

Brief Report

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Navigating Concurrent Disasters: Lessons learned from a Hospital Evacuation Amidst a Pandemic and an Earthquake

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Abstract

The concurrent challenges of the COVID-19 pandemic and a significant earthquake in Izmir on October 30, 2020, presented a unique scenario for disaster management and response. This study focuses on the impact of the earthquake, which resulted in 117 fatalities, including 1 due to drowning, and injured 1034 individuals, alongside widespread structural damage including to the Izmir Democracy University Buca Seyfi Demirsoy Training and Research Hospital. The objective is to assess the activation and implementation of the hospital disaster plan amidst the ongoing pandemic. Through a retrospective evaluation of all actions undertaken as per the Hospital Disaster Emergency Plan within the Disaster Management cycle, this study examines the decision-making process for the hospital evacuation on October 30, 2020, the evacuation of COVID-19 patients, and the strategies employed to increase hospital capacity. Of 216 patients hospitalized at the time of the earthquake, 65 were transferred to other facilities under COVID-19 protocols. The prolonged nature of pandemics and the likelihood of secondary disasters underscore the importance of comprehensive risk assessments and dynamic disaster planning, considering simultaneous multiple hazards. This study suggests the inclusion of multi hazard scenarios and diverse evacuation methods by using types of ambulances, such as ground, helicopter, and boat.

On 30 October 2020, at 14:51 local time, the Aegean Sea region experienced a significant seismic event, with a massive earthquake of magnitude $M_w=6.9$ striking off the coast of Seferihisar, near Izmir, Turkey (37.9020 North, 26.7942 East). The earthquake, occurring at a shallow depth of approximately 12 km, was felt strongly across Izmir and its surrounding districts, as well as in the broader Aegean and Marmara regions. This seismic event led to widespread structural damage, particularly in Bayrakli and Bornova districts, where buildings collapsed, resulting in 117 fatalities, including 1 due to drowning, and injuring over 1034 individuals. Among the affected infrastructure was the main building of Izmir Democracy University Buca Seyfi Demirsoy Training and Research Hospital (Buca Hospital), prompting an immediate evaluation of its capacity to continue operations amidst the crisis.^{1,2}

The earthquake's timing compounded the challenges posed by the ongoing COVID-19 pandemic, which had been declared a global epidemic by the World Health Organization (WHO) on 11 March 2020, following the initial reports of cases at the end of December 2019. Turkey had been actively responding to the pandemic since January 2020, with the first COVID-19 case reported on March 10, 2020. The pandemic necessitated widespread public health measures across the country, aiming to slow the virus's spread and mitigate its impact.^{3–6}

In disaster response, the critical role of hospital evacuation is underscored by its capacity to safeguard patient and staff welfare while maintaining essential health care services. This dynamic response is crucial in managing the surge in emergency medical needs and ensuring continuity of care, even as facilities face the risk of infrastructure damage.⁷ The significance of such evacuations is vividly illustrated by the aftermath of the 1971 California earthquake,⁸ which resulted in the evacuation and permanent closure of 4 hospitals due to severe structural damages, highlighting the profound impact of disaster preparedness and response on community health services.

The co-occurrence of the earthquake during the pandemic introduced a complex dual-disaster scenario, significantly straining the emergency response and health care systems. Hospitals, key to disaster intervention, faced the dual challenge of managing the surge in

emergency medical needs from the earthquake while continuing to care for patients amid a pandemic. This situation highlighted the critical need for effective disaster preparedness and response strategies that can adapt to the simultaneous occurrence of multiple disasters.^{9,10}

Chavez *et al.* highlights that hospitals are both victims and responders in disaster scenarios and preparedness is key in mitigating the risks and potentially keep the capacity to run essential services as showcased in 2011 Christchurch, New Zealand earthquake.⁷ Similarly, a case study from Zagreb, Croatia, delves into managing concurrent disasters (earthquakes and the COVID-19 pandemic) within a resilience framework, emphasizing the need for adaptable, multilayered crisis management protocols and the importance of resilience in health policy and community response.¹¹

The need for effective hospital evacuation and disaster response plans has been underscored by numerous studies and real-world events. Previous studies have identified limitations in existing hospital evacuation and disaster management plans, such as the lack of comprehensive and adaptable disaster response protocols, which can lead to inefficiencies and increased risks during evacuations.¹²⁻¹⁴

This study aims to critically evaluate the activation and execution of the hospital disaster plan at Buca Hospital in response to the earthquake, within the context of the ongoing COVID-19 pandemic. By doing so, it seeks to assess the effectivity of the methods and plans employed and contribute to the body of knowledge on managing health care facilities during concurrent disasters, offering insights into preparedness, risk assessment, and the implementation of crisis plans that can guide future responses in similar complex scenarios.

Methodology

Setting

This study was conducted in Izmir, Turkey's third-largest city (with a population of 4 394 694), with a focus on Buca district, known for its high population density (population of 507 773) and housing 2 key health care facilities: Izmir Democracy University Ministry of Health Buca Seyfi Demirsoy Training and Research Hospital (Buca Hospital) and its annex Buca Obstetrics and Pediatric Diseases Hospital Building (Buca Hospital Annex Building) which is located 2.6 km away. With a combined capacity of 535 beds, these institutions play a pivotal role in the region's health care provision. The main hospital, operational since July 6, 2002, encompasses a comprehensive range of services across 24 000 m². The main hospital complex is equipped with several specialized units, including an Adult Emergency Service, 10 Operation Rooms, Local Intervention Rooms, and intensive care units dedicated to tertiary care, coronary care, internal diseases, and surgical care, totaling a 405-bed capacity across 26 branches.

Hospital Disaster Preparedness and Response Framework

Following the directives of the Presidential Decree (numbers 663, Articles 2 and 40), the hospital adheres to a structured Disaster Management System, aligned with the Hospital Disaster and Emergency Implementation Directive by the Turkish Ministry of Health, updated last on March 18, 2020. The Hospital Disaster and Emergency Implementation Directive mandates that all Turkish hospitals be prepared to autonomously handle the initial 72 hours of a disaster or emergency. This encompasses readiness and

mitigation efforts for facilities under various ownerships, including the Ministry of Health, universities, and private entities. Instituted by a 2018 Presidential Decree, it categorizes hospitals by size, requiring tailored disaster and emergency plans that are regularly updated and practiced. Additionally, it specifies protocols for plan development, review, and enactment, alongside mandating disaster-related staff training.

Buca Hospital adopted 4-stage Hospital Disaster and Emergency Plan (HDEP) following the national guidelines by the Ministry.¹⁵

HDEP is a continuous cycle which starts with risk and damage reduction (mitigation phase) followed by preparedness, continues with response and recovery in the case of a disaster.¹⁶

Data Collection and Analysis

Data were retrospectively gathered from hospital records and reports concerning the earthquake on October 30, 2020. This analysis aimed to assess the hospital's disaster response comprehensively, examining pre-disaster planning, immediate interventions during the earthquake, and the subsequent recovery phase.

The study combines analysis of both quantitative and qualitative data looking at the various retrospective data and administrative processes including stages of initial damage assessment, the decision-making processes of evacuation with a timeline, the number of hospitalized patients, patient discharge and transfer procedures, number and conditions of patients transferred, receiving hospitals and transfer methods, and management of COVID-19 patients.

Qualitative data was incorporated to the results of the study through the administrative staff of the Buca Hospital as co-authors. Hospital departments in charge of the evacuation process as well as the hospital management have been involved in design and preparation of the manuscript. Qualitative data were extracted from the evacuation steps, including disaster plan activation, inspection and risk assessment, decision making and execution of the evacuation.

Ethical Considerations

Ethical approval for the study was obtained from Buca Seyfi Demirsoy Training and Research Hospital Non-Interventional Research Ethics Committee (dated 28.04.2021, numbered 2021/4-41).

Findings

Preparing and Mitigating for the Earthquake

Ahead of the earthquake, the Emergency and Disaster Unit at Buca Hospital meticulously revised its HDEP, aligning it with the Ministry of Health's guidelines. This process included not only annual updates for administrative shifts but also additional adjustments as needed. Emphasizing "risk reduction" and "preparedness," the hospital's HDEP Committee annually identified earthquakes as a critical risk. Accordingly, it implemented comprehensive risk reduction strategies addressing both structural and non-structural hazards to minimize potential earthquake damages.

Situated in a high-risk earthquake zone (category 1), Izmir necessitated a thorough review of Buca Hospital's structural integrity, considering past incidents. In 2012, a Ministry of Health-commissioned evaluation scrutinized various hospital

Table 1. Exercises held at the hospital between 2015–2019 and their scopes

Exercise year and type	Content
2015 – Tabletop	The arrival of many injured people to the hospital as a result of an earthquake with a magnitude of 6.9 and epicenter in the Aegean Sea
2017 – Evacuation	Evacuation of patients and the staff in the Psychiatry Clinic as a result of a smoking patient falling asleep and setting the couch on fire
2017- Tabletop	Evacuation of patients with special conditions in the Primary Care Surgical Intensive Care Unit due to problems that may occur in Medical Gas Pipes or Aspirator Vacuum System
2018 – Evacuation	Evacuation of patients and the staff due to a fire that started in the Second Floor General Surgery Service as a result of an electric heater being left plugged
2019 – Tabletop	The arrival of countless injured people at the emergency service as a result of an accident with a suburban train on the railway close to the hospital

facilities against the 2007 Earthquake Safety standards including Main Building, Outpatient Clinics Building, Workshop Building, Dining Hall and Medical Consumables Storage Building, Billing and Goods Building, Archives Building, Garage Building, and Cimentas Outpatient Clinic Buildings. This comprehensive assessment identified the need for reinforcement in several buildings to enhance resilience. Consequently, the Billing and Goods Building, identified as a significant risk, was systematically dismantled in 2019 to ensure the safety of the hospital's infrastructure and its occupants.

In addressing non-structural hazards, Buca Hospital prioritized securing materials and personal storage. Infrastructure was thoroughly assessed, with emergency exits and assembly points clearly designated for each clinic and unit. Detailed evacuation roles were assigned, ensuring all relevant staff were briefed. To comply with national regulations requiring biannual disaster plan testing, Buca Hospital conducted both tabletop and field exercises focused on earthquake response and evacuation, including scenarios mimicking actual earthquakes and fire-related evacuations (shown in Table 1). These drills, critical for identifying areas for improvement, underscored the importance of continual enhancement of disaster response capabilities.

Training was also a key part of the hospital's disaster preparedness efforts. Annually, all staff participated in a comprehensive 2-hour length "Disaster and Emergency Training" session. This training covered essential topics, including basic disaster response definitions, actions to take during earthquakes and fires, and evacuation procedures, blending theoretical knowledge with practical exercises to ensure readiness.

Hospital Disaster and Emergency Plan (HDEP)

Preparing a HDEP for a hospital is guided on a national level by the guidelines released by Ministry of Health.¹⁷ The HDEP was prepared according to first version of the guidelines published in 2015; later, in 2021, a much more comprehensive version of guidelines was published. Hence this study reflects the limitations of the older version.¹⁸

The 2015 guidelines lacked comprehensive and detailed procedures for hospital evacuations. In contrast, the 2021 guidelines

provided more explicit instructions on how to conduct evacuations effectively and efficiently during a disaster. Some weaknesses in the 2015 guidelines identified by Çiçekdağı et al. were:

- The 2015 guidelines did not emphasize the importance of regular evacuation drills and training for hospital staff.
- The 2015 guidelines did not sufficiently address the need for coordination with external agencies such as local emergency services, police, and fire departments during evacuations.
- Specific details about evacuation routes and designated assembly points within and outside the hospital premises were not clearly outlined in the 2015 guidelines.
- The 2015 guidelines did not include comprehensive strategies for tracking patients and performing triage during evacuations.

Intervention for the Earthquake Response

Following the Izmir Earthquake's occurrence at 14:51 on October 30, 2020, the Chief Physician, acting as the HDEP president, promptly activated the emergency plan. Immediate inspections by the HDEP Operation Chief and team revealed significant structural damages, including a compromised column, cracked beams, and wall damages. Given the prior assessments recommending earthquake reinforcement for the hospital's infrastructure, the team, in consultation with the Provincial Health Directorate, undertook a careful evaluation of in-patient conditions to ensure safety amidst ongoing aftershocks. The Process of Evacuation decision is presented in Figure 1 with the timeline given.

After the evacuation decision was made, systematic and swift evacuation was planned in a short timeframe, involving all inpatients, their companions, and hospital staff. Unlike impromptu evacuations, this process was conducted with prior preparation, ensuring a quick and organized departure. Physicians assessed inpatient conditions, including those not physically present via phone consultations. Preparations for discharge reports and prescriptions for those being transferred or discharged were initiated, with patient needs prioritized based on medical urgency.

On the day of the earthquake, Buca Hospital was treating 216 patients, ranging from a 13-year-old in Orthopedics to a 103-year-old in Palliative Care. The longest-staying patient had been admitted since August 28, 2020. At this time, 20 individuals were receiving care for COVID-19, with nearly half in the Intensive Care Unit and the rest in a specialized COVID-19 Service. The patient demographic showed a majority over 60 years old and a slight predominance of male patients as shown detail in Table 2.

Following the earthquake, a portion of the ambulatory patients independently moved to the hospital's garden. 54.63% of the of the inpatients were discharged under their existing medical conditions, while a 14.81% were discharged having recovered. A single patient opted against transfer, leaving against medical advice. For those unable to move on their own, hospital staff provided essential assistance in the evacuation process.

Following the earthquake in Izmir, ambulances along with their crews were dispatched from surrounding provinces to assist in the area. The local Emergency Medical Services in Izmir sent out 3 ambulances to a hospital affected by the quake to facilitate the interhospital transfer of 20 patients with COVID-19 to alternative medical facilities. Nurses from the hospital's COVID-19 ward escorted these patients in the ambulances to ensure their care continuity. Essential documents and medications for these patients were also transported to the receiving hospitals. The arrangement for nurses to accompany the COVID-19 patients in ambulances

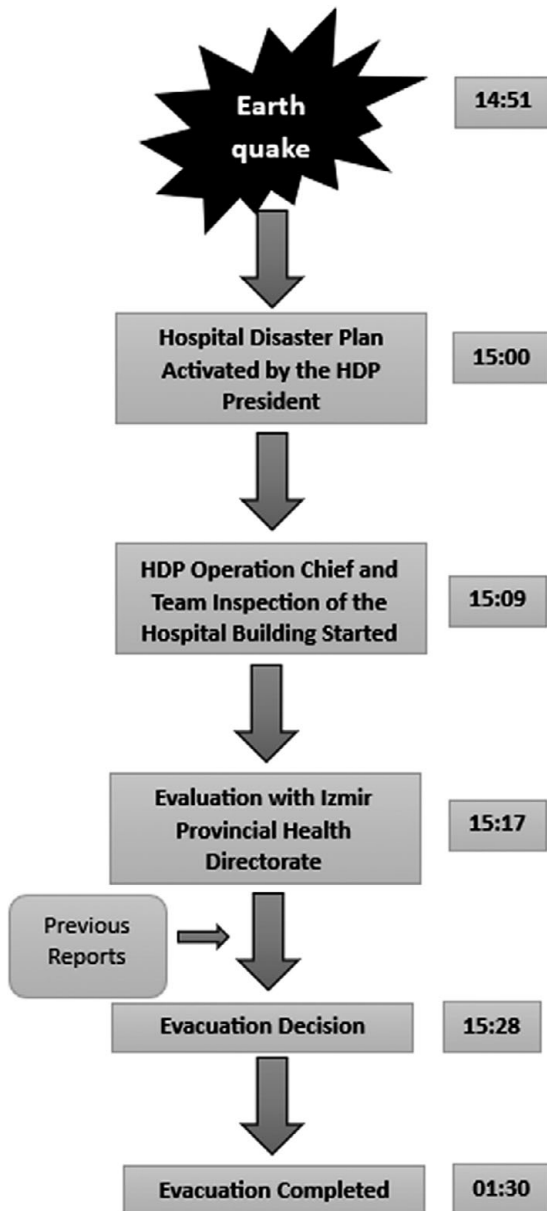


Figure 1. Actions and timeline of the hospital evacuation decision.

was specifically for those admitted with a COVID-19 diagnosis. Meanwhile, an additional 45 patients were moved to other hospitals by ambulance teams from the health department. Among these, 22 patients receiving treatment in departments such as cardiology, orthopedics, and internal medicine, who were unable to be discharged due to their health conditions, were transferred to the annex building of Buca Hospital (Table 3).

The earthquake caused significant destruction in the central Izmir, leading to an overflow of patients in central hospitals due to the influx of casualties. As a result, hospitals on the outskirts were primarily chosen for transferring patients from Buca Hospital to alleviate the pressure (as illustrated in Figure 2). Patients with COVID-19 who were receiving care in the intensive care unit (ICU) were relocated to the ICUs of various hospitals to ensure continued treatment. Specifically, 2 of these patients were moved to a hospital in the city center, 2 to a facility designated as a COVID-19

Table 2. Patients who were hospitalized on October 30, 2020 ($n=216$)

Features	<i>n</i>	%
Gender		
Female	101	46.76
Male	115	53.24
Total	216	100.00
Age groups		
0–19	5	2.31
20–29	12	5.56
30–39	15	6.94
40–49	20	9.26
50–59	34	15.74
60–69	54	25.00
70 and over	76	35.19
Total	216	100.00
Finalization		
Transfer to Other Hospitals	65	30.09
Discharge with the Current Medical Condition	118	54.63
Discharge with Healing	32	14.81
Discharge Against Medical Advice	1	0.46
Total	216	100.00

hospital, 4 to the ICU of a hospital located in the periphery, and 1 patient was transferred to a private hospital.

Individuals diagnosed with COVID-19 and receiving inpatient care were systematically transferred to predetermined health care facilities via ambulance services, adhering to established COVID-19 health care protocols. These patients were clinically stable at the time of transfer, with the process initiating with those admitted to the intensive care units. Health care professionals, specifically nurses who were directly involved in the patients' care, were designated to accompany them during the transfer, ensuring continuity of care. Furthermore, the patients' prescribed medications were meticulously transported to the receiving institution by the assigned nurse to maintain treatment protocols. In compliance with standard hand hygiene practices, the nursing staff employed protective gear, including gloves, aprons, medical masks, face shields, and masks. The health care facilities designated to receive these patients expedited their admission processes to ensure seamless integration into their new care environment.^{19,20}

As shown in Figure 2, patients from various intensive care units within the hospital were moved to district hospitals on the outskirts and private hospitals within Izmir. Those admitted to different departments of the hospital and deemed unfit for discharge were relocated to the Annex Building of Buca Hospital. Typically, patient transfers occur from peripheral locations towards central health care facilities. However, due to the earthquake's epicenter being located in the central region, numerous injured individuals sought medical attention at central hospitals, either via ambulance services or by their own means of transportation. Consequently, in the case of Buca Hospital's evacuation, efforts were made to facilitate transfers to hospitals located in peripheral areas as extensively as possible.

Table 3. Hospitals where the patients hospitalized at Buca Hospital were transferred (n=65)

Clinics of hospitalized patients during the earthquake	Number of patients (%)	Hospital they were transferred to	Number of transferred patients (%)	Distance in km.
Tertiary Care General (COVID–19) Intensive Care Service	9 (13.8)	Torbali State Hospital	4 (6.2)	40
		Cigli Training and Research Hospital	2 (3.1)	57
		Bornova State Hospital	2 (3.1)	30.3
		Private Medifema Hospital	1 (1.5)	27.9
COVID–19 Service	11 (16.9)	Bornova State Hospital	11 (16.9)	30.3
Palliative Care Service	11 (16.9)	Torbali State Hospital	11 (16.9)	40
Secondary Care Internal Diseases Intensive Care Service	7 (10.8)	Torbali State Hospital	3 (4.6)	40
		Private Tinaztepe Hospital	3 (4.6)	5
		Private Can Hospital	1 (1.5)	34.5
Primary Care Surgery Intensive Care Service	5 (7.7)	Torbali State Hospital	5 (7.7)	40
Neurosurgery Service	1 (1.5)	Buca Hospital Annex Building	22 (33.8)	2.6
Internal Diseases Service	1 (1.5)			
Infectious Diseases Service	2 (3.1)			
Physical Therapy and Rehabilitation Service	1 (1.5)			
Gastroenterology Service	1 (1.5)			
General Surgery Service	2 (3.1)			
Cardiology Service	4 (6.2)			
Neurology Service	3 (4.6)			
Orthopedics Service	5 (7.7)			
Palliative Care service	2 (3.1)			

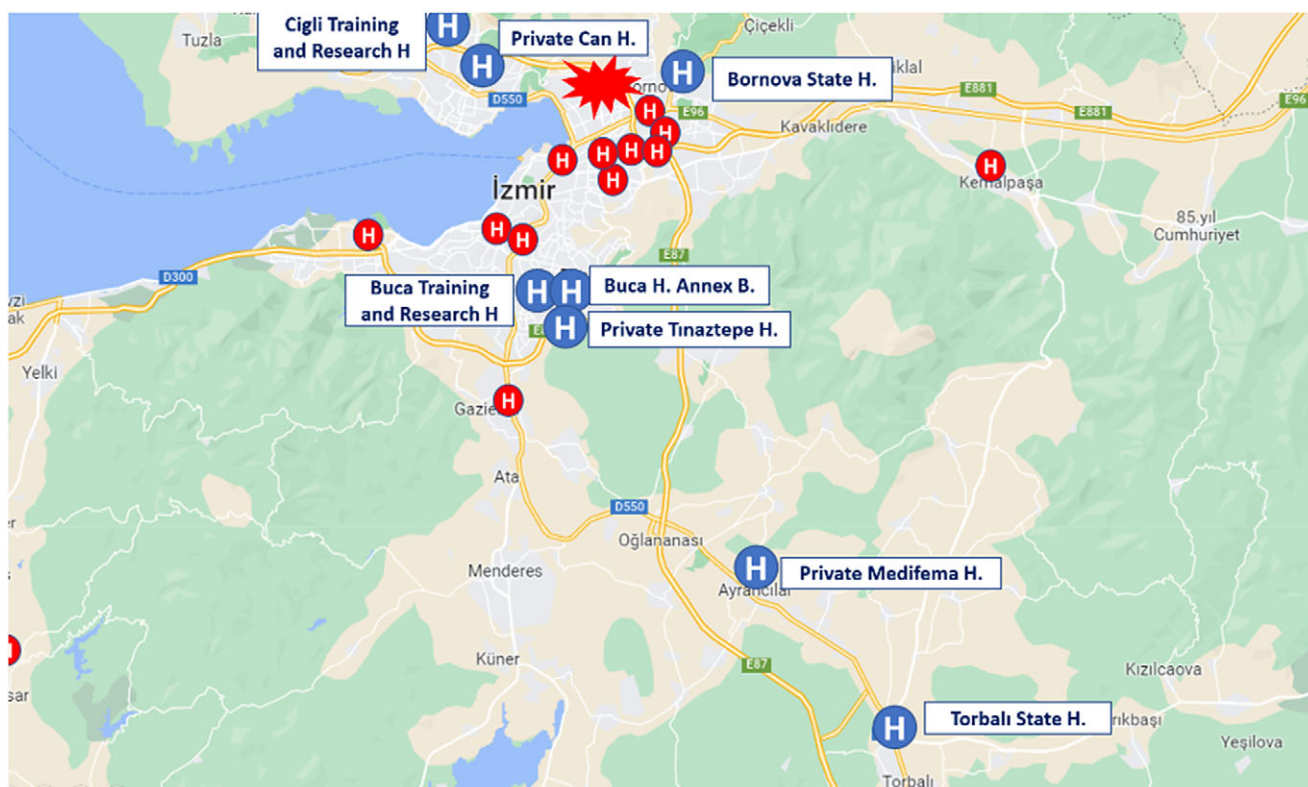


Figure 2. Izmir central hospitals and receiving hospitals.

On that Friday, at precisely 14:51, only 1 surgical operation was underway in a surgery room. Fortunately, as the operation was nearing completion, it was able to proceed despite the earthquake.

To mitigate the risk of aftershocks, a temporary infrastructure for computers and electricity was set up in a secure open area within the hospital's garden. This emergency setup was completed in approximately 3 hours. Consequently, all patient discharge records were initially processed manually, then digitally recorded in the hospital's information system once the setup was operational.

Following the hospital's full evacuation by 01:30 on Saturday, October 31, 2020, 2 members of the hospital management team conducted a thorough inspection of the facility, checking every room from top to bottom, including all restrooms, before securely locking the hospital's entrances.

Buca Hospital, being the sole state health care provider in Izmir's most densely populated district, continued to receive patients and those injured from the earthquake at its Emergency Department. Due to damage sustained by the Emergency Department's building, a makeshift emergency service was established outdoors to ensure uninterrupted care. During the ongoing evacuation, patients from the damaged Emergency Department were moved to this provisional setup. The emergency service capacity was expanded with the addition of an inflatable tent, and later, one-story prefabricated buildings, formerly used for different purposes, were repurposed as emergency service facilities.

Actions Taken after the Earthquake

Following the earthquake, as a precautionary step for safety, both the main and annex buildings of the hospital, including the conference and dining halls, were shut down. To continue providing essential health care services, patient admissions, surgical operations, and intensive care unit operations—excluding emergency services and outpatient clinics—were relocated to the Buca Hospital Annex Building. This relocation was facilitated by increasing the building's capacity through various adjustments.

In response to the need for a new facility, the Ministry of Health devised a strategy for the construction of a new hospital building. As part of this plan, a project was outlined for a 304-bed hospital made of reinforced concrete, designed to meet the increased demand and enhance resilience against future disasters. The contract for this new construction was awarded on May 6, 2021, with an ambitious completion timeline of 120 days, signaling a rapid response to restore and improve health care infrastructure in the aftermath of the earthquake.

Hospital surge capacities in Buca Hospital have been challenged by the concurrent disasters as shown in Table 4 below adopting 4S Framework.²¹

Discussion

Annually, disasters claim millions of lives, with their occurrence rate escalating over the past half-century. This trend has resulted in substantial fatalities, infrastructural destruction, and socio-economic upheavals.²² The prolonged nature of the pandemic, coupled with other disasters, introduces the risk of facing “double disasters.” Consequently, there is a pressing need for Emergency Plans to be revised to address the challenges presented by these compounded crises.²³

Buca Hospital demonstrated a prompt response to the earthquake, which struck amidst the ongoing adjustments to COVID-19 pandemic measures.²⁴ Aligning with the hospital's HDEP

Table 4. Assessing hospital surge capacity reflecting on 4S framework

Key aspect in 4 S framework	Finding
Staff	Buca Hospital faced significant challenges in mobilizing adequate health care personnel during the earthquake while managing the ongoing pandemic. The 2015 guidelines lacked comprehensive strategies for rapid staff mobilization due to the infection risk. The substantial health care personnel were on duty in so called covid clinics to perform testing, vaccination, and treatment with strict infection control limitations.
Stuff	The earthquake highlighted the necessity of having ample medical supplies and equipment. While Buca Hospital managed to secure essential items, there was a need for air patient transfer with helicopter ambulances due to the road closures because of the earthquake.
Structure	The physical infrastructure of Buca Hospital was significantly compromised during the earthquake, necessitating the evacuation of patients. However, the reproduction of the hospital was planned and is under execution.
Systems	HDEP was subjected to several limitations due to being prepared according to 2015 guidelines; however, effective communication and swift response of the hospital emergency team has proven that the previous drills and tabletops were helpful.

approach, immediate actions included bolstering both the physical and personnel capacities of the emergency service to continue service delivery. Specifically, care for earthquake injuries was facilitated through temporary setups, underscoring the necessity of adaptive planning in disaster scenarios. The importance of maintaining adequate supplies in hospitals is highlighted, especially in seismic events, as facilities with structural integrity may still face operational challenges without sufficient basic materials.²⁵

The structural soundness of hospital buildings, including critical components like columns, beams, walls, and foundations, is crucial for safety. In the wake of the Izmir earthquake, a swift evaluation of building conditions led to the decision to evacuate Buca Hospital. The HDEP team's inspection revealed structural concerns, including separations at block junctions, wall cracks, and beam damages. Given the pre-existing reports on the hospital's earthquake vulnerability and ongoing aftershocks, the decision to evacuate was made in consultation with the Provincial Health Directorate. Prior initiatives to mitigate non-structural damages at Buca Hospital enabled a smoother evacuation process. This scenario underscores the potential for moderate earthquakes to introduce immediate non-structural risks, complicating the evacuation of patients and emphasizing the need for comprehensive disaster preparedness plans.²⁶

Disaster Management's initial and most crucial phase is the implementation of risk reduction measures before a disaster strikes. Through “risk reduction” and “preparedness” initiatives, developed countries and those aware of disaster management can keep the damage from disasters to a minimum.

Activities following a disaster fall under Crisis Management, with “Rescue and First Aid” efforts being particularly critical at this stage. Effective crisis management can mitigate the chaos ensuing a disaster, paving the way for recovery and normalization.

In the case of the earthquake that struck the heart of Izmir, 23 hospitalized COVID-19 patients, accounting for 29.2%, from Buca Hospital were relocated to Torbali State Hospital in the outskirts, and 4 were moved to private facilities.

Evacuating a hospital is a complex and delicate operation that demands a robust strategy and careful execution. Historically, natural disasters were the primary reason for hospital evacuations.²⁷ However, the spectrum of threats has broadened in recent years to include hazardous material leaks and terrorist attacks, adding layers of complexity to evacuation scenarios. Amidst the COVID-19 pandemic, Buca Hospital had to respond to a natural disaster, showcasing the significance of conducting real-time evacuation drills. Such preparedness allowed the hospital staff to respond effectively and with awareness to the emergency.^{25,28}

Pandemics, being long-term disasters, heighten the likelihood of encountering secondary disasters. Other long-term disasters include natural events (like volcanic eruptions and landslides), environmental issues (such as erosion and deforestation), biological crises, outer space-related incidents, and human-induced disasters (covering technological and sociological aspects like infrastructure destruction and terrorism).²⁹ Consequently, Health Disaster Plan training and exercises should be continuously updated to reflect a variety of disaster scenarios, incorporating risk assessments tailored to each hospital's needs and considering the potential for prolonged disaster situations and the concept of "double disasters."³⁰

Buca Hospital underscores several lessons that align with the Major Incident Medical Management and Support (MIMMS) framework. MIMMS emphasizes command, control, and communication, which are critical during major incidents.³¹ The necessity of a clear command structure was evident at Buca Hospital, where the Chief Physician promptly activated the HDEP to coordinate the evacuation. Effective control mechanisms were crucial for managing resources and patient flow, highlighting the importance of predefined control strategies. Additionally, communication breakdowns can severely hamper disaster response efforts. The 2015 guidelines lacked sufficient emphasis on integrated communication systems, which was improved in the 2021 guidelines. Ensuring clear and consistent communication channels between all stakeholders is essential for an effective response.

However, this study faces limitations, primarily due to its focus on a specific location and population, alongside a unique set of concurrent disasters - an earthquake amidst the COVID-19 pandemic. This specificity restricts the study's broader applicability. Furthermore, the lack of follow-up on the health outcomes of the evacuated and transferred patients presents another limitation, leaving a gap in understanding the full impact of the evacuation process on patient health outcomes.

This study, being retrospective, is subject to several biases. Recall bias may affect the accuracy of participants' memories of the evacuation process. Missing data is another concern, as incomplete records could lead to gaps in the analysis. Acknowledging these biases is crucial for accurately interpreting the study's results.

Conclusion

The occurrence of the earthquake during the COVID-19 pandemic necessitated a swift and effective response to manage both the immediate impacts of the earthquake and the ongoing health crisis. The successful evacuation and management of hospital patients, including those with COVID-19, demonstrated the

critical role of comprehensive disaster preparedness and response planning. The adaptability shown by health care professionals and emergency response teams, driven by prior planning and drills, was instrumental in mitigating the effects of these concurrent disasters.

A pivotal conclusion underscores the necessity for comprehensive evacuation strategies at the provincial level, tailored to a variety of emergencies, disasters, or multi-hazard scenarios. Such plans should encompass the utilization of diverse transportation modalities, including land, air, and sea ambulance services, to ensure an effective and coordinated response to crises.

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Competing interest. There is no conflict of interest between the authors.

IRB statement. This study employed publicly available data from the earthquake activity report and, therefore, is exempt from IRB approval.

References

1. **Boğaziçi Üniversitesi Kandilli Rasathanesi Deprem Araştırma Enstitüsü Bölgesel Deprem ve Tsunami İzleme ve Değerlendirme Merkezi.** 30 Ekim 2020 Ege Denizi Depremi Basın Bülteni. 2020.
2. **Mertol HC, Akis T, Tunc G.** 30.10.2020 Ege Denizi Depremi Raporu (The Aegean Sea Earthquake Report, October 30, 2020). https://www.researchgate.net/publication/348658421_30102020_Ege_Denizi_Depremi_Raporu_The_Aegean_Sea_Earthquake_Report_October_30_2020 (2021). Accessed on 06/10/2021
3. **Sayfourı N, Heidari M, Miresmaeli SS.** Mutual impacts of the COVID-19 pandemic and the recent earthquakes: a scoping review of the lessons learned. *Disaster Med Public Health Prep.* 2023;17:e188.
4. **Sofuoğlu T, Sofuoğlu Z.** Covid-19 Pandemisi ve Sağlık Yönetimi. Ankara Nobel Tıp Kitapevleri: Ankara; 2021.
5. **Çubukcu A, Pervin A, Boz E, et al.** An idea evaluation phase in online communities: a case on the COVID-19 innovation platform. *J Organıs Stud Innov* 2023;10:4.
6. **Ares-Blanco S, Guisado-Clavero M, Del Rio LR, et al.** Primary care indicators for disease burden, monitoring and surveillance of COVID-19 in 31 European countries: Eurodata Study. *Eur J Public Health.* 2024. doi: 10.1093/EURPUB/CKAD224.
7. **Chavez CW, Binder B.** A hospital as victim and responder: the Sepulveda VA Medical Center and the Northridge earthquake. *J Emerg Med.* 1996;14: 445–454.
8. **Schultz CH, Koenig KL, Lewis RJ.** Implications of hospital evacuation after the Northridge, California, Earthquake. *N Engl J Med.* 2023 348, 1349–1355.
9. **Shabanikiya H, Gorgi HA, Seyedin H, et al.** Assessment of hospital management and surge capacity in disasters. *Trauma Mon.* 2016;21.
10. **Adini B, Laor D, Cohen R, et al.** Decision to evacuate a hospital during an emergency: the safe way or the leader's way. *J Public Health Policy.* 2012;33: 257–268.
11. **Svetina L, Kosec A, Curkovic M, et al.** A case study of complex disasters within the resilience framework in Zagreb, Croatia: two earthquakes in one pandemic. *Environ Res.* 2022;204:112079.
12. **Taaffe KM, Kohl R, Kimbler DL.** Hospital evacuation: issues and complexities. *Proceed Wint Simul Conf.* 2005;943–950.
13. **Sahebi A, Jahangiri K, Alibabaei A, et al.** Factors influencing hospital emergency evacuation during fire: a systematic literature review. *Int J Prev Med.* 2021;12.
14. **Yazdani M, Mojtahedi M, Loosemore M, et al.** Hospital evacuation modelling: a critical literature review on current knowledge and research gaps. *Int J Disaster Risk Reduc.* 2021;66:102627.
15. **31072 sayılı Resmi Gazete.** Hastane Afet ve Acil Durum Planları (HAP) Uygulama Yönetmeliği. <https://www.mevzuat.gov.tr/mevzuat/>

- MevzuatNo=34368&MevzuatTur=7&MevzuatTertip=5 (2020). Published on 18/03/2020. Accessed on 11/10/2021
16. **U.S. Department of Homeland Security Emergency Management Institute (EMI)**. Independent Study Fact Sheet for the Livestock in Disasters Course Unit 4. 2013 Preprint at <https://training.fema.gov/is/courseoverview.aspx?code=is-111.a&lang=en>. Accessed on 12/11/2021
 17. **HDEP Version 2**; <https://www.saglik.gov.tr/TR,1789/hastane-afet-ve-acil-durum-plani-hap-hazirlama-kilavuzu.html> (2021). Accessed on 21/10/2023
 18. **Çiçekdağı Hİ, Bozkurt Ö**. Hastane Afet ve Acil Durum Planı (HAP): 2015 ve 2021 Hazırlama Kılavuzu Karşılaştırmalı Analizi. *Ankara Sağlık Bilimleri Dergisi*. 2022;11:241–251.
 19. **World Health Organisation Regional Office for the Americas & Pan American Health Organisation (PAHO)**. Management of Inter-Hospital Transfer of Patients with COVID-19; 2022.
 20. **Sağlık Bakanlığı COVID-19 Bilimsel Danışma Kurulu**. *COVID-19 Pandemiğinde Sağlık Kurumlarında Çalışma Rehberi ve Enfeksiyon Kontrol Önlemleri*; 2021.
 21. **Hick JL, Einav S, Hanfling D**, et al. Surge capacity principles: care of the critically ill and injured during pandemics and disasters: CHEST consensus statement. *Chest*. 2014;146:e1S–e16S.
 22. **Khan A, Gupta S, Gupta SK**. Multi-hazard disaster studies: monitoring, detection, recovery, and management, based on emerging technologies and optimal techniques. *Int J Risk Reduc*. 2020;47:101642.
 23. **Şimşek, P. & Gündüz, A**. Turkey’de Afet Hemşireliği. *Journal of Uludağ University Medical Faculty*. 2021;47:469–476.
 24. **Lapčević Z, Mandić-Rajčević S, Lepić M**, et al. Evaluating a primary healthcare centre’s preparedness for disasters using the hospital safety index: Lessons learned from the 2014 floods in Obrenovac, Serbia. *Int J Disaster Risk Reduc*. 2019;34:436–442.
 25. **Taaffe KM, Kohl R, Kimbler DL**. Hospital Evacuation: Issues and Complexities. In: *Proceedings of the 2005 Winter Simulation Conference* eds. Kuhl ME, Steiger NM, Armstrong FB, et al.; 2005:943–950.
 26. **Ulug A** Nasıl bir Afet Yönetimi? in *TMMOB İzmir Kent Sempozyumu Bildirileri* 1–18. TMMOB, İzmir; 2009.
 27. **Reitherman R**. How to prepare a hospital for an earthquake. *J Emerg Med*. 1986;4:119–131.
 28. **Barten DG, Klockman VW, Cleef S**, et al. When disasters strike the emergency department: a case series and narrative review. *Int J Emerg Med*. 2021;14:1–9.
 29. **World Health Organization**. Health Emergency and Disaster Risk Management Framework. <https://www.who.int/publications/i/item/9789241516181> (2019). Accessed on 14/09/2021
 30. **Ćurković M, Svetina L, Košec A**, et al. Double jeopardy; what happens when an epidemic is followed by an earthquake? *Spat Spatiotemporal Epidemiol*. 2021;36.
 31. **Spreadborough P**. Major incident medical management and support (MIMMS): the practical approach at the scene. *BMJ*. 2010;341:c4378.