Disaster Medicine and Public Health Preparedness

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Experiences of Operating Room Professionals During the 2020 Izmir Earthquake: A Qualitative Approach

Gül Özlem Yıldırım PhD and Bektaş Sarı PhD

Atatürk Vocational School of Health Services, Ege University, İzmir, Türkiye

Original Research

Cite this article: Yıldırım GÖ and Sarı B. Experiences of operating room professionals during the 2020 Izmir earthquake: A qualitative approach. *Disaster Med Public Health Prep*. **17**(e566), 1–9. doi: https://doi.org/10.1017/dmp.2023.219.

Keywords:
earthquakes; experiences; operating rooms

Abbreviations:
OR, operating rooms; Mw, moment magnitude; WHO, World Health Organization

Corresponding author:
Bektaş Sarı; Email: bektas.sari@ege.edu.tr.

Abstract

Objective: In the aftermath of earthquakes, the availability of emergency units and operating rooms (OR) in hospitals can make a difference in the survival of those injured. OR professionals' experience during earthquakes is vital for ensuring safe and effective surgical procedures. This study was conducted to explore perceptions and describe the experiences of OR professionals, aiming to improve OR processes during and after earthquakes.

Methods: This phenomenological study employed semi-structured interviews to collect qualitative data from 16 OR professionals who experienced the earthquake. Purposeful sampling was utilized for face-to-face interviews, and MAXQDA20 was used for content analysis.

Results: The primary themes included workplace perspectives, during-earthquake experiences, ethical considerations, and post-earthquake experiences. The workplace was described as unique, dynamic, stressful, and disciplined. Participants experienced fear and panic during the earthquake. Abandoning patients was deemed unethical, resulting in ethical quandaries for professionals when their safety was at risk.

Conclusion: Participants displayed responsibility and ethical conduct while remaining with the patients during the tremor. Implementing practices is crucial in mitigating fear and chaos and improving information management. As such, it is highly recommended that hospital disaster plans incorporate the active participation of OR professionals.

Turkey is a country that has unfortunately experienced a multitude of nature-induced disasters, including earthquakes, floods, and landslides.[1] Although 2020 was a relatively calm year, the devastating Izmir earthquake was a stark reminder of the ongoing threat of earthquakes.[2] The earthquake, which occurred on October 30, 2020 (GLIDE: EQ-2020-000215-TUR), had a magnitude of 7.0, according to the American Geological Research Centre.[3] Its impact was felt not only in Turkey but also in the nearby Samos Island of Greece.[4] The earthquake caused 12 buildings to collapse, claimed the lives of 117 individuals, and caused significant damage to many buildings and infrastructure.[5] Additionally, a tsunami struck the Sığacık region of İzmir soon after the earthquake, causing further damage to homes, vehicles, and marine vessels.[6]

More than half of all earthquake-related injuries are to the extremities.[7] This includes orthopedic injuries, closed abdominal injuries, thorax traumas, pelvic traumas, and head-vertebra traumas.[8] Ortho-plastic surgery offers a range of treatment methods for these injuries.[9,10] Unfortunately, many victims are also at risk of developing "crushed syndrome" due to being trapped under collapsed buildings.[11] The survival of these patients depends heavily on the quality of medical care they receive from surgical units.[12] Patients brought to emergency services after the Izmir earthquake typically suffered traumatic injuries that required surgical treatment, such as fasciotomy and amputation.[13] These surgeries must be performed in a sterile operating room, with access to specialized technological devices and instruments and experienced professionals.

During times of crisis, such as pandemics, nature-induced disasters, and war, hospitals remain a vital source of medical care when other institutions are unable to operate. One of the most critical departments within a hospital is the operating room, which must be equipped to handle emergencies. The World Health Organization (WHO) recognizes the importance of the OR in its program to ensure hospitals can continue functioning in times of emergencies.[14,15] The WHO advises that the OR be prepared for emergencies, taking into account both structural and non-structural risks. Additionally, the organization stresses the need for standard operating procedures to be established and consistently followed across all ORs worldwide in disasters and emergencies.[15] This helps ensure that surgical protocols and regulations are consistently applied, regardless of location. The results of this study are a valuable resource for professionals in the field, including surgical staff and administrators, to ensure the safety and improvement of surgical procedures during earthquakes. They can also assist operating room teams in upholding safety measures before, during, and after such events. Preparedness is critical in minimizing the

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devastating impact of catastrophic events that can occur without warning.[16] The team's past encounters with disasters are crucial in their preparedness for future crises, but there is a need for qualitative studies that explore their experiences during earthquakes. By conducting research and sharing their experiences, we can help fill the knowledge gap and improve readiness in the future.

The purpose of this study was to delve into the first-hand experiences of OR professionals during the 2020 Izmir earthquake in a qualitative manner. To achieve this, the phenomenological approach was employed. The study took place between August and December of 2022, prior to the 2023 East Anatolia Earthquake (GLIDE: EQ-2023-000015-TUR). When conducting a phenomenological analysis, it is crucial to remain objective and refrain from biases. The initial phase involves identifying the subject and problem area, formulating research questions, conducting a literature review, and determining the study design. Additionally, participant criteria must be established, and data collection and analysis should occur before composing the final report.[17,18] Following these steps, we interviewed the participants and collected and analyzed data. The methodology section of the research further explains the details of these steps.

Methods

Research Design

The study aimed to explore perceptions and describe the experiences of OR professionals to improve OR processes during an earthquake. In this study, the phenomenological pattern, which is included in qualitative research, was used. Qualitative research focuses more on the process than the outcome or output.[17] The objectives of qualitative research are to understand the meaning of events, situations, and experiences, to understand the process by which events and actions occur, and to detect unexpected events and effects.[19] The basis of phenomenological research is to explain the essence or meaning of an event.[20] Phenomenological research focuses on lived experiences.[21,22] Processes of phenomenological research are being impartial, determining the subject, defining the research questions, deciding on the research design, choosing the participant criteria, collecting and analyzing the data, and writing the final report.[17,18] This study has 2 main research questions:

- How did OR professionals experience the 2020 Izmir earthquake?
- How did OR professionals consider ethical perspectives during and after the earthquake?

Semi-structured interviews with more detailed inquiries were conducted to answer these research questions.

Participants

We conducted interviews with 16 health care professionals who were present in the OR at Ege University Hospital during the 2020 Izmir earthquake. The participants included nurses, technicians, surgeons, and anesthesiologists, who were selected using a purposive sampling method. This method involves choosing individuals who can provide the most valuable insights to gain a deep understanding of the topic at hand.[17] The strength of this approach in qualitative research is its ability to examine specific cases thoroughly.[23] The inclusion criterion for our study was being present in the OR during the earthquake. Table 1 shows the descriptive characteristics of the participants.

Data Collection

The researchers conducted face-to-face interviews using a semi-structured interview form to gather data. The interviews took place between August and December 2022 and involved 16 participants. The duration of each interview ranged from 20 to 60 minutes. Two individuals who were in the hospital during the earthquake declined to participate. The interviews were conducted in a non-sterile resting area of the OR. The interviews were conducted in two stages. First, there was an introductory meeting where the researchers introduced themselves and explained the research. Then, a separate day and time were scheduled for the interviews to be completed. This way, the participants were allowed to express themselves more easily. Two researchers participated together in all interviews. Audio recordings of the answers were taken. The responses were reread, and the participants' confirmations were provided. After each interview, coding was concluded, and data collection was continued until sufficient saturation was reached. The saturation process occurs when previous codes are repeated instead of forming new ones.[24]

Data Analysis

In this qualitative study, Graneheim, Lundman, and Wildemuth were followed in the analysis process based on the content analysis method.[25,26] Data were analyzed using the MAXQDA20 qualitative analysis program. First, all interviews were recorded and then transcribed verbatim. To ensure confidentiality, the participants' names were not disclosed but represented by numbers. Then, the semantic units in the sentences were determined by two researchers (who held PhDs in Disaster Management and Surgical Nursing, respectively). Next, the highly expressed semantic units were coded based on their similarities and differences. Coding is the process of putting together meaningful and relevant pieces of data to answer research questions.[17] According to Lincoln and Guba, the units obtained in the coding process must first be heuristic; the unit should reveal information relevant to the study and encourage the reader to think beyond a particular piece of information. Also, codes should be the slightest information about something that can stand independently.[27] Furthermore, Guba and Lincoln put forward four guidelines for creating comprehensive and informative categories for qualitative research in the present circumstances:

1. The number of people talking about something or the frequency with which something occurs in the data indicates a critical dimension.
2. The researcher can identify what is essential.
3. Some categories will stand out because of their uniqueness and should be protected.
4. Specific categories may reveal areas of research not otherwise recognized.[28]

After reviewing the codes, the researchers achieved a consensus and extracted 50 codes, 14 categories, and four themes.

Trustworthiness

In qualitative research, a researcher's credibility, accuracy, consistency of results, and competence are critical factors for

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Table 1. Descriptive characteristics of the participants

Participant no.	Age	Gender (male/female)	Responsibility	Work experience (years)	Interview duration (minutes)
1	43	F	Surgical nurse	18	46
2	46	F	Surgical nurse	22	20
3	36	F	Surgical nurse	11	58
4	31	F	Surgical nurse	10	37
5	32	M	Surgical nurse	10	48
6	50	F	Surgical nurse	29	66
7	30	M	Plastic surgeon	4	28
8	28	F	Anaesthesiologist	3	21
9	46	F	Anaesthesiology Technician	25	39
10	35	F	Surgical nurse	13	22
11	35	F	Surgical nurse	13	58
12	25	M	Surgical technician	4	30
13	49	F	Surgical nurse	28	40
14	43	F	Surgical nurse	17	46
15	38	M	Surgical nurse	13	48
16	25	M	Surgical nurse	3	44

ensuring validity and reliability.[29,30] The criteria set by Guba and Lincoln were explained as credible, reliable, confirmable, and transferable and adopted by many researchers.[17,23,31–35] Several methods, such as long-term interaction, expert review, inclusion and exclusion criteria, and triangulation, are applied to ensure validity and reliability in qualitative research.[36,37] This study employed inclusion criteria, expert opinions, and long-term interaction techniques to ensure validity and reliability.

Ethical Considerations

The study adhered to ethical guidelines set forth by the Ege University Ethical Committee (No: 22-8.1T/22), as evidenced by the obtained ethics committee report. Participants were fully informed of the study's purpose, and their personal information was kept confidential using assigned participant numbers. Both written and verbal consent forms were obtained to ensure ethical standards were met.

Results

Behind the earthquake, 16 OR professionals were interviewed in person within the OR. Of the participants, 11 were female, with an average age of 37 and an average work experience of 14 years. Interview durations ranged from 20 to 66 minutes, with an average duration of 40 minutes. The outcome of the interviews resulted in the extraction of four main themes, 14 categories, and 50 codes (Table 2).

Workplace Perspectives

The participants' descriptions of their work environment were divided into 3 distinct categories: physical environment, teamwork, and extraordinary circumstances. The physical environment was further broken down into 4 areas: a specific area, a stressful area, a dynamic area, and a closed-cold area. The teamwork category included phrases related to collaboration and a disciplined work environment. In contrast, the final category dealt with physical hazards such as flooding, explosions, and electrical leakage, as well as critical situations and unsafe surgery codes (Figure 1):

> The workplace field we work in is a very different place. So how do I explain . . . . . The operating room environment is an environment that contains many emotions. Many different branches work here at the same time. Therefore, there is constant movement, and this is a dynamic area. (Participant No. 12)

During Earthquake Experiences

During the interviews, the participants shared their experiences and insights about the earthquake, covering four key categories: thoughts, feelings, behaviors, and aftershocks. They recounted how they had worried about their loved ones and the potential dangers, such as building collapse and fatalities, all while keeping the safety of their patients in mind. The participants highlighted that their top priority during such emergencies was to protect themselves and their patients as they waited for the earthquake to stop. Fear and panic were the most intense emotions that they experienced, and some shared that they had turned to prayer as a source of comfort. Following the earthquake, the participants detailed the codes for coordinating relief efforts, managing chaos, evacuating patients, exiting the building, resuming surgeries, and conducting safety checks (Figure 2):

> At the time of the earthquake, I was in operation, we held the sterile table, we got over the shock, then I thought what happened to my child, but I did not break the sterility. I thought of many things at that moment. My children are my family, but I held the sterile table as a reflex. It was a very complex process. I do not know how to explain it differently. (Participant No. 5)

> I looked around; so many different things were happening that I could not understand them at first. I said we would probably be buried here, and no one would find us. Some are shouting; people are running left and right, and I do not know exactly . . . (Participant No. 1)

> At the time of the earthquake, I immediately dropped next to the sofa and waited; I have a baby at home and have done drills many times. I did an earthquake drill with my child at home, so I had little difficulty then. Of course, I was unsure how much the sofa would protect us then, but I was still there. (Participant No. 3)

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Table 2. Themes, categories, and codes

Themes	Categories (subthemes)	Codes
Workplace perspectives	Physical environment	Special area
		Dynamic area
		Stressful area
		Closed and cold area
	Teamwork	Working together
		Disciplined area
	Extraordinary situation	Unsafe surgery
		Physical hazards
		Critical cases
During earthquake experiences	Feelings	Fear
		Panic
	Thoughts	Loved ones
		Death
		Collapse of building
		Patients
	Behaviors	Waiting end of earthquake
		Self-protection
		Petrified
		Protect the patient
		Prayed to God
		Urgent call to family
	After shake	Coordination
		Chaos
		Evacuation of the patients
		Leave the building
		Continue the surgery
		Check the hazards
Ethical considerations	Ethic behaviors	Not abandon patient
		Responsibility to patient
		Commitment to the team
	Ethical dilemma	Life safety
		Individual reasons
		Life safety of loved ones
	Unethical behaviors	Abandon the patient
		Abandon the team
		Rumors
Post-earthquake experiences	Coordination	Organization
		Resentment of medical professionals
		Ineffective hospital disaster plan
		Unassigned volunteers
	Evacuation	Routine exit used
		Emergency exit used
		Fewer cases
	Information flow	Rumors
		WhatsApp communication
		Disinformation
	Potential hazards control	Extinguisher checked
		Electricity checked
		Oxygen tubes checked
		Tissue samples checked

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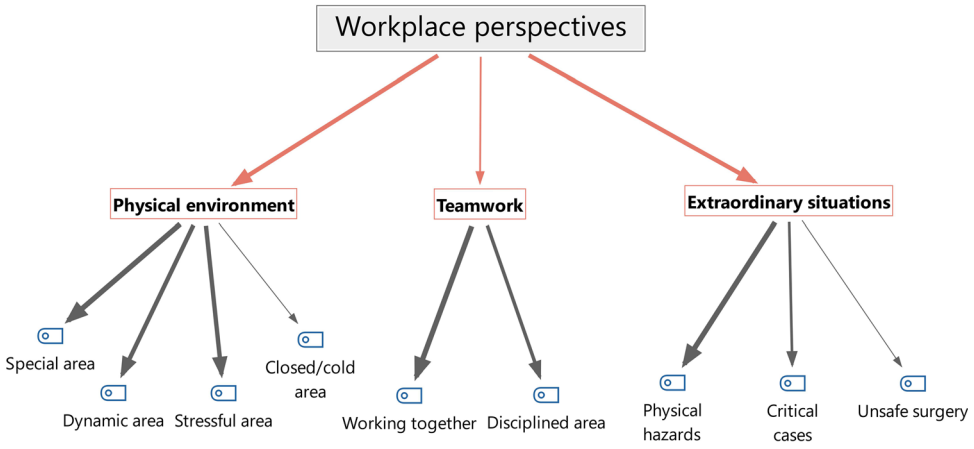

Figure 1. Categories and codes belonged to the "Workplace Perspectives Theme" *The arrows' thickness denotes the codes' intensity.

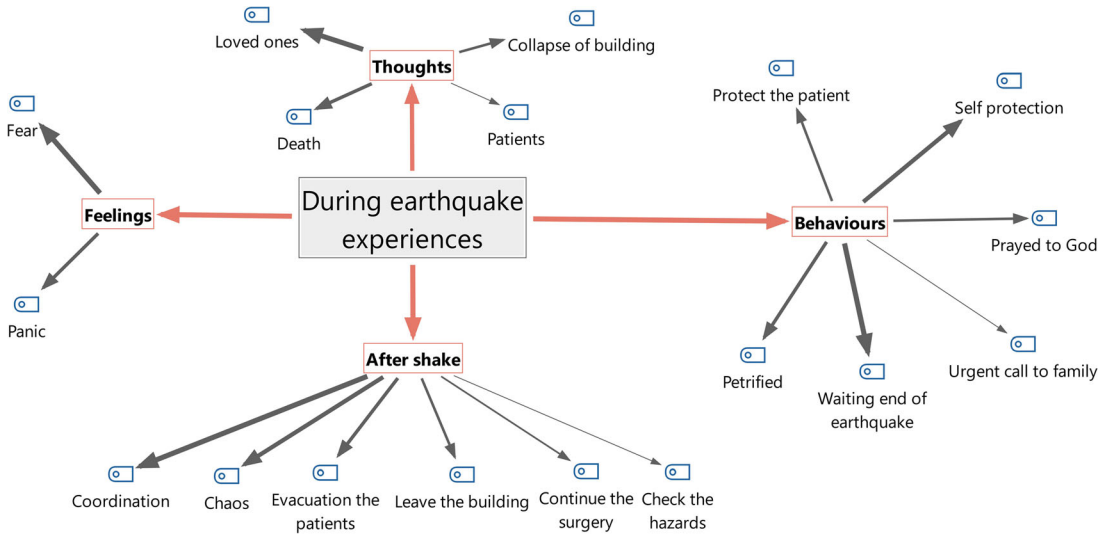

Figure 2. Categories and codes belonged to the "During Earthquake Experiences Theme" *The arrows' thickness denotes the codes' intensity.

Ethical Considerations (Theme)

Among the many ethical behaviors discussed by the participants, several codes stood out: never abandoning a patient during an earthquake, taking full responsibility for their care, and remaining loyal to their team. For these individuals, having an ethical perspective entails being accountable to the patient while demonstrating steadfast loyalty to fellow team members. The participants also discussed the ethical dilemmas they faced, which often involved weighing their safety, personal circumstances, and the well-being of their loved ones. Ultimately, the participants agreed that safeguarding themselves and their loved ones is a critical part of addressing any ethical quandaries that may arise (Figure 3):

> As healthcare professionals, we have many different responsibilities. This is . . . (a few seconds' wait), so even if there is a disaster or an earthquake, We cannot leave the patient; we are responsible to the patient. I do not know, but at least it is for me. (Participant No. 6)

> In the event of an earthquake or fire, sometimes we are not with the patients, or we are in other places, but . . . but the person next to the patient does not and should not leave the patient anyway. This does not seem like the right move to me. (Participant No. 7)

> People can experience very different things at certain moments. I do not know how people who leave the patient experience their stress because everyone's capacity to cope with events during stress is different. Everyone thinks about their own life first. They must save themselves first. (Participant No. 8)

> The issue of leaving the patient seems complicated to me. I do not want to judge people too much. If people have special circumstances, I cannot say anything about them leaving. I am unsure if my perception of others is accurate as I may not be fully aware of their current situation and experiences. (Participant No. 6)

It was clearly established that abandoning the patient in the OR, deserting the team, and spreading rumors during the earthquake were all highly unethical behaviors. Moreover, the dissemination of rumors with unknown origins within the OR was explicitly deemed as an act of unethical conduct:

> At that moment, we only listened to the sounds as we could not see anything inside. Voices came from outside the hall, and our circulating friend shouted

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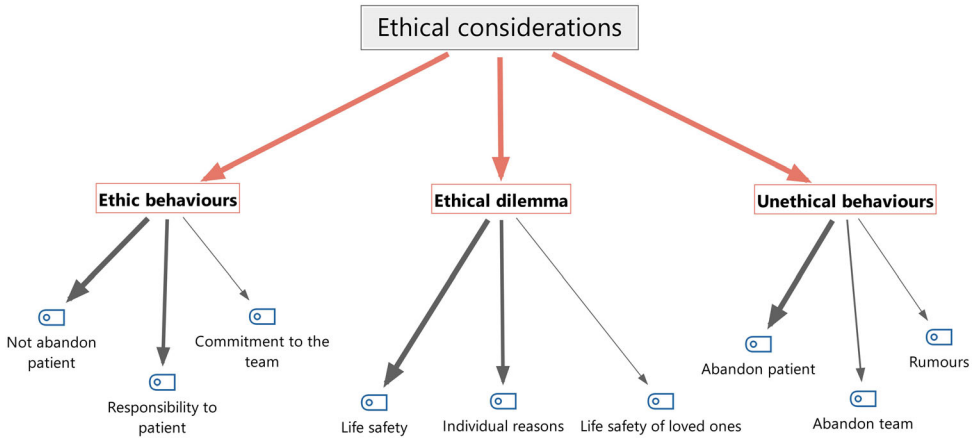

Figure 3. Categories and codes belonged to the "Ethical Considerations Theme" *The arrows' thickness denotes the codes' intensity.

Figure 4. Overall experiences of OR professionals during the earthquake.

that everything was destroyed. These rumors affected me a lot since we were in a closed area. I felt death, and I was afraid. Because we could not see outside, our circulating friends shouting like that scared us, which was unethical. Since we were sterile, we tried to understand the event only from the sounds. Nevertheless, it was tough for us . . . (Participant No. 5)

Post-Earthquake Experiences

After the earthquake, people's experiences can be categorized into four areas: coordination, evacuation, information flow, and potential hazard control. In the coordination category, participants mentioned codes related to organization, resentment, an ineffective hospital disaster plan, and unassigned volunteers. Regarding evacuation, it was noted that the low number of cases in the OR was a positive factor for evacuation efforts. Regarding information flow, codes were provided for rumors, communication via WhatsApp, and disinformation. Lastly, for potential hazard control, participants reported checking fire extinguishers, electrical sources, and oxygen cylinders for fire hazards, as well as examining tissue samples:

There needed to be more certainty about the post-earthquake information. It needed to be clarified precisely who said what. Moreover, we should have been informed more frequently. We waited for the patients who could come due to the earthquake; I could not go to my baby. I would go if I had my current mind. We waited unnecessarily. In such cases, hospital managers should make more accurate plans. (Participant No. 3)

There was a medical congress on the day of the earthquake, and the number of surgical cases was low because the teams were at the congress. I think this is an advantage. Because if there had been no Congress that day, there would have been too many surgical operations. That would have produced even worse results. I can say that we were fortunate in this respect. (Participant No. 8)

After the earthquake, many problems occurred; I had many problems from my perspective. I could not sleep for a certain time; I experienced stress. Restless legs syndrome and PTSD started after the earthquake. I took medication for two months. After the earthquake, no one asked us how we were. It was interesting that our managers did not ask us how we were. Of course, it caused some resentment. (Participant No. 5)

Upon examining the code cloud, which encompasses all categories and codes, it becomes apparent that the most prominent code is "not abandoning the patient." Subsequently, the codes of fear, coordination, concern for loved ones, sense of responsibility toward the patient, self-preservation, and frustration toward medical professionals follow in descending order of intensity (Figure 4).

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Discussion

This qualitative study identified four themes: workplace perspectives, during-earthquake experiences, ethical considerations, and post-earthquake experiences.

During discussions of the workplace perspectives theme, it was articulated that ORs are a special, dynamic, and stressful environment that requires discipline. Vural and Sutsunbuloglu have asserted that the OR can be a hazardous place, leading to musculoskeletal disorders due to stress.[38] Our research found that respondents did not attribute illnesses to their workplace but acknowledged that it can be a source of stress. In a study by Gao et al., the OR was described as a specialized space where various health care professionals, such as surgeons, anesthesiologists, and perioperative nurses, work together.[39] Teamwork is also considered a critical category for OR professionals. Totur and Bayraktar identified teamwork and communication as subthemes in their research. Moreover, they found that many participants experienced a functional and team-oriented environment in the OR.[40] Yeganeh et al. claim that nurses and physicians in the OR perceive teamwork as professional communication, which can contribute to a disciplined environment.[41]

Feelings of fear and panic were prevalent during the earthquake. The coronavirus disease (COVID-19) disaster revealed that nurses experienced psychological problems, anxiety, and fear.[42] A study by Sevimli et al. found that health professionals also experienced intense fear and panic during an earthquake.[43] These results suggest that the fear and panic observed in our study are common reactions to such events. All participants attempted to protect themselves by waiting during the tremor. Zhuravsky's qualitative study focused on the experiences of medical staff during earthquakes and identified the ability to remain calm as a critical theme.[44] Waiting in a safe area during an earthquake is recommended based on the building's structure. However, prompt evacuation is essential as remaining on the premises can pose additional dangers.

During arguments around ethical considerations, it was established that leaving patients behind is entirely unethical and should not be done. Those involved in the discussions encountered ethical dilemmas when faced with situations where patients' safety and the safety of their loved ones were at risk. Adini et al. noted that hospital professionals may encounter ethical dilemmas that not only put their patients' lives in danger but also their own.[45] Aghamohammadi et al. elaborated on the ethical guidelines for operating room nurses, highlighting the importance of maintaining professional conduct and protecting the patient's dignity.[46] A separate study suggested a correlation between the moral awareness of operating room nurses and ethical conduct.[47] Based on our research, participants associated ethical conduct with professionalism rather than moral behavior. However, there is a lack of research on ethical dilemmas during earthquakes. The sterile team felt uneasy about rumors spreading after the earthquake. They explained that creating and circulating rumors is unethical. O'Connor et al. claimed in their study that ORs are open to gossip as they are closed and stressful environments where people work in close contact.[48] Another study identified that critical gossip and rumors may affect the behaviors in the OR.[49] During our study, we discovered that the rumors that circulated in the operating room during the earthquake were not malicious or intentional but rather a result of panic and unawareness, which negatively impacted the sterile team.

It has been suggested that the hospital's disaster plan requires revision in the wake of the earthquake and must be enhanced. Nonetheless, it is expected that hospital disaster plans are capable of handling all evacuation events.[50] In a separate study, a majority of hospital professionals stated that guides and plans proved to be unhelpful during an earthquake.[51] A few participants questioned how necessary it was to evacuate all patients. Adini et al. emphasized in their study that there are different types of hospital evacuation. When it is necessary to evacuate the entire hospital, this decision should be made together with the regional or national health authorities.[45] The number of cases in the OR on the day of the earthquake is less than the average time due to a congress and a holiday. Suzuki et al. discussed in their study that the damage caused by the earthquake will vary according to the conditions such as day, time, and date.[51] Based on our research results, it is imperative to adopt a universal approach when implementing hospital disaster plans. Our results are consistent with previous studies and highlight the need for a more assertive approach.

According to participants, the lack of communication from management after the earthquake caused frustration and resentment. Mohammadi et al.'s study emphasized that OR professionals did not receive sufficient support from their managers during a pandemic disaster, leading to grievances.[52] Liu et al. stressed the importance of timely and practical solutions for operating room nurses' issues.[53] Supporting OR professionals during emergencies, disasters, or other issues or solving their problems can increase their motivation and efficiency. After the earthquake, many health workers voluntarily assisted in the emergency room. Yang et al.'s study asserted that nurses and health workers willingly participated in post-earthquake responses.[54] Operating room professionals are highly skilled and knowledgeable in life-saving procedures, and during disasters, they can assume leadership roles in various units to rescue individuals. Studies show they also play a significant role in fighting pandemics and other critical situations. Therefore, it is essential to have solution-oriented communication with operating room professionals.

The study encountered two limitations, one being the challenge of selecting an appropriate time and location for conducting interviews with participants due to the specialized and restricted nature of the operating rooms. The second limitation was posed by a few participants unwilling to be interviewed outside the hospital premises. To mitigate the effects of these limitations, we proactively scheduled participant interviews weeks in advance to align with their planned surgical operations and offered to conduct interviews at a location that was convenient for them.

Conclusions

This study explored the experiences of OR professionals during earthquakes, revealing a wide range of encounters. The participants displayed unwavering adherence to ethical standards while tending to their patients amidst the chaos. The results suggest that conducting exercises can go a long way in helping the staff deal with earthquakes and manage anxiety in enclosed areas such as OR. It is crucial to proactively participate in these drills and incorporate them into hospital disaster plans. The adverse impact of rumors and false information on the sterile team's earthquake response was significant. Therefore, nurses and technicians must receive training on information management during earthquakes to ensure safety in the OR. Holding situation assessment meetings

https://doi.org/10.1017/dmp.2023.219 Published online by Cambridge University Press

with OR professionals during post-earthquake periods also helps minimize worker resentment toward the administration.

Data availability statement. Data cannot be publicly shared due to confidentiality. However, upon request, voice recordings and written texts are available for scientific purposes.

Acknowledgments. The authors are particularly grateful to all participants who have contributed to this study. The authors are also thankful to the director of the operation rooms for facilitating the research process.

Author contributions. Dr. Gül Özlem Yıldırım obtained ethics committee approval. Dr. Bektaş Sarı conducted the MAXQDA analysis. Both authors researched other areas collaboratively.

Funding statement. The authors received no financial support for writing or publishing this article.

Competing interests. None.

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https://doi.org/10.1017/dmp.2023.219 Published online by Cambridge University Press