness of health facilities determines the sustainability of their services. There are also studies that assessed preparedness from the perspective of the safety of health workers because of the high number of infected health care workers. This review showed that almost all hospitals were prepared; however, some articles [25] did not mention the level of preparedness based on the assessment results because they used different instruments by adopting the WHO and CDC instruments. However, there are elements that are commonly studied including infection control and preparedness of facilities related to respiratory symptoms.

The lack of preparedness was seen in critical care facilities such as ICU rooms, isolation rooms, AIIR, ventilators, and beds, although those are the ones that determines patients' recovery and survival. There was also a large deficit in essential medical supplies such as PPE for infection preventive efforts for health workers [26] including areas for wearing and removing PPE when studies actually showed that health workers were infected due to, among others, incorrect use of masks caused by inadequate supply [27]. In addition, there was a lack of ability to perform tests and surveillance due to inadequate laboratory facilities which is caused by inadequate funding, poor health system/policies, and lack of quality of care, according to these studies. However, there were indeed insufficient facilities since before the COVID-19 pandemic, which was seen, for example, in Yemen, as a country that has been involved in a 5-year conflict that includes attacks on hospitals and medical facilities resulting in fatalities that many medical staffs left the country [19]. These circumstances created very little capacity to deal with COVID-19 or other public health emergencies. In addition, there were also gaps in the implementation of plans and protocols for team of workers training, risk communication, surge capacity, laboratory capacity, and contamination control in hospitals. Furthermore, there were only few studies that showed adequate preparedness level although future improvements were still needed in terms of laboratory preparedness and training for health care workers. Sources of funds are indeed important in times of disaster.

All studies stated that there were only several factors that affect the preparedness level of a hospital: knowledge, hospital level, financial support, outbreak experience, and knowledge of the etiology of COVID incubation period, symptoms, diagnostic criteria, appropriate care for infected patients, relevant regulations, and regulations for hospital staff regarding handling and providing services during the COVID pandemic period. This is supported by findings from previous studies that the knowledge of staff/health care workers greatly influences hospital preparedness [28, 29]. This knowledge can be obtained through training, such as COVID-related clinical training, training on testing and sampling, case management training, infection preventive management training, and waste management training. This training should be facilitated by the hospital or can be done independently on the WHO website [30-32].

Data collection in these studies used instruments adopted from the WHO and CDC instruments and then developed according to local conditions. There is only one study that directly used the instrument from WHO, which is the Hospital Readiness Checklist. The similarity of the elements of the question items are seen in demographic data, health workers knowledge, and indicators of preparedness such as the availability of essential facilities such as the AIIR isolation rooms, ICU rooms, ventilators, wards, and infection preventive facilities such as PPE that consists of masks, face shields, hazmat suits, eye protection, and hand sanitizers.

Infection preventive efforts were also assessed in these studies, such as inspection of visitors at the entrance standard operational procedures, Task force team and diagnostics which are discussed in several studies. All questionnaires include indicators of infection preventive program and practices because these programs and practices are essential for the success of the treatment and the size of the spread of infection depends on the control efforts, starting from the administrative prevention through policies to implementation through continuous IPC activities, increasing knowledge of health workers with structured and routine training, visitor screening, and provision of adequate waiting room. Another control measure discussed is environmental engineering that includes changing the infrastructures for service facilities. The last part of the control hierarchy assessed is the use of PPE and the availability of adequate hygiene measures and sanitation. The presence of a response team or Task force to coordinate tasks as a team in the hospital is also mentioned. However, most of the reviewed studies do not clearly state the model of coordination applied and only one study mentioned the implementation of the Incident Command System (ICS). This model has been widely used in emergency response systems in hospitals and several studies have shown that ICS is proven to help improve communication, use of resources, staff and patient safety. With the implementation of directive commands and protocols, all preparedness activities become more effective. In all instruments used, it seems that the researchers make adjustment to the predetermined focus or target. Thus, here are several preparedness indicators items that are not assessed.

In the data collection process, almost all of studies used online surveys through the use of email and social media. Some studies conducted direct interviews with hospital staff via face to face and telephone. Time of return for answers also takes time and large size documentation data cannot be sent. This is due to the limitation applied on direct contacts, remote location of the hospital, and the large number of respondents. However, this creates a problem if the data are needed in real time to improve facilities and services. This raises a concern for further studies to find the best solution. One of the studies also asked hospital staff respondents such as doctors or nurses in the infection department to independently assess the preparedness of the institution. This can introduce bias from the subjective nature of the assessment.

Efforts to establish hospital preparedness are described concretely in several studies, including the efforts of Nepal government that focused on improvements of infection prevention, triage system, and dead body handling by, among others, increasing multi-sectoral cooperation. Dead body handling is very important because not all staffs are able to do it quickly and appropriately despite the fact that there was no scientific evidence to prove that the body of COVID-19 patient is still contagious. Different countries have different guidelines due to different processes and customs. WHO has developed a guideline based on observations and based on the SARS guideline.

One of the limitations stated in all reviewed studies is the process of data collection which was carried out independently and subjectively, such as using online surveys without direct observation on the hospital conditions. The assessment was mostly done from the perspective of health care workers, such as doctors, nurses and other health professionals, on the facilities in the hospital where they work. Although there were studies conducting direct assessments by looking at supporting documentary evidence, both face to face and virtual, limitations still exist. Another limitation is that the studies presented in the articles did not cover all existing hospitals as it was difficult to get information because of the lack of support. The status of hospital facilities was constantly changing and studies tended to be performed only at a specific point of time and fails to capture the dynamics. Therefore, routine studies to assess the preparedness status and preparedness of health facilities are very important.

5. CONCLUSION

The COVID-19 pandemic is a new phenomenon that not many studies have been performed to comprehensively analyze hospital preparedness in dealing with this pandemic. This review showed that hospitals are not prepared well to handle COVID-19 disaster, especially in terms of the availability of critical care facilities such as ventilators, ICU rooms, isolation rooms, oxygen, and PPE. In addition, not all studies presented the preparedness level of the hospitals and the data collection method used was still subjective and included asking for the opinion of health workers such as doctors and nurses at the hospital where they work regarding the preparedness of the hospital instead of interviewing the person in charge of the task force team. Almost all studies used online surveys via email with limited time that it may bring non-optimum results of the study. Therefore, a comprehensive digital preparedness assessment instrument is needed for rapid response, especially during a pandemic with limited face-to-face opportunities, especially countries with large areas such as Indonesia. The variables related to this finding are staff knowledge, hospital distance, hospital level, and outbreak experience.

ACKNOWLEDGMENT

This study was supported by grants from Research and Community Engagement Directorate (DRPM) Universitas Indonesia No. NKB-0592/UN2.R3.1/HKP.05.00/2019.

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