

## Case Study

# Hospital management and challenges during COVID-19 outbreaks: lessons from a level 1 hospital in the southeast of Iran-case study

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## Abstract

**Background** The COVID-19 pandemic has presented unparalleled challenges to hospitals globally, particularly those in resource-limited settings. This case study elucidates the experiences and lessons from managing a 40-bed public hospital in Rask, Iran, during the pandemic.

**Methods** Data were gathered through focus group discussions with the management team and key informants, supplemented by document analysis. Thematic analysis was employed to discern key themes and subthemes related to the challenges encountered and solutions implemented by the hospital.

**Results** The study underscores the necessity of a dynamic management team, effective external stakeholder communication, staff involvement in decision-making, and establishing connections with pre-hospital care units. It also emphasizes the need for adaptable protocols, comprehensive staff training, and infrastructure enhancements. Despite these strategies, the hospital grappled with unresolved issues such as inadequate disaster planning, ethical dilemmas, and poor inter-hospital coordination.

**Conclusion** This case study offers insights into managing a small hospital in a resource-limited setting during a health crisis, highlighting the importance of effective leadership, staff support, infrastructural flexibility, and community engagement. The lessons gleaned can guide the development of context-specific strategies to bolster the resilience and preparedness of similar hospitals. Further research is warranted to assess the long-term impacts of the pandemic on these hospitals and to explore the perspectives of frontline staff, patients, and families for a more comprehensive understanding of effective hospital management during health disasters.

**Keywords** COVID-19 · Hospital administration · Health policy · Developing countries · Health services accessibility · Problem solving

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## 1 Introduction

The COVID-19 pandemic presented governments worldwide with a multitude of challenges. These included addressing issues in public hospitals such as technical and allocation inefficiencies, low productivity, lack of accountability to patients, and instances of waste, fraud, and corruption [1, 2]. In many developing countries, healthcare managers primarily focus on referral and educational hospitals [3, 4]. Despite the service capacity and quality in these referral hospitals, they were unable to function effectively during the COVID-19 outbreaks due to an overload of hospital admissions [5, 6]. The only viable strategy to alleviate this pressure and control disease spread during such outbreaks and crises is through healthcare systems and local hospitals [1, 7, 8].

In this case study, we present our experiences managing a small hospital, detailing the challenges we faced, the local solutions we implemented, and the lessons we learned over two years from September 2020 to September 2022. We posit that small hospitals serving high populations with limited facilities encountered unique experiences and opportunities that larger, better-equipped hospitals did not. The aim of this case study is to share these experiences and lessons learned during the pandemic from a 40-bed public hospital in southeast Iran, a region characterized by significant poverty and poor health indicators.

## 2 Methods

### 2.1 Study design

This qualitative solitary case study was conducted to gain an in-depth understanding of a 40-bed public hospital's experiences in managing the COVID-19 crisis in southeast Iran. The case study approach was chosen as it allows for a detailed exploration of a complex phenomenon within its real-life context, enabling researchers to identify key factors, processes, and relationships that contribute to the hospital's response to the pandemic.

### 2.2 Setting

The study was conducted at a public hospital located in the "Sarbaz" Mountains, adjacent to the "Sarbaz" River, in southeast Iran. The hospital serves a population of approximately 200,000 people, primarily from the rural areas of Sarbaz and Rask regions. The area also has a considerable number of migrants from Pakistan and Afghanistan, particularly near Pishin City, a major city close to the Pakistan border. Due to the historical culture of Baluchistan, residents of Rask frequently travel between Iran and Pakistan, making this area a critical point for infection transmission.

### 2.3 Healthcare system and infrastructure

The hospital operates under a public-governmental healthcare system supervised by the "Iranshahr University of Medical Sciences". There are no other public or non-governmental organization (NGO) centers in the area. The nearest hospitals are in "Iranshahr," "Chabahar," and "Nikshahr," which are approximately two to three hours away by car. The roads are in poor condition, and there is no public transportation available between these cities. The hospital has two outdated ambulances, with only one being operational, and a helipad is required.

### 2.4 Hospital capacity and resources

Prior to the COVID-19 outbreaks, the hospital had forty active beds, including a 3-bed coronary care unit (CCU), a labor ward, two general surgery rooms, a thalassemia ward, a dialysis ward, and a general ward. The hospital was equipped with an old analog X-ray machine but lacked a computed tomography (CT) scan and a picture archiving and communication system (PACS). It had an oxygen concentrator machine with a capacity of 120 L, four ventilators, and

thirty-five oxygen cylinders, each with a capacity of forty liters. The nearest center for recharging oxygen cylinders is in “Konarak” Port, which is 3 h away.

## 2.5 Staffing

The hospital staff consisted of 210 individuals, 127 of whom worked in the medical department. Only twelve were trained nurses, while the remaining medical personnel were nurse-aids (Behyar). There was no security guard. Two to four general physicians worked in the emergency ward and examined all outpatients and inpatients. Additionally, there were twelve clinical specialists, each of whom stayed at the site for only two weeks, including two internists, two obstetricians and gynecologists, two anesthetists, two radiologists, two pediatricians, one surgeon, and one psychiatrist.

## 2.6 COVID-19 crisis and conditions

The hospital faced three distinct COVID-19 crises that severely impacted its operations and management. The first positive COVID-19 polymerase chain reaction (PCR) test was reported on March 20, 2020, in the area. The first crisis, caused by the Wuhan variant, occurred from mid-February 2021 to the end of April 2021. The second crisis, attributed to the Delta variant, took place from June to September 2021. The third crisis, caused by the Omicron variant, occurred from March 2022 to May 2022. Each crisis and inter-crisis period presented unique challenges for the hospital in terms of patient care, resource management, and infection control.

## 2.7 Participants

Purposeful sampling was used to select sixteen members of the hospital management team who were actively involved in hospital administration during the COVID-19 pandemic. The participants were divided into two focus groups to facilitate in-depth discussions on the challenges faced and the solutions implemented by the hospital.

The first focus group consisted of 12 participants: the chairperson (overseeing overall hospital affairs), the chief operating officer (managing non-medical staff and assessments), the chief nursing officer (managing medical staff and assessments), the medical director (representing doctors and responsible for decision-making), and eight head nurses (in charge of active hospital wards or nursing supervision). This focus group composition allowed for a comprehensive representation of the hospital's management structure and diverse perspectives on the crisis.

The second focus group included four key decision-makers: the chairperson, the chief operating officer, the chief nursing officer, and the medical director. This smaller group enabled a more focused discussion on the strategic aspects of crisis management and the development of solutions.

## 2.8 Data collection

The data for this case study was collected through focus group discussions and document and artifact analysis.

### 2.8.1 Focus group discussions

Two semi-structured focus group discussions were conducted to explore the challenges and solutions of managing the hospital during the COVID-19 pandemic. The first focus group involved twelve participants, including the chairperson, chief operating officer (COO), chief nursing officer (CNO), medical director, and eight head nurses. This focus group participated in three 90 min sessions to identify the key challenges faced by the hospital. The second focus group consisted of four participants: the chairperson, COO, CNO, and medical director. This group took part in two 120 min sessions to discuss the solutions implemented by the hospital.

A semi-structured interview guide was developed based on the research objectives and existing literature on hospital management during health crises. The guide included open-ended questions that encouraged participants to share their experiences, perspectives, and insights. The focus group discussions were audio-recorded with the participants' consent and later transcribed verbatim. The researchers reviewed the transcripts for accuracy and clarity.

## 2.9 Document and artifact analysis

In addition to focus group discussions, the researchers analyzed various official and unofficial documents and artifacts relevant to the case study. Official documents included reports from the hospital and the health ministry, such as statistics on COVID-19 cases and hospital capacity, policy changes in response to the pandemic, and feedback from staff and patients. Unofficial documents consisted of local media and social media reports, including news articles, blogs, and posts that reflected public perceptions and opinions of the hospital. The researchers also reviewed minutes from hospital meetings and committees, such as the infection control committee, quality improvement committee, and crisis management committee.

## 2.10 Data analysis

Thematic analysis, as described by Braun and Clarke (2006), was employed to identify, and categorize the main themes and subthemes from the collected data. The six-step process involved: familiarization with the data: the researchers read and re-read the transcripts and documents to become immersed in the data. Generating initial codes: they identified and labeled relevant features of the data. Searching for themes: the codes were collated into potential themes. Reviewing themes: the researchers checked the themes' fit and coherence with the data. Defining and naming themes: the scope and meaning of each theme were refined. Producing the report: the most salient themes and subthemes were selected and illustrated with quotes and examples.

NVivo 12 software was used to organize and manage the codes and themes. The researchers triangulated the data by comparing the findings across focus group transcripts, official documents, unofficial documents, and artifacts to enhance the credibility and validity of the results. They also looked for convergent and divergent patterns among the data sources to provide a more nuanced understanding of the case.

## 2.11 Trustworthiness

Several strategies were employed to ensure the trustworthiness of the research process and findings: member checking: the researchers shared the preliminary themes with the participants for verification and feedback. Peer debriefing: the data and findings were discussed with research experts who offered guidance and examined alternative interpretations. Triangulation: the findings were compared across different data sources to enhance credibility and validity. Rich description: detailed descriptions of the context, methods, and findings were provided to allow for transferability assessment. Audit trail: records of the research process were kept enabling scrutiny of the methods and findings.

## 2.12 Ethical considerations

The study received ethical approval from the local institutional review board (Iranshahr University of Sciences and the local health and treatment network of the Rask region [shabake-Behdasht-va-Darman-Rask]). All participants provided informed consent and were assured of data confidentiality and anonymity. For unofficial documents and artifacts, the researchers obtained the necessary permissions and ensured that the use of these sources adhered to ethical standards and guidelines.

# 3 Results

## 3.1 Challenges

Following the provision of adequate facilities and plans for controlling any surge by the task force from the health ministry, the hospital also faced a significant increase in emergency admissions from locals due to the growing fear of COVID-19 symptoms. Prior to the onset of COVID-19, the emergency department (ED) ward had about 900 to 1000 visits per month. After the start of COVID-19 outbreaks in Qom (the first city where confirmed COVID-19 patients were reported in Iran), this number increased to about three thousand monthly visits in March 2020, and it reached seven thousand monthly

visits in July 2021. The key challenges that emerged from the study are summarized in “Supplementary Table”. These challenges fell into six themes: (1) deficits in supply and logistics, (2) spatial constraints, (3) staffing strains, (4) difficulties in training, (5) complexities in management, and (6) internal hospital issues. The solutions focused on infrastructure upgrades, training programs, staff support, communication with stakeholders, and localized protocols.

## 1 Deficits in supply and logistics

The hospital faced shortages in personal protective equipment, ventilators, pharmaceuticals, oxygen cylinders, infrastructure, and advanced equipment. As the COO described: “We didn’t have even basic medical supplies like gloves and masks when the pandemic started. Our oxygen supplies were extremely limited for the number of respiratory patients we received.” “We had no reserve of laboratory equipment, and laboratory kits were entirely scarce.” (Medical Director).

“The hospital’s 120 L capacity concentrator machine was insufficient for its needs, and its oxygen cylinders were inadequate due to the time-consuming recharging process.” (COO).

### 3.1.1 Infrastructure vulnerability

The study site is in one of the regions of Iran with inadequate facilities, which has experienced several droughts and low voltage problems due to overloading on the network or small conductors, especially in the summers. Therefore, the resources for the water and sewage system, as well as the fuel reservation for electric generators, were extremely limited. Due to fuel smuggling in the region, the government restricted the amount of fuel that could be reserved at the site. To provide electricity when the electric network was offline, sufficient fuel reserves were needed. Moreover, the hospital’s uninterruptible power supply (UPS) system was out of service. The hospital’s heating, ventilation, and air conditioning (HVAC) system needed to be updated and required proper maintenance and safety services. Additionally, communication and information technology (IT) systems needed to be improved. For most of the weekdays, there was no internet connection at the site.

### 3.1.2 Shortages of advanced medical equipment

The hospital lacked more advanced medical equipment for respiratory support, except for four ventilators and twelve vital sign monitors. Additionally, it had one blood gas analyzer that was out of service and one biochemistry spectrophotometer. The rest of the hospital laboratory was entirely non-functional.

### 3.1.3 Drug shortages

Throughout the COVID-19 outbreak, the hospital faced a shortage of saline, corticosteroids, and some specific COVID-19 drugs such as remdesivir and tocilizumab, due to the increasing demand across the country. Drug manufacturers preferred to distribute these drugs to more prominent or more important hospitals.

### 3.1.4 Shortages in oxygen supplies

The hospital faced a high demand for oxygen resources for COVID-19 patients, as oxygen therapy played a crucial role in their management and prognosis. The hospital’s 120 L capacity concentrator machine was insufficient for its needs, and its oxygen cylinders were inadequate due to the time-consuming recharging process. Moreover, the hospital always needed some reserved cylinders for operation rooms and the ED. Additionally, any instability in the electric network caused the machine to shut down for more than an hour. The hospital could not provide home oxygen, and there was no private center for home oxygen needs.

### 3.1.5 Shortages of routine hospital needs

The hospital lacked room furniture and standard hoteling equipment to increase bed capacity or open new wards. It also had no reserve of laboratory equipment, and laboratory kits were entirely scarce.

### 3.1.6 Personal protection equipment

At the onset of COVID-19, the hospital had no personal protective equipment (PPE). Every patient and staff member had to provide their own PPE.

### 3.1.7 Ineffective diagnosis tools

The hospital had an outdated analog X-ray machine, and no computed tomography (CT) scan or polymerase chain reaction (PCR) set was available. The doctors had no diagnostic tools, except for one ultrasound machine for pregnant patients.

### 3.1.8 Unstandardized or warned-out equipment.

Most of the existing equipment was worn out, such as beds, chairs, and pads.

### 3.1.9 Low-quality or low-standard equipment

All new equipment, such as PPE, diagnostic kits, or even detergent materials, had low quality or standard conditions and needed to be more effective.

### 3.1.10 Delay in the arrival of equipment

All new equipment, such as PPE, diagnostic kits, or even detergent materials, had low quality or standard conditions and needed to be more effective.

### 3.1.11 Low access to engineering services

Most of the engineering services for maintenance or installation of new equipment arrived with a significant delay compared to other cities due to the long distance and the fear of low security in the Baluchistan area.

### 3.1.12 Transferring patients

Due to the high demand for oxygen on the road and outdated ambulances, transferring most patients to other high-facility hospitals or higher referral levels was impossible. Moreover, all the hospitals during the crisis were completely over capacity and could not accept any patients (even respiratory or non-respiratory patients) from the study site. Therefore, referring patients was almost zero during the COVID-19 crisis.

## 2 Spatial constraints

The hospital confronted significant challenges in expanding its shared space due to various constraints, such as a lack of authorization for new constructions, limited financial resources, and a shortage of standard construction materials and qualified engineers and workers. As noted by several head nurses, "we don't have standard resting rooms during shifts and proper housing after each shift". Another challenge was providing accommodation for staff, particularly non-native physicians, and health workers, as locals were unwilling to rent homes to them due to fear of COVID-19.

## 3 Staffing strains

The high patient volumes and expanded services strained the staff, who faced challenges such as high nurse-to-patient and physician-to-patient ratios, personal stressors, burnout, and overwork. As one staff member described, "We were overwhelmed with the workload. Our staff hadn't been trained to handle an ICU or this patient volume."

“I had to work in compact shifts and have fewer off days. This also increased my attendance duration.” (ED Head Nurse) “Despite being vaccinated, most of our health workers were infected by COVID-19 and had to stay in home quarantine.” (Medical Director).

## **3.2 Some of the problems they encountered included**

### **3.2.1 High nurse-to-patient and physician-to-patient ratios**

Prior to the COVID-19 outbreaks, the nurse-to-patient ratio in the ED ward was approximately one to three or four, and each physician dealt with about 20 to 30 patients in each eight-hour shift. During the COVID-19 crisis, the nurse-to-patient ratio increased to one per 19 or 20, and each general physician dealt with about 80 to 100 patients in about eight-hour shifts. In the general ward, the nurse-to-patient ratio increased to one per 10 or 12 patients in every shift.

### **3.2.2 Personnel's stressors**

Our staff experienced various stressors that affected their performance, such as obligations to their family and the risk of transmitting the virus to their home or family members. Furthermore, most personnel had to deal with their family's financial or health problems. Some of the staff lost family members during COVID-19.

### **3.2.3 Burnout and overwork**

Staff worked for extended periods in a high-stress environment with high turnover wards, overheating, and limited access to food, water, or even a bathroom. Additionally, low motivation due to low payment and unclear employment status led to decreased efficiency among the health workers.

### **3.2.4 Shift work and attendance duration**

As we increased the number of active beds and busy wards without increasing our staff, all health workers had to work in compact shifts and have fewer off days. This also increased their attendance duration in the local area. Moreover, our general physicians and some specialists spent more time in the hospital despite being non-native. For example, one of our GPs and our second radiologist stayed for the entire duration of the crisis in the hospital to reduce patient overload pressure.

### **3.2.5 Staff protection and resilience support**

Our ED staff, ICU staff, and COVID-19 staff were on the front line of COVID-19 exposure and were exposed more than standard to COVID-19 patients. Their protection and vaccination were always our concerns because every staff member had a valuable role in controlling the COVID-19 crisis. It was also important for the staff to know that we cared about their protection. This challenge persisted until the end of our service in the Rask region.

### **3.2.6 Oversimplification of protocols**

After receiving the first dose of vaccination, most of the patients, visitors, and staff relaxed their adherence to safety protocols due to fatigue from restrictions.

### **3.2.7 Post-COVID-19 recovery periods**

Despite being vaccinated, most of our health workers were infected by COVID-19 and had to stay in home quarantine for about five to 10 days. This condition completely disrupted the shift schedule and increased pressure on health staff.

#### 4 Training difficulties

The provision of consistent information, practical protocols, and adequate training time posed significant challenges. As one head nurse explained, "We desperately needed training, but the information we received kept changing. There was no time to properly train people." "We also had to train our current staff to establish ICUs or new care units because we did not have permission to hire new staff." (CNO), "Most of our health workers were nurse aides (Behyar & Komak-behyar) who required more experience and training." (Head Nurse). We also had to train our current staff to establish ICUs or new care units because we did not have permission to hire unfamiliar staff.

#### 5 Management complexities

Challenges were faced in disaster planning, ethical issues, hospital coordination, managing visitors, and data reliability. As the medical director stated, "We had no clear ethical framework for COVID-19 patients. These issues included who should be treated, new and unknown drug side effects, pregnant COVID-19 patients." "We faced multiple ethical issues during every COVID-19 crisis, and we had no clear ethical framework for COVID-19 patients." (Chairperson), "We needed access to realistic pandemic data to make proper decisions in the early periods." (COO). Some of the challenges were:

##### 3.2.8 Lack of disaster planning

Most policymakers were surprised and unprepared for any disaster and pandemic conditions at the beginning of the COVID-19 outbreak in many countries. This lack of preparedness was evident in small hospitals. Most existing disaster plans were unrealistic and outdated. This situation caused problems for our hospital, which needed a practical disaster plan. Moreover, most of the previous strategic plans were designed for local diseases with low demand for medical services.

##### 3.2.9 Ethical issues

We faced multiple ethical issues during every COVID-19 crisis, and we had no clear ethical framework for COVID-19 patients. These issues included who should be treated, new and unknown drug side effects, pregnant COVID-19 patients, allocation of expensive drugs, distribution of ICU and ward beds, prioritization of limited equipment, fugitive COVID-19 patients, cardiopulmonary resuscitation (CPR) of COVID-19 patients, bad news delivery, and conflict between our hospital's ethical framework and the local public's expectations and beliefs.

##### 3.2.10 Links with pre-hospital care and inter-hospital coordination

The only way to decrease hospital healthcare demand and control any disease crisis was by linking with pre-hospital care. They had a significant role in prevention, tracking of new patients, vaccination of the general population, and treating mild symptom patients in rural care houses. However, there were substantial gaps and disconnection between our hospital and the pre-hospital care system (Behdasht). Moreover, there was no relation and grading among our hospital, which provided no cooperation at patient admission and supported the hospital's deficits.

##### 3.2.11 Disconnection with local non-health managers

To implement our solutions and manage patients, we needed to establish connections with local non-health managers to facilitate the provision of many hospital infrastructures and urban facilities, such as electricity and water. We also require these influential managers as external supporters.

##### 3.2.12 Lack of financial resources and insurance uncooperating

Like other parts of the world, we needed more financial resources, in addition to dealing with our country's universal inflation and economic challenges. Our hospital received insufficient financial resources from our center and the affiliated university due to its location in a region considered a low priority by policymakers. We understood that other hospitals were overcrowded and required more attention from policymakers and related authorities in the affiliated university.



However, our region consistently requires more recognition from them. Furthermore, we had to obtain our financial outcomes from insurance systems to provide for our routine needs. However, there were many disorganizations and unusual bureaucracy between our hospital and the insurance system. For example, one of the public insurance organizations categorized us as having the wrong capacity with the wrong affiliated university.

### 3.2.13 Visitors' organization

One of our significant problems was controlling the unnecessary influx of visitors due to the supportive culture in this area. Most families and patients tried to visit their patients in the hospital and ICU to provide them with as much hope and help as they could. This was not only for non-COVID-19 patients but even for severe COVID-19 cases. Our hospital required security guards for this situation. This condition posed a significant problem in controlling the infection cycle and preventing new COVID-19 cases. Moreover, we could not use local police or armed forces for financial and non-financial reasons.

### 3.2.14 Unreliable pandemic data

In the early periods of COVID-19 outbreaks, we needed access to realistic data to make proper decisions. This unclear data led us to make restricted or unrealistic decisions.

### 3.2.15 External influencers' unfamiliarity with our hospital

Due to our location, most of the external influencers and non-governmental organizations (NGOs) had no data or perspective about our hospital and no trustful relations or tendencies to support us.

### 3.2.16 Remuneration and recognition

The health ministry promised many facilities and recognition for all the health workers. However, there were problems in the allocation and distribution of these benefits among health workers. This caused a lot of protests and distrust among the staff, while we had no authority over this recognition. Moreover, a significant delay in remuneration from the health ministry added more pressure on the health workers.

### 3.2.17 Organizational instability

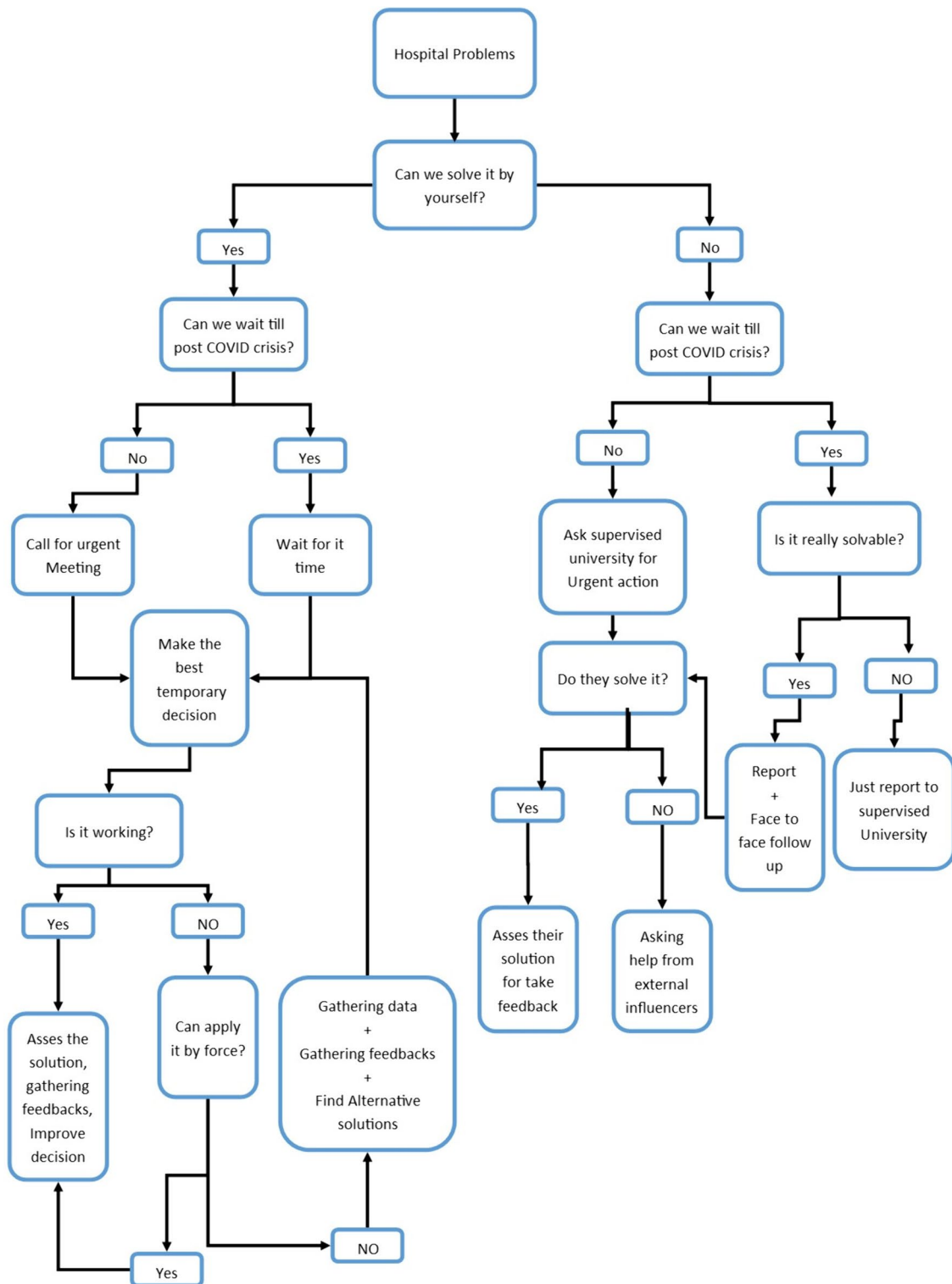
The central supervised university management team changed about four times over 30 months. These changes resulted in multiple changes in the policies. Most of the trained and experienced high-ranked managers were replaced, and most of the procedures had to be changed. Also, there was a significant gap and delay between ongoing developing programs between every shift, making it disorderly and chaotic in the region. For example, the development of a new part of our laboratory and emergency units faced a six to nine-month delay due to bureaucratic reasons.

## 6 Internal hospital issues

The hospital had to address numerous internal issues, such as managing non-COVID patients, infection control, unnecessary admissions, respiratory triage, and patient safety. As the chairperson noted, "One of our significant problems was controlling the unnecessary influx of visitors due to the supportive culture in this area." "Despite the high demand for oxygen on the road and outdated ambulances, transferring most patients to other hospitals was impossible." (Medical Director), "One of our significant problems was controlling the unnecessary influx of visitors due to the supportive culture in this area." (Head Nurse).

## 3.3 Decision-making process

The management team, consisting of the Chairperson, COO, CNO, and Medical Director, met every night or every two nights during the COVID-19 crisis periods and every two weeks during the inter-crisis periods. They evaluated the situation, conducted stakeholder analysis, and identified latest problems. All challenges and problems were approached



**Fig. 1** Hospital Problem-Solving Algorithm: this algorithm begins by prioritizing issues based on solvability or importance. Our team refines solutions through reevaluation, feedback, and data from peer hospitals. Unresolved problems are escalated to the affiliated university and, if necessary, external influencers such as local legislators, council members, deans, governors, NGOs, bloggers, and journalists. Despite these efforts, some challenges remain due to their need for fundamental, long-term solutions

using a local algorithm (Fig. 1), which involved prioritizing issues based on their solvability or importance and seeking solutions through internal resources, the affiliated university, or external influencers.

### 3.4 Consequences of local solutions

The hospital implemented various strategies to address the challenges, including infrastructure upgrades, increased bed capacity, establishment of an ICU, staff training and support, localized protocols, and engagement with external stakeholders. “Supplementary Table” provides a summary of the key challenges and solutions. Despite these efforts, some challenges remained unresolved, such as the lack of disaster planning, ethical issues, and poor coordination with other hospitals.

We sought to engage the affiliated university and external influencers to provide infrastructure and increase capacity. We repaired and renewed most of the essential infrastructure. We relocated the clerical units out of the main building into restored unused rooms and mobile containers in the hospital’s yard. The indoor space was gradually repaired and redesigned. Ultimately, our active beds reached a total of ninety-five. Without significant construction, our wards underwent several changes, including a four-bed CCU, a five-bed labor ward with eight postpartum beds, a six to eight-capacity modern ICU, and a four to six-capacity neonatal ward. Our imaging unit was equipped with digital radiology X-ray, a 16-slice CT scan with dual injectors, and an effective domestic PACS. The oxygen unit was equipped with two concentrator machines (120 L + 600 L), 20 non-portable ventilators, two portable ventilators, and 79 oxygen cylinders, each with a 40 L capacity. The laboratory was equipped with a new blood gas and electrolyte machine. All blood bank and laboratory electronic devices were repaired and serviced. Through real-time planning and estimation of our drug and equipment needs, we supplied most of our medical needs with university support, and external influencers provided our income and remaining needs. Despite the high demand conditions and limitations of drugs and equipment, we were one of the prepared hospitals in the inter-crisis and crisis periods. Computerizing and updating the Health Information System (HIS) and Laboratory Information System (LIS), as well as continuous observation by the management team, led to control of our drug and equipment storage. Unessential needs and non-standard purchased items were returned. Our staff numbers remained the same (input and output staff approximately remained equal), except in the crisis periods when we could use some temporary nurse aides (89-days personnel). We designed our personnel chart, though most of the charts still needed to be filled in. We had no security guard until the end. The number of doctors also remained the same. Despite this staff limitation, we could train our medical and non-medical staff as we established a new ICU and increased bed capacity. Our external influencers in the town prepared proper houses for staff accommodation. We tried to reduce most staff stressors, and our psychologist played a prominent role through face-to-face communication and evaluating the persons. All staff had access to precise data and were engaged in many decisions. Staff had enough rest time and tried to change every team unit except head nurses. This made all staff ready and prepared for serving in any department. We provided early vaccination for our staff except for pregnant staff. After involving public opinion and pressure from external influencers, especially the legislators, the health ministry ordered to make all COVID-19 patients in “Sistan va Baluchistan” province free of admission costs. So, our staff were satisfied with their admission costs.

In addition to COVID-19, we encountered the G6PD crisis, influenza, and traumatic patients during this period, necessitating the management and screening of COVID-19 patients. Furthermore, the rate of labor admission increased for distinct reasons, presenting additional challenges that we had to overcome. We redesigned and localized national protocols, discovering that managing low-symptom COVID-19 patients at home and conducting daily visits significantly decreased the “bed turnover ratio” and “average length of stay”. We ought to involve more management teams in decision-making about inpatient admissions to reduce unnecessary patient admissions. In cases of disagreements between specialists, the management team endeavored to resolve them immediately, thereby increasing patient satisfaction and reducing discontent.

We also established an ethical council, comprising management teams, related doctors, the head of the pre-hospital care system, and a trusted ordinary native staff. This council aimed to resolve moral dilemmas. When necessary, we consulted influential local members such as the dean or the city’s governors. We strived to maintain an unwritten ethical framework that combined the national ethical framework and traditional local preferences. All activities, challenges, needs, and demands were reported both orally and in writing. Weekly hospital needs were sent directly to the high-level authority in the affiliated university, and when necessary, we reported to trusted external influencers. We held special meetings and daily reports with local pre-hospital care managers and local council members to foster relationships and involvement in hospital affairs. This increased our authority to solve some problems and

use them as external supporters. Pre-hospital care units played an essential role in resolving most challenges and controlling every COVID-19 crisis.

### 3.5 Lessons learned

1. The initial step towards establishing a dynamic and efficient hospital in smaller cities involves “selecting an effective management team.” The influence of the COO, CNO, and Medical Director can resolve most challenges.
2. Having a sufficiently trained hospital workforce is the most critical factor in managing crises and outbreaks.
3. Active planning and localization of national protocols to create flexible plans and protocols enhance hospital efficacy.
4. Limitations of financial and human resources are realities in small hospitals.
5. Continuous communication and data sharing with pre-hospital units are essential in any crisis.
6. Trustful relationships and continuous communication with external influencers can resolve deficits in financial and non-financial resources.
7. Continuous personnel training should be considered in every management period.
8. Engagement of the management team along with doctors can prevent many mismanagements.
9. Access to transparent and trustworthy data by health workers during crises and outbreaks can enhance their functions and cooperation.
10. Special attention to staff and provision of financial and emotional support increase efficacy during crises and outbreaks.
11. In the inter-crisis periods, the health ministry should rigorously enforce small hospital accreditation to improve infrastructural hospital problems.
12. Having effective small hospitals and pre-hospital systems significantly reduces overload pressures on referral hospitals.
13. Some challenges and problems are never resolved; they persist from one management period to another.

## 4 Discussion

This qualitative single-case study explored how a small, resource-constrained public hospital in southeast Iran managed the challenges and implemented solutions during the COVID-19 pandemic. The findings revealed that the hospital encountered various difficulties related to supply chain and logistical operations, staffing, spatial constraints, training, and overall management. These challenges were consistent with those reported by other hospitals in Iran [3, 4, 9] and globally [1, 2, 10, 11] during the pandemic, highlighting the unprecedented pressure that COVID-19 exerted on health-care systems worldwide.

The study emphasized the crucial role of the hospital management team in leading the pandemic response, making timely decisions, adapting national guidelines, and collaborating with external stakeholders. This finding aligns with previous research that underscored the importance of strong leadership during health emergencies and the COVID-19 pandemic [1, 7, 9, 12, 13]. The hospital management team demonstrated agility, problem-solving abilities, and the capacity to make context-specific decisions, which were essential in mobilizing resources, supporting staff, and ensuring quality of care despite immense challenges [13, 14].

The study also highlighted the hospital's focus on staff training, support, and engagement to address shortages and burnout. Despite constraints, the hospital provided early vaccination, facilitated recovery, implemented safety measures, and fostered open communication to support its overburdened staff. These findings are consistent with research that emphasizes the need for hospitals to prioritize staff well-being through interventions [2, 8, 15–19] such as vaccines, flexible schedules, transparent communication, and other support measures to retain and motivate the workforce during the pandemic [2, 8, 12, 20–22].

Furthermore, the study found that upgrading hospital infrastructure, expanding bed capacity, and establishing an ICU helped mitigate spatial constraints and accommodate surges in admissions. This aligns with research on hospitals in other resource-limited settings [1, 12, 23–25], which also emphasized the need for infrastructural adaptability in pandemic response [19, 20].

The hospital implemented various strategies to overcome the identified difficulties, such as prompt decision-making, adaptation of national protocols, engagement with external stakeholders, staff training and support, infrastructure

upgrades, and establishment of an ICU. These strategies were consistent with previous research that emphasized the importance of leadership [12], staff well-being [2, 8, 16], and infrastructural adaptability in pandemic response [1, 7, 8, 12, 14, 26].

The findings of this study have important implications for small, public hospitals in low-resource settings seeking to enhance their pandemic preparedness and response. The study underscores the need for effective supply chain management, staff training and support systems, flexible infrastructure, and robust leadership, which require planning and mobilization well before outbreaks occur. Additionally, the study suggests that small rural hospitals should develop context-specific protocols, decentralized decision-making, ethical frameworks, and community linkages based on their limited resources and vulnerability to health crises. These measures can help tailor their response to local needs and conditions while leveraging available resources and support from the external environment [1, 7, 8].

#### 4.1 Limitations

This study has several limitations that should be acknowledged. First, the sole case study design focusing on a small hospital in southeast Iran limits the generalizability of the findings to other hospitals in different regions or countries. Future research could conduct comparative case studies to examine the similarities and differences in hospitals' responses to the pandemic. Second, the reliance on qualitative data collected from the management team may introduce bias and exclude the perspectives of frontline staff, patients, and families. Future research could include these voices to provide a more holistic understanding of the hospital's response. Third, the study does not provide a quantitative assessment of the impact of the local solutions on various aspects of the hospital's functioning and performance. Future research could use quantitative methods to evaluate the effectiveness and efficiency of the implemented solutions. Fourth, the study does not explore the long-term effects of the COVID-19 crisis on the hospital and its staff or the potential implications of future pandemics. Future research could follow up with the hospital over a longer period to examine the long-term consequences and lessons learned. Finally, the study does not consider the role and influence of external factors, such as socio-economic context, government policies, ethical issues, technological innovations, community engagement, and international cooperation, in addressing the challenges faced by the hospital. Future research could examine the interaction and integration of internal and external factors and their impact on the hospital's resilience and sustainability.

## 5 Conclusion

This case study explored the challenges and solutions of managing a small hospital in southeast Iran during the COVID-19 pandemic. The findings revealed the importance of having well-equipped and trained staff, an efficient management team, and robust infrastructure to cope with the health crisis. The study also emphasized the need for localizing protocols, communicating with pre-hospital care units, and engaging external stakeholders to overcome resource limitations. Despite facing numerous difficulties, the hospital successfully implemented various strategies, such as upgrading facilities, expanding bed capacity, establishing an ICU, providing staff training and support, and adapting protocols to the local context. These strategies, along with the resilience and dedication of the hospital staff, were instrumental in managing the crisis. The study offers valuable insights for small hospitals in similar settings, but more research is required to examine the long-term impacts of the pandemic on the hospital and its staff, as well as the perspectives of patients and their families, to provide a more comprehensive understanding of the hospital's response to the crisis.

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**Data availability** The data that support the findings of this study are not publicly accessible due to commercial constraints. However, the data can be obtained from the corresponding authors upon reasonable request and with the permission of “Iranshahr University of Medical Sciences”.

## Declarations

**Competing interests** The first and Third authors were the chairperson and medical director of Rask Hospital. They served their “Compulsory medical service programme” between September 2020 and September 2022. At the time of writing this article, they are not in charge anymore in that Hospital or other part of the health ministry. They received no funds for this project. All other authors do not have any competing interest to declare.

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