

Challenges and Opportunities of Hospital Preparedness and Resilience Plans in India: Experience from Covid-19 Pandemic.

Ali Alshikh Hasan^{1*}, Dr. Sunil Kumar Ambrammal²

¹*Research Scholar, Department of Humanities and Social Sciences, National Institute of Technology Cuncolim, Goa, India, email id: alihasan@nitgoa.ac.in

²Assistant professor, Department of Humanities and Social Sciences, National Institute of Technology, Cuncolim, Goa, India, email id: sunilkumar@nitgoa.ac.in

***Corresponding Author:** Ali Alshikh Hasan

*Research Scholar, Department of Humanities and Social Sciences, National Institute of Technology Cuncolim, Goa, India, email id: alihasan@nitgoa.ac.in

Abstract:

As per the United Nations, climate change and infectious diseases stand as the two most significant threats to humanity. Throughout history, novel influenza strains have repeatedly caused human pandemics, resulting in widespread illness, loss of life, and disruptions to healthcare systems. Infectious diseases have exerted a significant impact on society and humanity, including the Plague, Cholera, H5N1 influenza, SARS, and Covid-19. The Coronavirus (Covid-19) pandemic, which erupted in China and expanded worldwide, influenced hospitals' capacity to provide treatment for patients. It caused damage to their infrastructures, such as a lack of medical supplies, personal protective equipment kits (PPE), hospital beds, drugs, oxygen supplies, and face masks. Therefore, hospitals needed to be prepared for such situations to save people's lives. In this context, the present study aims to evaluate the preparedness plans of hospitals in India against biological disasters such Covid-19 pandemic. The study provides comprehensive information on the topic, which enables the identification of the challenges that healthcare workers face. Therefore, the study tries to improve the preparedness level of the hospitals towards any future disaster.

Keywords: Pandemic, Covid-19, Hospital Preparedness, Capacity, Health Care Workers.

Introduction

Biological disasters bring threaten to individuals' health and safety, placing substantial financial and labour loads on the impacted society and health systems. Infectious illness pandemics are becoming more dangerous on a global scale. Significant disease outbreaks and pandemics, such as the Spanish Flu, Hong Kong Flu, SARS, H7N9, Ebola, and Zika, have been documented throughout history (WHO, 2011b)¹². The Covid-19 disease, a severe threat to people's lives and the world's medical facilities following its first incidence in China, spread quickly to a global pandemic. This hazard is

¹ The 1918 influenza pandemic (Spanish Flu) was the leading cause of mortality in modern history. It was caused by an H1N1 virus with avian genes. It spread throughout the world during 1918-1919. The Hong Kong flu, also recognized as the 1968 flu pandemic, was a flu pandemic that killed between one and four million people worldwide in 1968 and 1969. It was caused by an H3N2 strain of the influenza virus and was one of the deadliest pandemics in history.

² In March 2013, the A (H7N9) virus ("Asian H7N9") was first detected in China. It is a subtype of influenza viruses that has previously been detected in birds. This virus had never been seen in either animals or humans before it was discovered in China. While, SARS first appeared in China in 2002. It quickly spread around the world, but it was quickly contained. SARS is a virus that spreads through droplets in the air when a person with the disease coughs, sneezes, or talks.

The Ebola virus is transmitted to humans from wild animals and spreads through human-to-human transmission. The 2014-2016 Ebola outbreak in West Africa was the largest since the virus was revealed in 1976. The outbreak began in Guinea and spread across borders to Sierra Leone and Liberia.

The Zika virus is a mosquito-borne virus that was first identified in a Rhesus macaque monkey in Uganda in 1947, followed by evidence of infection and disease in humans in other African countries in the 1950s. Human infections were detected irregularly across Africa and Asia from the 1960s to the 1980s.

partially brought on by increased local and international travel and trade, which permits any highly contagious infection to spread quickly across borders.

The disease can spread swiftly during pandemics, which can impact the ability of hospitals and the efficiency of the entire healthcare system. We can see from Italy's experience that the excess mortality could come as a surge which would overwhelm health services due to this increased infectivity (Armocida et al., 2020). The possibility of reoccurring pandemics must be viewed as inevitable in a world that is becoming more globalized. It needs a vigorous public health response and a highly proactive and operating healthcare delivery system to respond to a crisis (Kruk et al., 2015). Therefore, building "resilient healthcare system" can withstand the shock of such emergencies by drawing from past failures and mistakes. Meanwhile, governments and other organizations such as NGOs can respond to pandemics while ensuring the uninterrupted delivery of essential healthcare services (Blanchet, 2015).

Hospitals are essential organizations as a place of care and treatment for patients during biological disasters. Professionals and employees with the knowledge and skills necessary for physical events can significantly reduce mortality and morbidity in the community (WHO). Thus, hospital readiness and responsiveness to such factors play a significant role in reducing infection transmission, number of casualties, and mortality rate. Also, the Covid-19 Pandemic highlighted the relevance of planning as an essential part of hospital preparedness.

The availability of personal protection equipment (PPE) and appropriate training of hospital employees indicate a hospital's enhanced preparedness plan. Moreover, increasing the capacity, oxygen supplies, and hospital beds will protect healthcare workers in their response to emergencies. However, the challenge of any healthcare facility, including hospitals, is to perform their essential functional tasks during epidemic conditions, and capacity may no longer handle this demand. Even a hospital that is well-equipped for disasters will struggle to manage the effects of catastrophes. As a result, preparing a hospital for a pandemic is a complex task involving many domains and subdomains. This preparedness is crucial in a nation like India, where the population is diverse and dispersed among states with varying geographies, population densities, educational levels, living standards, access to healthcare services, and political diversity. India has historically had some pandemics, such as Plague in 1994, Cholera between (1863-1875), smallpox in 1974, and Nipah in 2008. These events caused harm to medical facilities, decreased hospitals' capacity to handle patient loads and prevented hospitals from having sufficient time to rebuild and improve their preparedness. Covid-19 significantly impacted hospital capacity in India due to the considerable number of patients that came to hospitals looking for ICU beds, which were almost filled.

Additionally, there is a lack of preparing preparation plan strategy inside the hospitals, material supplies, and health workforce. Therefore, this study aims to evaluate the preparedness plans of the hospitals in India against biological disasters such as the Covid-19 Pandemic. It provides comprehensive information on the challenges that healthcare workers face in dealing with this kind of disasters. It also gives an opportunity to evaluate the rescue operations of hospitals under consideration.. The present study helps to improve the readiness level of the hospitals of the country against biological disasters.

Literature reviews

The demands for medical care during the Covid-19 epidemic raised quickly, potentially exceeding hospitals' capabilities. Emergency management is critical for management to prepare for unexpected or anticipated interactions with the cases. This preparation involves reconfiguring the medical staff and moving medical supplies like ventilators and personal protective equipment (PPE) (Kaito et al., 2020). Moreover, designated teams should be set together and stratified by the severity of the disease to handle patients with Covid-19 from a hospital management viewpoint. A study conducted by Djalali et al (2013) to compare between Iran and Sweden in regard to their hospitals' preparedness towards disaster. The comparison based on hospital affiliation, size, and type of hazards. The functional capacity was evaluated and calculated using the Hospital Safety Index (HIS) from the World Health Organization (WHO). This study found that the overall level of hospital preparedness for the Swedish hospitals included in this study is functional, whereas those in Iran were at risk (Djalali, A et al., 2013). The study revealed that the most common hazards that affected hospitals' capacity in Iran were earthquakes, infrastructure failure, and epidemics. In parallel, chemical accidents, epidemics, and terrorism were the major risk for Swedish hospitals. Previous research has found that countries with higher socioeconomic status also have a higher level of preparedness in hospitals (Kaji et al.. 2008; Niska & Shimizu 2008; Higgins et al. 2014).

A previous study conducted by Milch et al (2010) has described the impact of socioeconomic standards on hospital preparedness. Middle-income countries, as demonstrated by studies from Turkey and China (The World Bank 2011), have deficiencies in hospital preparedness (Top et al., 2010) and a high vulnerability to disasters. In contrast, the level of hospital preparedness in the United States (Higgins et al., 2004; Kaji et al., 2008) and Canadian medium and large hospitals was equivalent to that in Sweden (Higgins et al., 2004; Kaji et al., 2008).

The countries with a high socioeconomic standard have prioritized investing adequately in hospital preparedness plans in order to create safe and functional hospitals (Djalali et al., 2013). However, the study showed that despite an overall high level of preparedness, Swedish hospitals had inadequate contingency plans and insufficient availability of resources during disasters (Djalali et al., 2013). A similar lack of contingency plans was reported in a national assessment of hospital preparedness in the United States, with 32% of hospitals devoid contingency response plans for at least one of six hazards (Niska & Shimizu, 2008). Many studies drew attention to shortcomings in hospital preparedness's acute medical response to disasters by reviewing other published work on hospital disaster preparedness (WHO, 2011). An article "Attachment Requirements and Expectations by Source Hospital Emergency Preparedness (2007)" showed that poor hospital disaster planning and preparedness is more prevalent in developing countries than in developed countries.

A systematic review of the methods and checklists used for evaluating hospital catastrophe was presented by Nekoie-Moghadam et al. (2019). Themes include logistics, planning, human resources, Triage, communication, command and control, structural and non-structural preparedness, training, evacuation, recovery from a disaster, coordination, transportation, surge capacity, and safety all discussed (Verheul & Dückers, 2020). The study by Mulyasari et al. (2013) employed four dimensions and twenty-one indicators under these dimensions to evaluate hospitals. Four dimensions were used to assess eight hospitals in Iran which are structural preparedness, non-structural preparedness, functional preparedness, and human resources. According to the findings of their study, the structural and functional preparation characteristics were weighted even more and least, respectively (Gül & Yucesan, 2020).

Few studies have investigated the preparedness for and responsiveness to infectious public health emergencies in the hospital context. Most of the data originated from nations where the pandemic was most severe. Hospital preparedness and resilience evaluation is a complicated procedure that is mainly subjective. Therefore, we used this chance to assess how well our hospitals' readiness levels were during the Covid-19 pandemic in India. We decided to conduct a survey to analyse the difficulties and opportunities that emerged among hospitals' managers during the epidemic.

Method

We followed a cross-sectional study to assess the disaster preparedness plans of hospitals in the state of Goa in India. The survey was conducted from January through February; 2023. A paper-based questionnaire was addressed to the managers. For this study, hospitals were classified into three groups based on how they responded: primary (managing casualties initially), secondary (serving as a backup for primary hospitals), and tertiary (acting as a referral hospital for casualties with specific needs). The selected hospitals covered the region of Goa. This survey targeted 46 governmental and private hospitals.

After reviewing relevant studies, this study's authors collected standard questionnaires for hospital catastrophic plans. The research survey was divided into six major sections: The section one displays the type of hospitals, hospital policies during the Covid-19 crisis, and if the hospital has a plan for an emergency case; second section highlights the surge capabilities (including the availability of personal protective equipment kits (PPEs); beds capacity; oxygen supplies; the number of isolation rooms; the availability of medicine drugs); whilst the third shows the knowledge and training practices among healthcare workers (including covering the existence of training programmes, training techniques, and drill exercise briefings). The section forth gives a general evaluation of the hospital's preparedness plan toward dealing with biological disasters such as pandemics, the fifth section includes the challenges which occurred during this pandemic, and the last section checks the availability of disease surveillance system and technology for providing the needful information inside the hospital.

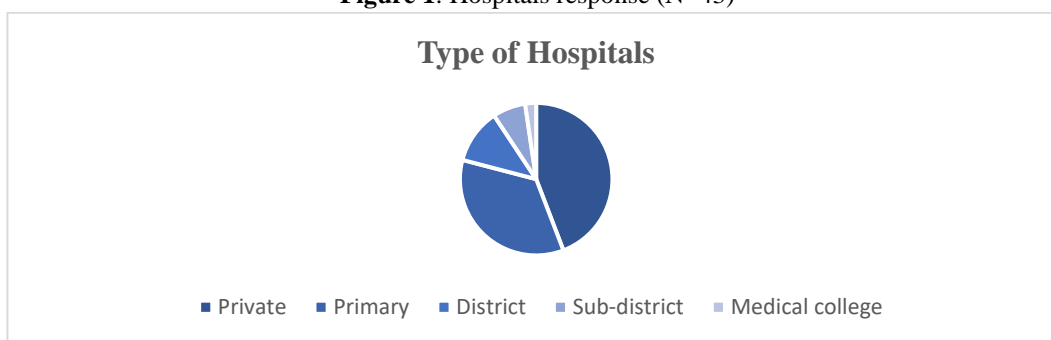
Data Collection

Forty-three questions have been sent to the 46 hospitals by email and phone calls in the state of Goa in India. The phone call aims to explain the participants' queries in case any doubt occurs. If necessary, a second questionnaire was issued to

explain to them the viewpoint of the question that maybe could not understand it fully. The participants have provided enough time to answer the questions. The researcher was questioned further to address in case any discrepancies discovered by the participant during the process between the responses given and the written question. All sites were required to complete and submit questionnaires within one month.

After being separately collected, they were checked for the accuracy of responses. The reviewer called the responsible respective director for incomplete information and requested to complete the missing data. At the end, we received 43 responses from 46. Whilst the remaining three apologized to respond. Figure 1 describes various categories of hospitals that participated in the sample survey. Of the total participants, 44.1 per cent belong to private hospitals, 34.8 per cent primary health centre, 11.6 per cent district hospitals, 7 per cent sub-district hospitals, and one medical college.

Figure 1. Hospitals response (N=43)



Source: Research survey done by authors.

Data Analysis

A Microsoft Excel 2016 spreadsheet was used to store and codify the information. Before doing any statistical analysis, the raw data of the essential study variables were checked for any missing values to determine the degree of omission and the pattern of the missing data. All significant variables were examined to complete this work, and their frequencies and percentages of missing data were reported. Tables and graphs summarise and present categorical variables. We structured the following data according to our research survey's standard. We highlighted the strategy and policies of hospitals during covid-19 Pandemic and the way they perform to manage the current situation. In parallel, we explained the capacity of hospitals' structure such as isolation rooms, triage chambers, and beds. Furthermore, our data reveals the measures that have been taking to control cases and prevent the spread of disease among health care workers. Nevertheless, we illustrated the challenges that occurred in hospitals, training programs, and the availability of disease surveillance system.

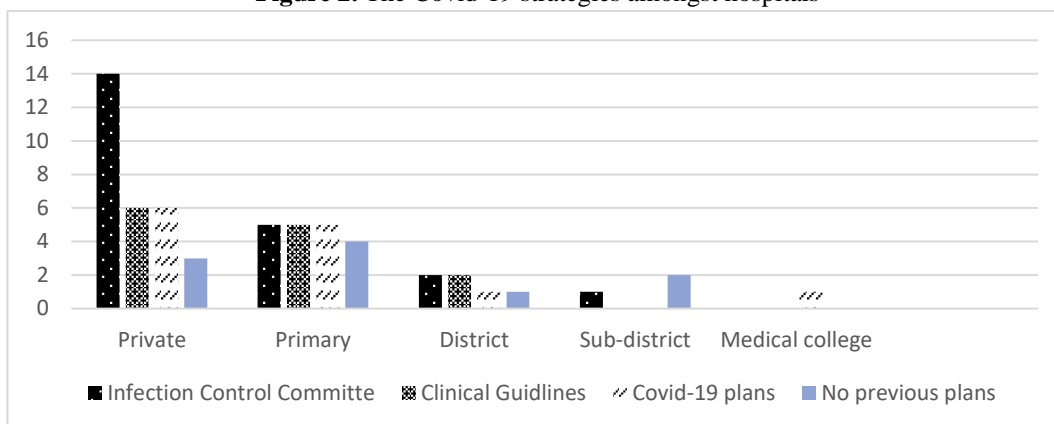
Results

The Policy of hospitals towards the Covid-19 Pandemic

Each hospital devises its unique method for handling crises, and the Covid-19 pandemic has emphasized the importance of having a thoroughly prepared plan to reduce casualties and effectively address the situation promptly. Continuously updating policies based on the current risk level is essential. This study reveals that a majority of hospitals (51.2 percent) have established an infection control committee specifically geared towards addressing Covid-19 (See Figure 2)³. The findings indicate that 14 private hospitals, five primary centers, along with two district hospitals and one sub-district hospital, have integrated an infection control committee into their protocols to handle and contain Covid-19 outbreaks (Figure 2).

³ This committee comprises professionals from diverse disciplines within the healthcare facility, such as physicians, nursing staff, infection control practitioners, and risk management personnel. The significance of this committee is pivotal in addressing any disaster, given their prior experience in planning, monitoring, and consistently updating relevant information. Furthermore, it offers explicit guidance to support individuals in establishing and sustaining a secure environment

Figure 2. The Covid-19 strategies amongst hospitals



Source: Research survey done by authors

The World Health Organization (WHO) established clinical guidelines for managing the Covid-19 disease, aiming to assess and disseminate information to healthcare systems globally. These guidelines encompass details about the symptoms, diagnosis, and necessary precautions to minimize infection rates across nations. Additionally, it offered a recommendations regarding the vaccination of healthcare workers and the general public. Hence, the study shows that 30.2 percent of hospitals adopted a similar approach in dealing with the current situation, formulating clinical guidelines to enhance patient care as indicated in Figure (2). This policy has been beneficial for patients, shedding light on overlooked health issues and preventive measures. Private hospitals have shown a positive response with approximately six hospitals implementing clinical guideline schemes (See Figure 2). Additionally, this strategy was adopted by five primary care centers and two district hospitals. Concurrently, 30.2 percent of hospitals had preparedness plans for the Covid-19 pandemic, comprising six private hospitals, five primary care centers, 1 district hospital, and one medical college. However, 23.3 percent of hospital inadequately prepared and lacked plans to address the situation. Notably, primary hospitals exhibited a higher rate among hospitals, with nearly five primary hospitals lacking preparedness (Figure 5.3.1.1). Conversely, three private hospitals, two sub-district hospitals, and one district hospital lacked established plans to manage the pandemic and prevent infection cases.

The capacities of hospitals

The initial surge of disease outbreaks, spanning from March 2020 to May 2020, placed significant strain on hospitals, primarily attributed to the overwhelming influx of patients’ treatment requirements. As the cases continued to rise, the insufficiency in hospital capacity became apparent, encompassing a shortage of Intensive Care Units (ICU), hospital beds, and oxygen supplies. Numerous hospitals expanded their bed capacity to ensure an adequate surge capacity in their emergency departments, as noted by Singh et al. (2022). Nevertheless, handling the substantial patient influx posed challenges, as many hospitals were ill-equipped to manage the resulting overcrowding. The significance of maintaining ample capacity in a hospital lies in ensuring that the facility's size and structure align appropriately with the needs of the community. Consequently, an effective capacity management plan within hospitals becomes crucial, encompassing the assessment of the maximum staffing and resource levels.

This study assessed hospital capacity by examining details related to isolation rooms, triage chambers, and the availability of hospital beds. The findings reveal that 53.5 percent of the hospitals exhibited satisfactory capacity, with a majority being private hospitals (Figure 3). Almost 14 private hospitals reported with sufficient resources, including available Intensive Care Units (ICUs) and beds. Additionally, only one district hospital and one primary hospital demonstrated excellent capacity (See Figure 3). On the contrary, others faced challenges, struggling to adequately address medical conditions. Conversely, 30.2 percent of hospitals reported with a fair capacity. This category comprised five primary hospitals, four private hospitals, and two sub-district hospitals as showed in Figure (3). Notably, only one medical college demonstrated an adequate capacity level. Furthermore, among these, only three primary hospitals and one sub-district hospital encountered the significant challenge of providing suitable accommodation for their patients.

Figure 3. Hospital Capacity



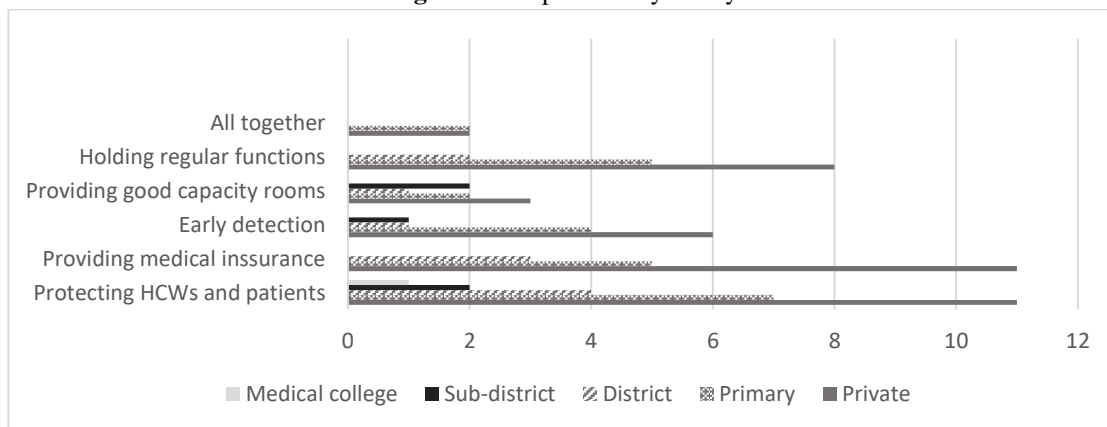
Source: Research survey done by authors

Hospital Safety Policy

Healthcare services prioritize creating a safe and secure environment for patients, healthcare workers, and medical facilities. Each hospital has implemented infection control procedures and policies, with all healthcare workers tasked with enforcing preventive measures to reduce the risk of infections. However, it's important to recognize that achieving complete elimination of the risk of disease outbreaks is difficult, and certain individuals may face a higher risk of contracting infections than others. The majority of private hospitals emphasized the protection of healthcare workers by implementing a safe hospital policy, which included offering medical insurance to their staff amid the Covid-19 pandemic (See Figure 4).

While six private hospitals implemented early detection as a strategy to assess the level of infection risk and determine necessary measures, eight others opted to suspend all regular services and convert them into emergency facilities for Covid-19 cases (Figure 4). Further, primary care facilities prioritized ensuring adequate capacity in rooms and safeguarding both medical staff and patients as part of their safe policy. Consequently, a few primary facilities, approximately five hospitals, temporarily halted their regular functions (Figure 4).

Figure 4. Hospital Safety Policy



Source: Research survey done by authors

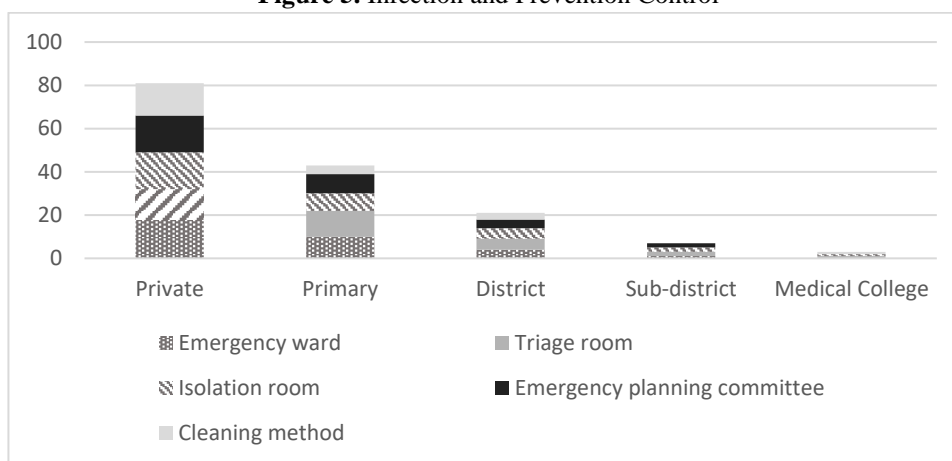
Infection prevention and control

An emergency ward serves as the initial point of contact for individuals in acute hazardous conditions who require immediate medical attention. Well-equipped Emergency Departments (ED), overseen by qualified medical professionals, are dedicated to providing urgent care to preserve lives. A well-equipped emergency ward is furnished with isolation rooms, point-of-care diagnostics, monitoring equipment, and essential medications, ensuring the delivery of high-quality medical care to patients. The emergency department maintains collaboration with other departments, including radiology, laboratory, blood bank, and more. Amid this outbreak, characterized by a surge in suspected cases and increased staff anxiety, the readiness of Emergency Departments (EDs) to triage patients and safeguard staff safety is paramount. Hospitals in this study implemented substantial changes in their operational protocols. Approximately 76.7 percent of hospitals upgraded their emergency wards to meet the immediate treatment requirements of Covid-19 patients (Figure 5). Furthermore, 18 private hospitals, ten primary health care centers, four district hospitals, and one sub-district hospital

enhanced their emergency departments by deploying trained professionals to offer emergent medical support to their patients.

Conversely, 76.7 percent of hospitals established 24/7 triage checkpoints to segregate Covid-19 patients from those with other health conditions. Fourteen private hospitals, 12 primary hospitals, five district hospitals, two sub-district hospitals, and one medical college designated triage rooms as part of their infection and prevention control strategy (See Figure 5). Moreover, 76.7 percent of hospitals created isolation areas within their premises to segregate Covid-19 patients and provide them with oxygen supplies and necessary medical drugs. Nevertheless, some hospitals formed emergency planning committees and devised cleaning and disinfection protocols as part of infection control plans to effectively manage the situation (Figure (5)).

Figure 5. Infection and Prevention Control

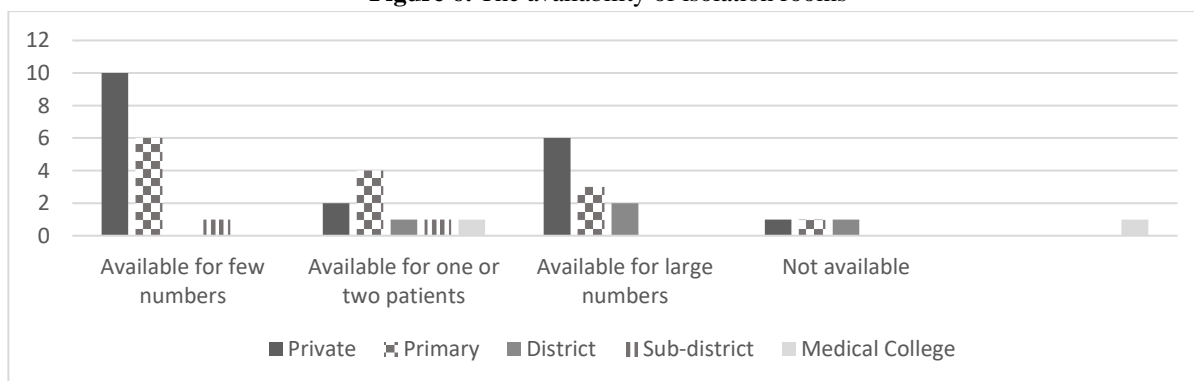


Source: Research Survey done by authors

Isolation Chambers

An isolation facility aims to regulate room airflow, reducing the concentration of infectious particles in the air to a level that prevents transmission to others within a healthcare facility, as per the guidelines by WHO. Effectively managing the spread of airborne infectious diseases in hospitals is a paramount concern for patients, healthcare workers, and visitors. Additionally, isolation rooms should be equipped with a continuous supply of medical essentials such as oxygen and drugs. Most private hospitals have isolation chambers, although primarily for a limited number of patients (See Figure (6)). Meanwhile, around six private hospitals have an extensive availability of isolation rooms, accommodating significant numbers of patients. Nevertheless, nearly two district hospitals possess ample space for isolation rooms, while others have limited availability for patients (Figure 6).

Figure 6. The availability of isolation rooms

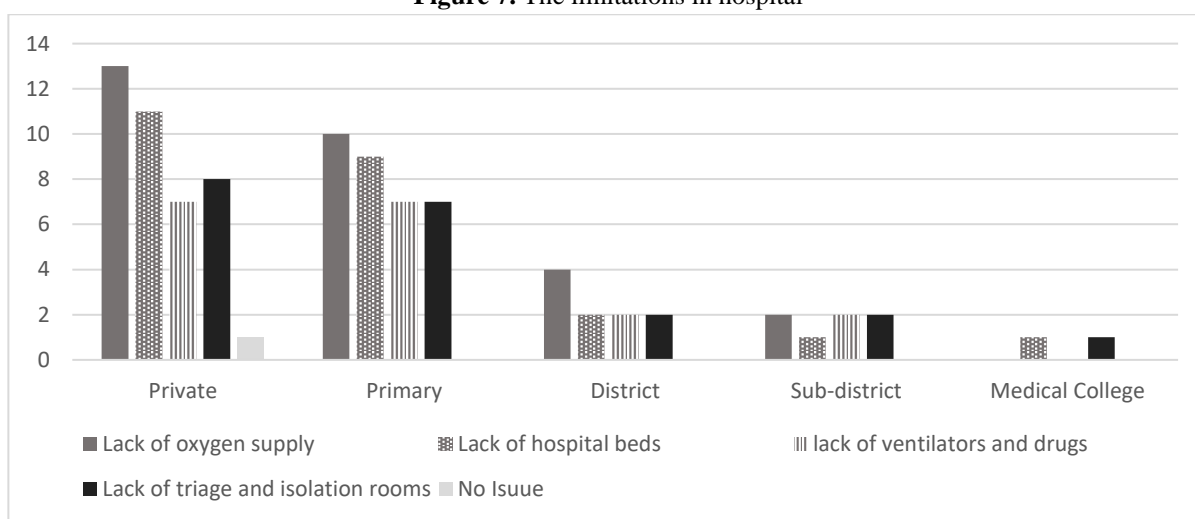


Source: Research survey done by authors

The difficulties faced by hospitals

Several challenges have emerged in Indian hospitals amid the current situation. A significant issue revolves around the lack of confidence in public hospitals' ability to deliver prompt medical care to patients. Additionally, there is a scarcity of PPE kits to safeguard healthcare workers, along with shortages in oxygen supplies, hospital beds, and isolation rooms. Further, the deficiency in human resources stems from a high number of casualties among healthcare workers (Motkuri & Mishra, 2020). Figure (7) indicates that a majority of hospitals (67.4%) faced inadequacies in oxygen supplies. Moreover, 58.1 percent of hospitals encountered difficulties related to the availability of beds, which proved to be a critical barrier in addressing Covid-19 outbreaks. Approximately 41.9 percent of hospitals experienced pressure due to shortages in material supplies and human resources. Moreover, 48.9 percent of hospitals were grappling with the absence of ventilators and essential drugs, while a similar percentage was challenged by the lack of triage and isolation chambers (See Figure 7).

Figure 7. The limitations in hospital



Source: Research survey done by authors

The Table (1) shows that 30.2 percent of hospitals received patient complaints related to the unavailability of transportation facilities, specifically ambulances. Out of the surveyed hospitals, 22 (51.2 percent) have between four to six ambulances, 11 (25.6 percent) possess two to four ambulances, and nine (20.9 percent) have only one ambulance. Additionally, a significant majority of hospitals (94 percent) reported a shortage in human resources. This scarcity is exacerbated by insufficient training and experience among healthcare workers. The shortage of PPE kits for safeguarding healthcare workers treating Covid-19 patients, coupled with the apprehension of contracting the disease and the social stigma linked to falling ill, compounded the challenges facing India's healthcare system. Nevertheless, PPE kits and other support materials were readily available to medical professionals in 29 hospitals. Additionally, 25 hospitals (58.1 percent) have sufficient airborne isolation rooms, while 18 hospitals (41.9 percent) encounter difficulties in providing airborne isolation rooms for their patients (See Table 1).

Table 1. Specific questions regarding the difficulties in hospitals

Specific questions	Yes	No
Has your hospital received any complaints from patients about the unavailability of transportation facilities such as (ambulances)?	13	30
Have your hospital faced a lack of human resources (health workforce) during the Covid-19 outbreak?	40	3
Does the hospital have enough airborne isolation capabilities and capacities?	25	18
Does the hospital have plans for having designated staff limited to treating either Covid-19 or non-Covid-19 patients?	24	19

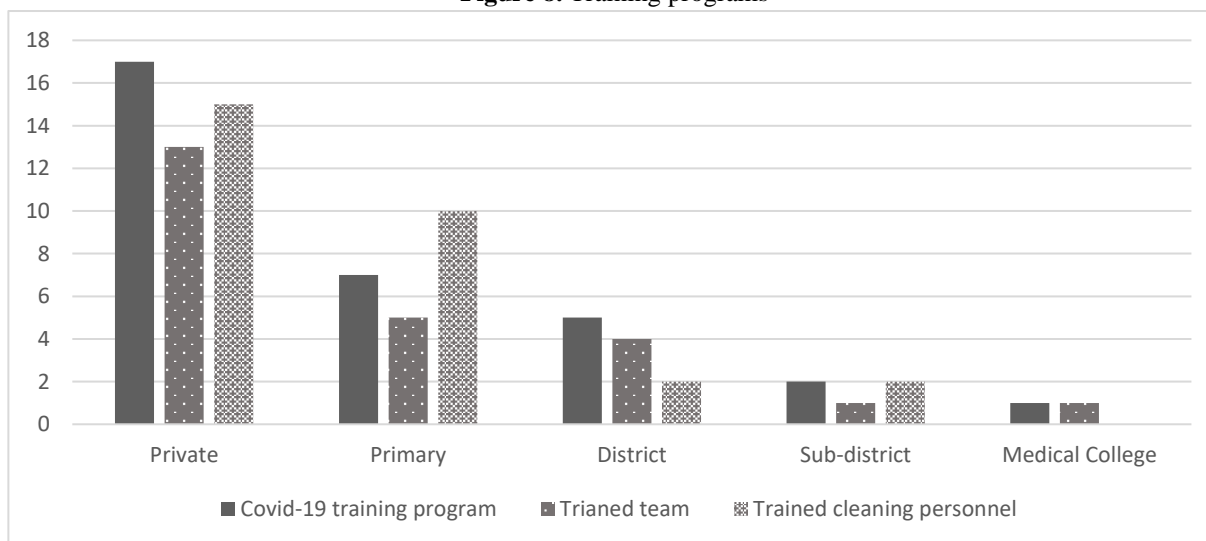
Personal protective equipment (PPE) (i.e. medical/surgical masks, gloves, gowns, eye protection) is easily accessible to the staff, especially in frontline areas.	29	14
--	----	----

Source: Survey done by author

Training programs

During an emergency or crisis, hospital staff are required to assume roles and responsibilities beyond their regular duties, often in stressful situations (WHO, 2014). Staff members need to participate in emergency planning, irrespective of their hospital, departmental, or individual roles. This training helps them distinguish between routine and emergency responsibilities, enhancing their ability to contribute effectively to emergency responses (WHO, 2014). Figure (8) indicates that 30 out of 43 hospitals implemented training programs addressing the Covid-19 pandemic⁴. The aim is to educate medical professionals on proper patient treatment, precautionary measures for self-protection, and the correct utilization of PPE kits and other support materials. Concurrently, 20 hospitals established training teams to swiftly train new medical staff who may join duty during emergencies (See Figure 8). Furthermore, around 28 hospitals have provided training to cleaning personnel in preparation for handling such situations. However, conducting training programs during pandemics is challenging, and qualified teams with prior expertise can serve as a bridge, sharing their experiences with other staff.

Figure 8. Training programs



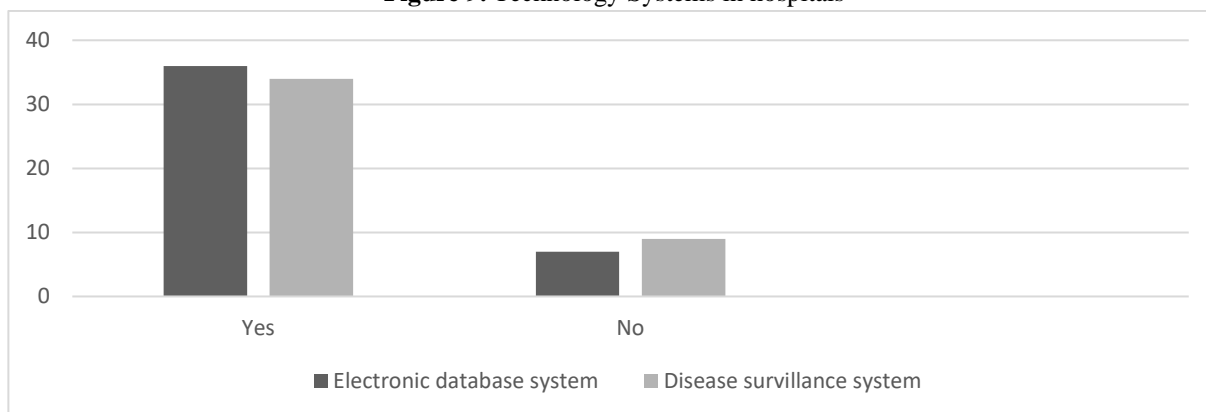
Source: Research survey done by authors

Disease Surveillance System

Consistent surveillance for emerging infectious diseases is crucial in pandemic responses, aiming to control the spread and reduce the risk level. Efficient disease surveillance systems should regularly report data on morbidity patterns from all healthcare providers, including any sudden and unusual health occurrences. Approximately 36 hospitals (83.7 percent) affirmed the presence of an electronic database system to monitor patients' presenting issues or complaints (Figure 9). Additionally, 34 hospitals (79.1 percent) possess an information system that furnishes data on biological disasters and the management of infectious patients (See Figure 91). This suggests that numerous hospitals have actively developed their disease surveillance systems.

⁴ These programs involve all medical staff, including doctors, nurses, and paramedical workers.

Figure 9. Technology Systems in hospitals



Source: Research survey done by authors

Conclusion

Biological disasters and pandemics are unforeseen events that occur without any warning signs. They create turmoil, risk of illness or injury, and overburden on health care facilities. There is frequently a mismatch between resources and that 'patients' needs, intensify the threats and losses when emergencies strike. Research in disaster management may assist planners in avoiding common management flaws, thereby improving disaster response planning. Hospitals frequently play a, substantial, but a vulnerable role in public health emergency management (WHO 2023). The present study, therefore analysis various parameters related to hospital preparedness and resilience. In the context of India, considering Goa as a case.

This study conducted a research survey in all hospitals in the Goa region to assess the preparedness and response strategy used during the Covid-19 Pandemic. In this regard, we divided the questionnaires into six major pillars that serve as a standard for hospital function during times of crisis. This includes the policies of hospitals, capacity such as isolation and triage rooms, infection and prevention control, training programs, and the availability of disease surveillance system. Furthermore, we appraised the difficulties that arose as a consequence of a lack of material supplies or human resources. Thus, we received 43 responses out of 46 questionnaires at a response rate of 97.7 per cent. The survey was mainly focused on hospital managers. We explore the strategies and the different risks associated with hospital preparedness at the time of the Covid-19 situation. Hospital emergency planning starts with a comprehensive analysis of 'the hospital's safety policy. Table 2 highlights the observation of our study in regard to the difficulties arose inside hospitals and the positive points that have been displayed in our study. Hospitals 58.1 per cent established policies for protecting the lives of healthcare workers and patients by ensuring them the necessary medical requirements. While 44.2 per cent of hospitals provide medical insurance to their medical professionals. In addition, 27.9 per cent conducted an early detection of disease to take prompt actions, and 18.6 per cent provided good room capacity for patients to reduce the overloads. However, only 43.9 per cent shut down their regular health facilities and transformed their function to deal with this Pandemic only. During the analysis, the respondents encountered a number of difficulties in carrying out their hospital's functions. For example, 67.4 percent of hospitals reported a lack of oxygen supplies, 58.1 percent identified a shortage of hospital beds, 48.8 percent noted a lack of isolation and triage rooms, and 41.9 percent disclosed a lack of drugs and ventilators. Pre-experience with non-governmental organizations (NGOs) in dealing with the previous disaster emphasizes 88.4 per cent of hospitals to cooperate with NGOs for controlling the widespread disease. They all highlight the need for constant support from NGOs in providing PPE and material kits.

Table 2. Challenges and opportunities in hospitals

<i>Strategies</i>	<i>Challenges</i>	<i>Opportunities</i>
<i>General policies</i>	Lack of Covid-19 plans Lack of preparedness plans	Availability of Infection control committee. Following WHO guidelines as a protection measure
<i>Safe hospital plans</i>	Lack of isolation chambers	Priorities the safety of HCWs

Hospital capacity
Training programs

Technology system

Shortage in early detection kits	Providing incentives and sick leaves.
Fair level in some hospitals	Providing medical insurance
Available for doctors and nurses	Good level in most hospitals
	Need to increase the level to cover all HCWs.
Few hospitals don't have disease surveillance system.	Most of hospitals developed electronic database to provide information regularly.

There is a need for well-prepared hospitals and providers who can meet the needs of the population affected by a disaster. Continuous supply chain, and adequate training are central foundation stones for hospital preparedness. Thus, training or educational programmes are to be developed to enhance the knowledge and skills of healthcare workers regarding the preventive measures that must be taken during pandemics. Our work reveals that 72.1 per cent of hospitals implemented a training program for dealing with Covid-19. These programmes are to be enhanced in the national and international levels. While responding on infection control strategies in hospitals, 76.7 per cent of the survey respondents agreed that hospitals have an emergency department for immediate care for patients, and 76.7 that a triage area is available in their hospitals by a trained doctor, nurse, or paramedical. Isolation rooms to stabilize critical patients are available in 76.7 per cent of hospitals. But 39.5 per cent of isolation room is available for few patients, while only 27.9 per cent is available for significant numbers. A written disaster plan without practices may create a sense of wrong protection among hospital personnel, managers, and leaders.

In hospitals, 'emergency preparedness' is a critical concept in disaster management and planning. Our research shows that 81.4 percent of both the emergency stock and drugs is sometimes available, implying that most hospitals were struggling to treat a large number of patients. Additionally, 51.2 percent have hospital beds for Covid-19 patients, while 32.6 per cent don't have any beds. Being prepared for epidemics and other emergencies entails risk reduction and emergency preparedness activities, such as emergency response planning, training, and activate disease surveillance system. To meet these new requirements, all staff members must participate in emergency planning. This aims HCWs distinguish between routine and emergency responsibilities and improve their ability to contribute to the emergency response. Furthermore, agreement on key hospital resilience measures would improve the consistency of emergency practises and provide hospitals with a better ability to cope with disasters of all kinds, including a pandemic like COVID-19.

Recommendations

Research on hospital's preparedness towards pandemics in its primitive stage. Not much has been written about this topic. Advanced studies are required to better understand specific skills like basic clinical care and triage. More importantly, the transitions that health care providers go through during emergencies. To achieve efficacy preparedness strategy within hospitals, an important elements must be developed such as increase the capacity of isolation and triage rooms, increase the supply chain of medical tools during emergencies, provide significant numbers of hospital beds, and develop tele-health measure inside facility in order to reduce the contact between health care worker and patient.

There must be a policy in India to transform the private hospitals and merge them with the governmental facilities during disaster time. In addition, increase the number of man power and conduct internship program to increase their knowledge, attitude, and practices towards pandemics. Nevertheless, motivation and incentives should be provided to healthcare workers by the Government., and

References

1. Armocida B, Formenti B, Ussai S, Palestra F, Missoni E. The Italian health system and the COVID-19 challenge. *Lancet Public Health* 2020;5:e253.
2. Blanchet K (2015) Thinking shift on health systems: from blueprint health programmes towards resilience of health systems. *Int J Health Policy Manag* 4(5):307–309. po

3. Country and lending groups by income. The World Bank. <http://data.worldbank.org/about/country-classifications/country-and-lending-groups>. Accessed November 2011. Google Scholar
4. Cvetković, V. M., Nikolić, N., Radovanović Nenadić, U., Öcal, A., K. Noji, E., & Zečević, M. (2020). Preparedness and preventive behaviors for a pandemic disaster caused by covid-19 in Serbia. *International Journal of Environmental Research and Public Health*, 17(11), 4124. <https://doi.org/10.3390/ijerph17114124>
5. Djalali, A., Castren, M., Khankeh, H., Gryth, D., Radestad, M., Öhlen, G., & Kurland, L. (2013). Hospital disaster preparedness as measured by functional capacity: A comparison between Iran and Sweden. *Prehospital and Disaster Medicine*, 28(5), 454–461. <https://doi.org/10.1017/s1049023x13008807>
6. European Centre for Disease Prevention and Control. Homepage | European Centre for Disease Prevention and Control. (n.d.). Retrieved January 3, 2023, from <https://www.ecdc.europa.eu/en>.
7. Gupta, S., & Federman, D. G. (2020). Hospital preparedness for covid-19 Pandemic: Experience from Department of Medicine at Veterans Affairs Connecticut Healthcare System. *Postgraduate Medicine*, 132(6), 489–494. <https://doi.org/10.1080/00325481.2020.1761668>
8. Gül, M., & Yucesan, M. (2020). Hospital preparedness assessment against covid-19 Pandemic: A case study in Turkish tertiary healthcare services. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3630080>.
9. Hanefeld J;Mayhew S;Legido-Quigley H;Martineau F;Karanikolos M;Blanchet K;Liverani M;Yei Mokuwa E;McKay G;Balabanova D; (n.d.). *Towards an understanding of resilience: Responding to health systems shocks*. Health policy and planning. Retrieved January 3, 2023, from <https://pubmed.ncbi.nlm.nih.gov/29325025/>.
10. Higgins, W, Wainright, C, Liu, N, Carrico, R. Assessing hospital preparedness using an instrument based on the mass casualty disaster plan checklist: results of a statewide survey. *Am J Infect Control*. 2004;32(6):327-332. CrossRefGoogle ScholarPubMed
11. Hosseini, S. M., Bahadori, M., Raadabadi, M., & Ravangard, R. (2019). Ranking Hospitals based on the disasters preparedness using the TOPSIS technique in western Iran. *Hospital Topics*, 97(1), 23–31. <https://doi.org/10.1080/00185868.2018.1556571>.
12. Kaito, D., Matsumura, K., & Yamamoto, R. (2021). Hospital preparedness for covid-19: The known and the unknown. *The Keio Journal of Medicine*, 70(2), 25–34. <https://doi.org/10.2302/kjm.2020-0011-0a>.
13. Kaji, AH, Langford, V, Lewis, RJ. Assessing hospital disaster preparedness: a comparison of an on-site survey, directly observed drill performance, and video analysis of teamwork. *Ann Emerg Med*. 2008;52(3):195-201. CrossRefGoogle ScholarPubMed
14. Kruk, M. E., Myers, M., Varpilah, S. T., & Dahn, B. T. (2015). What is a resilient health system? lessons from ebola. *The Lancet*, 385(9980), 1910–1912. [https://doi.org/10.1016/s0140-6736\(15\)60755-3](https://doi.org/10.1016/s0140-6736(15)60755-3).
15. Maldin, B, Lam, C, Franco, C, et al. Regional approaches to hospital preparedness. *Biosecure Bioterror*. 2007;5(1):43-53. CrossRefGoogle ScholarPubMed
16. Milch, K, Gorokhovich, Y, Doocy, S. Effects of seismic intensity and socioeconomic status on injury and displacement after the 2007 Peru earthquake. *Disasters*. 2010;34(4):1171-1182. CrossRefGoogle ScholarPubMed
17. Mulyasari, F., Inoue, S., Prashar, S., Isayama, K., Basu, M., Srivastava, N., & Shaw, R. (2013). Disaster preparedness: Looking through the lens of hospitals in Japan. *International Journal of Disaster Risk Science*, 4(2), 89–100. <https://doi.org/10.1007/s13753-013-0010-1>.
18. National Association of Public Hospitals and Health Systems (2007) Research Brief. Hospital Staffing and Surge Capacity during a Disaster Event
19. Nekoie-Moghadam, M., Kurland, L., Moosazadeh, M., Ingrassia, P. L., Della Corte, F., & Djalali, A. (2016). Tools and checklists used for the Evaluation of Hospital Disaster Preparedness: A Systematic Review. *Disaster Medicine and Public Health Preparedness*, 10(5), 781–788. <https://doi.org/10.1017/dmp.2016.30>.
20. Niska, RW, Shimizu, IM. Hospital preparedness for emergency response: United States, 2008. *Natl Health Stat Report*. 2011;24(37):1-14. Google Scholar
21. Normile, D. (2020). Coronavirus cases have dropped sharply in South Korea. ' 'what's The secret to its success? *Science*. <https://doi.org/10.1126/science.abb7566>.

22. Sundararaman, T., Muraleedharan, V. R., & Ranjan, A. (2021). Pandemic resilience and health systems preparedness: Lessons from covid-19 for the twenty-First Century. *Journal of Social and Economic Development*, 23(S2), 290–300. <https://doi.org/10.1007/s40847-020-00133-x>
23. Sauer, LM, McCarthy, ML, Knebel, A, Brewster, P. Major influences on hospital emergency management and disaster preparedness. *Disaster Med Public Health Prep.* 2009;3(2 Suppl):S68-S73.CrossRefGoogle Scholar
24. Top, M, Gider, Ö, Tas, Y. An investigation of hospital disaster preparedness in Turkey. *Journal of Homeland Security and Emergency Management.* 2010;7(1): Article 69.CrossRefGoogle Scholar
25. United Nations. (n.d.). *Modernizing our public health systems to be ready for the next Pandemic.* United Nations. Retrieved January 3, 2023, from <https://www.un.org/en/un-chronicle/modernizing-our-public-health-systems-be-ready-next-pandemic>.
26. Verheul, M. L. M. I., & Dückers, M. L. A. (2019). Defining and operationalizing disaster preparedness in hospitals: A systematic literature review. *Prehospital and Disaster Medicine*, 35(1), 61–68. <https://doi.org/10.1017/s1049023x19005181>
27. World Health Organization (2011) Safe Hospitals in Emergencies and Disaster; Structural, Non-Structural and Functional Indicators. World Health Organization, Regional Office for Western Pacific [Citation Time(s):1]