

Unveiling the roadblocks: Explaining the Threatening Factors to Patient Safety in Hospitals Receiving COVID-19 Patients: A Qualitative Study

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Abstract

Background: With the COVID-19 outbreak, patient safety in hospitals has become a serious challenge. Identifying the factors threatening patient safety in this critical situation is crucial for improving the quality of healthcare services and reducing adverse outcomes.

Objectives: To determine the factors threatening patient safety in hospitals that admit COVID-19 patients

Methods: This qualitative study was conducted in hospitals in Iran that were receiving COVID-19 patients in 2023. 26 participants, including deputies, patient safety experts, nurses, head nurses, and nursing managers, were selected by purposive sampling until data saturation. The data were collected using a semi-structured, in-depth, face-to-face interview. A conventional content analysis approach was used for data analysis, and MAXQDA 2020 was used for data management.

Results: The findings from the conventional content analysis showed that the factors threatening the safety of COVID-19 patients include four categories (factors related to the patient and disease, task-related factors, management factors, and organizational-infrastructure factors), 11 subcategories (factors related to the patient, factors related to the disease, communication factors with the patient, non-communication factors with the patient, medications and medical equipment, human resources, physical resources, planning and decision-making, supervision, maintaining human resources, processes and protocols), and 33 sub-subcategories.

Discussion: The findings indicate the complexity of patient safety challenges during the COVID-19 pandemic and the need for comprehensive approaches to improve safety conditions in healthcare systems.

Conclusion: These factors directly impact the quality of healthcare services and patient safety. Therefore, reforming policies and improving infrastructure are essential to promoting patient safety in critical care settings.

Keywords: Patient safety, COVID-19, treatment, disease.

1. Background

In late 2019, a new strain of the coronavirus, named SARS-CoV-2, emerged and rapidly spread worldwide (1). The World Health Organization declared the COVID-19 outbreak a "public health emergency of international concern" on January 30, 2020. On March 11, 2020, it

classified it as a "pandemic" (2). The COVID-19 pandemic affected more than 185 countries and approximately 80% of the world's population (3). The COVID-19 pandemic has had a profound global impact, with over 767 million confirmed cases and 6.9 million deaths worldwide as of 2023 (4). In Iran, the situation was

particularly difficult, with over 7.5 million confirmed cases and 146,000 deaths (5). Given the rapid spread, the increasing number of infected and affected individuals, the high mortality rate associated with this infectious disease, and the social and economic sectors impacted, the COVID-19 disease not only transformed into a great biological disaster in modern history but also placed a significant strain on healthcare systems (6, 7).

The spread of COVID-19 not only significantly impacted healthcare systems worldwide but also posed a new challenge for healthcare service providers. Proper management of this global epidemic and the provision of safe and effective services required hospitals to be adequately prepared to perform their clinical duties (8). Thus, hospitals needed to be immediately reorganized to respond to the crisis, with a focus on patient safety and improving the quality of care (9, 10). A combination of uncertainty in diagnosis and treatment of the disease, lack of awareness due to job shifts and the changes in patient care, increased workload, and workplace limitations, increased occupational stress due to self-protection against infection and avoidance of transmission to family members (11, 12), high costs of healthcare services, shortages of personal protective equipment, shortages of hospital beds and ventilators in intensive care units (ICUs), and low-quality patient care, including patient safety threats such as those mentioned, were among the challenges faced by hospitals during the COVID-19 outbreak (13). According to Greenberg et al., this situation led to problems for healthcare workers, affecting patient safety and the quality of care provided (14).

Various factors drove healthcare systems toward this collection of challenges and consequences. On the one hand, the fragility and lack of preparedness of healthcare systems, combined with

resource shortages and poor service provision, led to their collapse during the pandemic (15, 16). For example, in India, a weak healthcare infrastructure, coupled with poor supply chains, resulted in a severe shortage of oxygen despite additional oxygen capacity (17). Other evidence indicates the negative impacts of this pandemic on healthcare service delivery, driven by human resource challenges. The main concerns in this regard include the number, distribution, type, and performance of healthcare workers. It is crystal clear that optimal management of healthcare human resources and the timely identification of related challenges are guiding principles for policymakers seeking to manage the pandemic better (18). In another study, the greatest concerns regarding patient safety in COVID-19-related events included laboratory testing, processes/protocols, and integration into patient isolation (19).

The Iranian healthcare system, like other similar centers, faced multiple challenges during the pandemic (20). In Iran, the government implemented measures and recommendations to protect against COVID-19. These measures were applied across all healthcare facilities, primarily addressing issues of staff and patient safety (21). However, the COVID-19 pandemic negatively affected Iran's health and healthcare system, leading to a range of problems, including resource shortages amid the massive influx of hospital visitors (22). A study in Iran showed that referral hospitals treating COVID-19 patients faced numerous challenges. These included inaccurate diagnoses of patients with diseases, insufficient resources to care for more patients in the event of an increase in COVID-19 cases, lack of continuous monitoring and assessment of service quality, and ineffective communication channels both within and outside the hospital (21). According to the findings of

Kamali and colleagues, the challenges of care and treatment, challenges related to the provision of physical resources and personal protective equipment, and challenges related to healthcare providers were among the issues raised by providers and health managers regarding the care of patients during the COVID-19 pandemic in Iran (23).

While previous studies have examined hospital preparedness (24) and healthcare worker burnout (25), few have specifically analyzed patient safety threats from the perspective of hospital managers in Iran. While the clinical impacts of the pandemic are well-documented, systemic failures in safety protocols remain understudied. The COVID-19 pandemic exposed critical vulnerabilities in healthcare systems worldwide, particularly in Low- and Middle-Income Countries (LMICs), where structural limitations, such as resource shortages, understaffing, and weak health infrastructure, exacerbated patient safety risks. While existing research has extensively documented the clinical aspects of COVID-19, few studies have systematically examined hospital management failures that compromised patient safety in resource-constrained settings like Iran. This article, in light of this background, examines the threats to patient safety that hospitals faced during the COVID-19 pandemic.

2. Objective

To determine the factors threatening patient safety in hospitals that admit COVID-19 patients.

3. Methods

3.1. Study Design and Theoretical Framework

The current study is a qualitative research project conducted between February 2023 and March 2024 using the conventional content analysis approach. As

a technique for collecting subjective data, qualitative research aims to comprehend the natural world and is entirely interpretive. The qualitative method is used to identify, classify, and extract concepts from texts or expert opinion, among other purposes (26, 27). This research aimed to explain the factors threatening patient safety in hospitals admitting COVID-19 patients from the perspective of managers and executive officials actively engaged in the frontline fight against COVID-19. The conventional content analysis approach in qualitative research is particularly suited to exploratory research aimed at developing a concept. Conventional content analysis is methodologically developed and grounded in empirical evidence. When our prior knowledge is limited, we employ this strategy, which relies on the methodical collection of data and the development of a conceptual framework for the topic at hand to establish verifiable facts by established evidence. This method aims to know and understand people's experiences of events in a specific context (27, 28).

3.2. Formulation of the research question

The initial interview began with the main question: "Please tell us about the issues that have jeopardized patient safety in your hospital (as a hospital admitting COVID-19 patients)?" Further, the interview guide included more in-depth questions. For example, "In your opinion, has the outbreak of COVID-19 disease harmed patient safety in your hospital?" "What factors made it more or less difficult for you to pay attention to patient safety during the COVID-19 outbreak, and what factors contributed to the creation of these factors?" "What were the most important obstacles to ensuring the safety of patients during the outbreak of COVID-19?" Based on the findings, the interview guide was adjusted accordingly. Probing questions such as "Could you clarify what you mean

by...?" were also used as needed. The research team developed the interview questions based on a literature review of patient safety in pandemics (19-23). Pilot testing with two non-participants refined the guide for clarity.

3.3. Participant Selection and Setting

Using purposive sampling, we recruited 26 participants from three major COVID-19 referral governmental hospitals in Mashhad (Imam Reza Hospital, Qaem Hospital, and Dr. Shariati Hospital). Participants included: Head Nurse, Nurse, Patient Safety Expert, Deputy Director of Hospital, Deputy Human Resources Development Manager, Nursing Manager, and Infection Control Supervisor. Inclusion criteria required participants to be: Currently employed in COVID-19 patient care units, with a minimum of 6 months of experience in COVID-19 designated units, holding positions with direct patient safety responsibilities, and Willing to participate in detailed interviews. Data saturation was achieved when no new themes emerged from interviews 24-26, as monitored through iterative coding and theme frequency tracking, aligning with established qualitative standards (29). It indicated comprehensive coverage of the research topic, and no new themes or insights emerged from subsequent interviews. Saturation was systematically monitored by tracking code frequency and thematic development during iterative analysis. Recruitment concluded once three consecutive interviews yielded no additional categories or subcategories related to patient safety threats, confirming that sufficient depth and breadth of data had been obtained. This approach aligns with established qualitative research standards, ensuring methodological rigor while capturing the complexities of patient safety challenges during the pandemic. Of the 35 initially approached eligible participants, 9 declined participations (26%

refusal rate), primarily due to fatigue from COVID-19 duties (n=6) and time constraints (n=3). No participants dropped out after consenting. Co-investigators included nursing faculty with specialized training in content analysis via MAXQDA software. No prior personal or professional relationships existed between the researchers and participants to minimize bias; participants were selected solely on the basis of inclusion criteria through hospital administration channels.

3.4. Data Collection

Before interviews, participants were informed about the researchers' affiliations with Mashhad University of Medical Sciences, their expertise in patient safety and qualitative research, and the study's objective to explore safety threats without any personal agenda. This information was provided verbally and in the consent form to ensure transparency and informed participation. After explaining the study's objectives and obtaining verbal informed consent to record conversations, the study collected information on age, marital status, work experience, and education. A series of face-to-face, semi-structured interviews served as the research instrument. To prepare the interview guide, relevant documents and published articles were reviewed to identify key criteria and initial questions. The responses of the twenty-fourth interviewee onwards added no new information, meaning that the interview data reached saturation. However, for further certainty, the interview was extended to 26 individuals, although no new categories emerged from the last two interviews. In the current study, interviews were semi-structured, conducted in the presence of the interviewer at the workplace, and coordinated beforehand. Each interview lasted 45-60 minutes and was conducted over two working days. The categories in this study corresponded to the

findings extracted from the participants' interview responses. Field notes were taken during and immediately after each interview to record nonverbal cues, contextual observations, and the researcher's reflections, which were later integrated into the analysis to enrich the data. All interviews were conducted by the principal investigator (a PhD-qualified researcher with 10+ years of experience in health management) and one co-investigator (a PhD-qualified researcher with 10+ years of experience in nursing). Potential biases, such as assumptions about systemic failures in Iranian hospitals based on prior COVID-19 studies, were mitigated through reflexivity journals and peer debriefing. The researchers' interest in the topic stemmed from a professional commitment to enhancing patient safety during pandemics, with no financial conflicts of interest.

3.5. Data Analysis

The data analysis was conducted using MAXQDA 2020 software. Following the completion of interviews, all collected data were carefully reviewed and organized into a structured table containing participant codes and their exact verbal responses. Through a systematic coding process, key concepts were identified and analyzed. These codes were then critically re-examined, consolidated into broader thematic categories, and systematically arranged in a comprehensive coding table. During this analytical phase, all expert statements regarding threats to patient safety in COVID-19 treatment hospitals were compiled, recorded, and appropriately labeled through a two-stage categorization process. Data reduction followed systematic steps: initial open coding, axial coding for subcategories, and selective coding for main categories, as per Hsieh and Shannon (2005) (26). Concepts were abstracted from concrete participant statements (e.g., 'fear

of death' as a sub-subcategory) to broader subcategories (e.g., 'patient mental state') and main categories (e.g., 'factors related to patient and disease'), ensuring theoretical depth and alignment with qualitative abstraction principles (26, 27).

3.6. Trustworthiness

To ensure the authenticity and accuracy of participant experiences, the study employed four established criteria for evaluating qualitative research rigor: credibility, transferability, dependability, and confirmability (29, 30). Multiple verification methods were implemented to assess the study's validity and reliability, including participant validation and external expert review by supervisors and consultants. In the participant validation stage, respondents were asked to evaluate the findings and verify whether the derived categories accurately reflected their experiences and perspectives. The study incorporated four key validation approaches: member checking (where participants reviewed preliminary findings), peer debriefing (with supervisors evaluating results), collaborative analysis (joint interpretation with participants), and researcher reflexivity (conscious efforts to minimize biases throughout the research process). In member checking, selected participants critically examined the initial analysis report, coding procedures, and resulting categories. Transcripts were returned to a subset of participants (n=10) for review and correction to ensure accuracy; minor clarifications were incorporated without altering core themes. Selected participants (n=8) provided feedback on preliminary findings, confirming that categories accurately reflected their experiences, with no major revisions required. Peer review involved a thorough examination and commentary by supervising professors. The collaborative analysis phase engaged participants directly

in interpreting the data. At the same time, the reflexivity component maintained rigorous control over potential researcher biases throughout all study phases.

4. Result

Twenty-six participants, including deputies, patient safety experts, nurses, head nurses, and nursing managers working in COVID-19 patient care units, underwent semi-structured interviews. [Table 1](#) presents the demographic information of the study participants. Regarding gender, 20 participants (76%) were female, and 6 (24%) were male. Regarding marital status, all 26 participants (100%) were married. The average age of the participants was 41.46 years. In terms of employment type, 18

participants (69%) were officially employed, 2 (8%) were on contract, and 6 (23%) were on temporary contracts. Regarding education level, 17 participants (65%) held a bachelor's degree, 7 (27%) held a master's degree, and 2 (8%) held a professional doctorate. The average work experience of the participants was 16 years. By job type, 5 participants (19%) were head nurses, 8 (31%) were nurses, 3 (12%) were patient safety experts, 2 (8%) were deputy directors of the hospital, 2 (8%) were deputy human resources development managers at the hospital, and 3 (12%) were nursing managers and infection control supervisors. The distribution of job roles indicates that nursing roles had the highest frequency in this study.

Table 1. Baseline characteristics and comorbidities of the two-stage and three-stage technique groups

Demographic Characteristics	Variable Levels	Number (Percentage)	Mean	Standard Deviation
Gender	Female	20 (76%)	-	-
	Male	6 (24%)	-	-
Marital Status	Married	26 (100%)	-	-
	Single	-	-	-
Age	-	-	44.28	7.37
Employment Type	Official	18 (69%)	-	-
	Contractual	2 (8%)	-	-
	Temporary	6 (23%)	-	-
Education Level	Bachelor's	17 (65%)	-	-
	Master's	7 (27%)	-	-
	Professional Doctorate	2 (8%)	-	-
Work Experience	-	-	20.92	5.77
Job Type	Head Nurse	5 (19%)	-	-
	Nurse	8 (31%)	-	-
	Patient Safety Expert	3 (12%)	-	-
	Deputy Director of Hospital	2 (8%)	-	-
	Deputy Human Resources Development Manager	2 (8%)	-	-
	Nursing manager	3 (12%)	-	-
	Infection Control Supervisor	3 (12%)	-	-

The conventional content analysis conducted based on the findings from semi-structured interviews revealed that the factors threatening the safety of COVID-19 patients include four main categories (factors related to the patient and disease, task-related factors, managerial factors, and organizational-infrastructure factors), 11 subcategories (factors related to the patient, factors related

to the disease, communication factors with the patient, non-communication factors with the patient, medications and medical equipment, human resources, physical resources, planning and decision-making, supervision, maintaining human resources, processes and protocols), and 33 sub-subcategories. (Table 2).

Table 2. Explanation of Factors Threatening Patient Safety Based on Findings from Semi-Structured Interviews

Category	Subcategory	Sub-subcategory	Semantic Units
Factors Related to Patient and Disease	Factors Related to the Patient	Issues Related to Patients' Mental State	Fear of death
			Separation from family members
			Loss of self-confidence
			Patients' anorexia
		Issues Related to Patients' Underlying Diseases	Lack of attention to patients' underlying conditions
			Nurses' unfamiliarity with patients' underlying diseases
	Discharge with Personal Consent	Family pressure for patient discharge	
		Patient's insistence on discharge	
	Factors Related to Disease	Unknown Nature of the Disease	Various Clinical Manifestations During Treatment
			Novelty of the disease
Lack of Diagnosis		Asymptomatic Patients	
		Patients with symptoms similar to COVID-19	
Task-related factors	Communication factors with the patient	Personalized medication	Adverse drug effects
			Administration of herbal medicine to patients
			Discontinuation of prescribed medications by a new examining physician
		Weakness in nutritional assessment and support	Inadequate nutrition for patients
			Insufficient time allocated for patient feeding
		Issues related to patient visits	Specialists' reluctance to visit patients in general COVID-19 wards
			Insufficient time for patient consultations
			Non-specialized consultations
		Unsafe patient transfers	Unsafe patient handling during transfers
			Lack of qualified personnel for patient transfers
			Inadequate assessment of the patient's

		Unsafe patient discharges	condition before transfer	
			Use of shared elevators for patient transfers	
			An incomplete education is provided to patients upon discharge.	
		Ineffective care and treatment services for patients	Weak follow-up on patient status after discharge	
			Inconsistent clinical status evaluations of patients	
		Lack of implementation of the two-tier triage	Intermittent presence of healthcare and caregiving staff at the patient's bedside	
			Lack of categorization for emergency patients	
		Factors unrelated to the patient	Poor waste management	Insufficient space for separating emergency patients
				Untimely collection of infectious waste
	Inadequate cleaning and disinfection of the environment and equipment		Failure to separate infectious from non-infectious waste in departments	
			Inadequate time spent on cleaning and disinfection	
	Insufficient adherence to standard precautions by staff		Low quality of disinfectant materials	
			Improper use of personal protective equipment by staff	
	Organizational and infrastructural factors	Laboratory services, pharmaceuticals, and medical equipment	Shortage of medical equipment	Weak adherence to hand hygiene protocols
				Delayed replacement of personal protective equipment
Use of a single imaging device for all patients				
Shortage of medications and IV fluids			Use of mobile medical equipment for all patients	
			Excessive transfer of medical equipment	
			Shortage of medications	
Issues related to laboratory services		Shortage of IV fluids		
		Lack of trust in laboratory test results		
		Absence of a COVID-19 laboratory		
Human resources		Quantitative shortage of human resources	Delays in COVID-19 test results	
			Shortage of nurses	
			Shortage of nursing assistants	
		Qualitative shortage of human resources	Assistance from specialist doctors	
			Use of inexperienced staff	
Physical resources		Insufficient physical space and facilities for service delivery	Use of underqualified staff	
	Presence of a shared waiting area for services			
		Shared pathways between COVID-19 and non-COVID-19 patients		

			Use of shared restrooms
		Inefficiency in ventilation systems	Incorrect design of ventilation systems
			Malfunctioning ventilation systems
			Untimely repairs of ventilation systems
			Lack of timely assessment of ventilation systems
		Poor oxygen delivery	Oxygen shortages
			Unacceptable oxygen concentration
Management factors	Planning and decision-making	Policy of merging COVID-19 and non-COVID-19 patients based on underlying conditions	Transmission of infection from patient to patient
			Transmission of infection from nurse to nurse
		Policy of using general COVID-19 wards without considering patients' underlying conditions	Insufficient familiarity of nurses with patients' underlying conditions
			Lack of prioritization for treating patients' underlying conditions
	Supervision	Ineffective implementation of medical equipment maintenance programs	Lack of periodic assessment of medical equipment
			Improper and untimely repair of medical equipment
		Inefficiency in the procurement and distribution of personal protective equipment	Shortage of personal protective equipment
			Low quality of personal protective equipment
			Improper distribution of personal protective equipment
	Maintenance of human resources	Inadequate support for infected staff	Concealment of illness by infected staff
			Return to work before full recovery by staff.
			Non-approval for sick leave for infected staff
		Work pressure on nursing staff	Increased patient-to-nurse ratio
			Excessive number of shifts
		Fear and anxiety among staff	Fear of transmitting illness to family
			Fear of contracting illness
		Decrease in human resources	Staff absenteeism
			Staff resignations
			Increased sick leave among staff
	Processes and guidelines	Executive guidelines	Designation of the hospital as a referral hospital
Frequent cancellation of elective surgeries			
Drug protocols		Absence of standard drug protocols	
		Frequent changes in drug protocols	

Category: Factors Related to the Patient and Disease

Factors related to the patient and the disease were divided into two subcategories: patient-related and disease-related. Factors related to the patient include subcategories such as issues concerning the patient's mental state, problems related to underlying diseases, and discharge at the patient's request. Factors related to the disease include subcategories such as the unknown nature of the disease and failure to diagnose the disease.

Subcategory: Factors Related to the Patient

According to the participants' statements, one of the factors threatening the safety of hospitalized patients was related to patients' mental health issues, their underlying diseases, and their desire for discharge at their personal request from the hospital. In this regard, several participants stated: "The hospital environment was extremely stressful, and patients were afraid of death; we could not provide a calm environment for patients and their companions (P7)." "Many patients had lost their spirits due to a lack of companionship and being away from family members, which led them to depression, negatively affecting their treatment process (P12)." "Doctors paid little attention to patients' underlying diseases; their priority was only treating COVID-19. To be honest, many patients died due to their underlying conditions (P1)." "Sometimes a patient would request discharge at their own request because they felt they were not receiving adequate care in the ward. Then that same patient would be readmitted after a few days in worse condition (P14)."

Subcategory: Factors Related to the Disease

Based on participants' statements, one factor threatening the safety of hospitalized patients was the unknown nature of the disease and the failure to diagnose it. In this

regard, several participants stated: "Patients' varying reactions to treatment made it difficult for us to prescribe a uniform and effective treatment for the disease; we were constantly trying different treatment methods and medications on patients, which itself posed a threat to patient safety (P13)." "In my opinion, the most important factor that put patient safety at risk was our lack of awareness and understanding of this new disease. We neither understood the disease well nor had any treatment for it (P8)." "Many of our colleagues were carriers without knowing it; they showed no symptoms but came into close contact with patients and worked with them. It put patient safety at risk, causing non-COVID patients to become infected with COVID (P6)." "Unfortunately, we often face misdiagnoses that completely divert the treatment path and harm the patient. Of course, making a correct diagnosis is also difficult when a test is negative, but the patient still shows symptoms! (P12)"

Category: Task-Related Factors

Task-related factors were divided into two subcategories: communication factors with the patient and non-communication factors. Communication factors with the patient include: subjective medication administration; inadequate assessment and nutritional support; issues related to patient visits; unsafe patient transfers; unsafe patient discharges; ineffective care and treatment services; and failure to implement two-layer triage. Non-communication factors with the patient include: improper waste management, inadequate cleaning and disinfection of the environment and equipment, and insufficient adherence to standard precautions by staff.

Subcategory: Communication Factors with the Patient

According to the participants' statements, one of the factors threatening the safety of hospitalized patients was related to subjective medication administration, inadequate

assessment and nutritional support, issues related to patient visits, unsafe patient transfers, unsafe patient discharges, ineffective care and treatment services provided to patients, and failure to implement two-layer triage. In this regard, several participants stated, "Unfortunately, the lack of management and integration of information in recording the care provided for COVID-19 patients in different hospitals harmed patients. We had patients who were exposed to a bombardment of dexamethasone and developed mucormycosis, losing their eyesight (P12)." "Unfortunately, we had patients here who had no one to bring them a glass of water; you might not believe it, but we had a patient who said he had not had water for 24 hours! In a low-water environment, all cellular activities in the body are disrupted, including immune cells (P5)." "COVID-19 patients could not eat their meals quickly due to their conditions; therefore, someone needed to sit next to them and assist them. A meal would take about 45 minutes. We also did not have enough staff to do this for the patients (P10).""We had a shortage of doctors; one doctor had to visit all the patients and could not spend enough time with each one because there were too many patients and the ward was crowded (P9).""Because we had a shortage of nurses and nursing assistants, when transferring a patient from one ward to another, we sometimes used service staff; sometimes they were accompanying the patient (P21)." "We had space limitations and could not separate emergency patients as needed; the emergency room was crowded, and there were many incoming patients; we could not distinguish between COVID-19 and non-COVID-19 patients (P8)."

Subcategory: Non-Communication Factors with the Patient

According to participants' statements, one factor threatening the safety of hospitalized patients was improper waste management, inadequate cleaning and disinfection of the

environment and equipment, and insufficient adherence to standard precautions by staff. In this regard, several participants stated: "The lack of waste separation in inpatient wards was another issue that was not done properly; this lack of separation led to an increase in infectious waste volume and raised the risk of infection transmission (P12).""We had a shortage of service staff, which meant that infection control tasks like disinfecting the environment were not done properly; they only did the bare minimum (P15).""Inexperienced young nurses administered medications without performing hand hygiene, thus transferring contamination (P23)." "The staff themselves endangered patient safety by not adhering to infection control measures; simply being present at the patient's bedside without hand hygiene put patient safety at risk (P25)." "Some colleagues presented at non-COVID-19 patients while wearing the same clothes they used for COVID-19 patients and did not change their gloves; we also faced a shortage of gloves (P24).""There were instances when COVID-19 patients were hospitalized alongside non-COVID-19 patients; we observed that a nurse would go to a non-COVID-19 patient's bedside wearing the same clothing and gloves as when attending to a COVID-19 patient. Although these instances were rare, they did occur (P18)."

Category: Organizational-Infrastructural Factors

Organizational-infrastructural factors were divided into three subcategories: "medications and medical equipment," "human resources," and "physical resources." The subcategory of medications and medical equipment was identified as including shortages of capital medical equipment, medications, and intravenous fluids, as well as issues related to laboratory services. The human resources subcategory was identified in two forms: quantitative and qualitative

shortages. The subcategory of physical resources was identified as including shortages of physical space and service delivery facilities, inefficiencies in ventilation systems, and inadequate oxygen delivery.

Subcategory: Medications and Medical Equipment

According to participants' statements, one factor threatening the safety of hospitalized patients was the shortage of capital medical equipment, medications, and intravenous fluids, as well as issues with laboratory services. In this regard, several participants stated: "The use of a single imaging device for both COVID-19 and non-COVID-19 patients puts the safety of non-COVID patients at risk. Although the device was disinfected before use, I felt it was insufficient, and sometimes proper disinfection was not performed (P14)." "There was a lot of movement of equipment, which negatively affected the calibration of the devices, making it difficult to trust their performance (P13)." "Unfortunately, the movement of mobile equipment did not follow standards and protocols, and there was no oversight on this issue. I am sure many results from this mobile equipment were incorrect because its settings were disrupted with each move (P11)." "There was a shortage of medications that were expensive and not accessible to everyone; only certain pharmacies had them, and you had to know someone to get them (P15)." "The shortage of intravenous fluids became very severe for a while, with prices several times higher and only cash accepted. Most of our purchases were on credit for months, but I remember at that time anyone who had intravenous fluids sold them only for cash (P11).""Considering that nearly 40% of PCR tests and rapid tests had false negatives, we could not rely much on negative test results, making it very difficult for those with symptoms (P5)." "The lack of a COVID-19 laboratory and the lengthy turnaround time

for COVID-19 test results were problems in our hospital; getting test results took a very long time (P14)." "We had a shortage of staff in the laboratory; on the one hand, we lacked experienced personnel to collect samples from the throat and nose. This process was done once a day, and it took 48 hours to get results (P10)."

Subcategory: Human Resources

According to participants' statements, one factor threatening the safety of hospitalized patients was the combined quantitative and qualitative shortage of human resources. In this regard, several participants stated: "We had a significant shortage of nurses, which led to reduced attention to patients and insufficient time spent on patient care by the staff (P11).""The shortage of nurses was considerable, which increased the workload for existing nurses while severely decreasing the quality of care (P12)." "The shortage of internal medicine and infectious disease specialists in the hospital led to increased waiting times for patients in outpatient clinics; longer waiting times also increased contamination in waiting areas, causing non-infected patients to become infected (P17)." "Most nurses were temporary or contract nurses who could not operate specialized devices; they had not received training to use them. As a result, work progressed slowly, wasting time during patient care, which harmed patients (P25)." "The hospital quickly turned into a mega ICU; through government support and donations, necessary equipment was somewhat purchased, but the experience level of doctors and nurses remained at its previous level with no improvements (P5)."

Subcategory: Physical Resources

According to participants' statements, one factor threatening the safety of hospitalized patients was a shortage of physical space and service-delivery facilities, as well as inefficiencies in ventilation systems and

inadequate oxygen delivery. In this regard, several participants stated: "In the beginning, we did not have enough space in the emergency department to implement two-layer triage; therefore, all patients—both COVID-19 and non-COVID-19—were examined in one location (P13)." "We could not separate COVID-19 patients from non-COVID-19 patients due to limitations; patients shared common spaces such as waiting areas for outpatient clinics, reception areas, and diagnostic sections (P19)." "Occupational health engineers who visited our ventilation system noticed that the ventilation output for one section was directly in front of our entrance (P12)." "Out of all isolation rooms in the hospital designated for COVID-19 patients, only one or two had negative pressure; the rest had issues (P11)." "The filters in ventilation systems were not being changed regularly; this reduced their efficiency and did not provide adequate air ventilation (P23)." "Oxygen shortages often became problematic; although buying oxygen concentrators resolved many oxygen delivery issues for patients, there were still times when oxygen concentration in the ward dropped to 60% (P5)."

Category: Management factors

Managerial factors were divided into four subcategories: "planning and decision-making," "supervision," "human resource maintenance," and "processes and protocols." The subcategory of planning and decision-making was identified as including "the policy of integrating COVID-19 and non-COVID-19 patients based on the patient's underlying conditions" and "the policy of using general COVID-19 wards without regard to the patient's underlying conditions." The supervision subcategory was identified as including "ineffective implementation of medical equipment maintenance programs and inefficiencies in the procurement and distribution of personal

protective equipment." The human resource maintenance subcategory was identified as including "insufficient support for infected staff, workload pressures on nursing staff, staff fear and anxiety, and reduced human resources." The processes and protocols subcategory was identified as including "executive instructions" and "medication protocols."

Subcategory: Planning and Decision-Making

According to participants' statements, two factors threatening the safety of hospitalized patients were the policy of integrating COVID-19 and non-COVID-19 patients based on underlying conditions and the policy of using general COVID-19 wards regardless of patients' underlying conditions. In this regard, several participants stated: "There was a period when they said that, considering the underlying conditions of COVID-19 patients, they should be hospitalized in their specialized wards; this meant we had both COVID-19 and non-COVID-19 patients in the same ward. This decision caused the virus to be transmitted from COVID-19 patients to non-COVID-19 patients (P3)." "Patients with underlying conditions were more affected during the early peaks of COVID because their immune systems were weak, and all diagnoses focused on COVID, with less attention given to underlying conditions. Additionally, nurses were inexperienced and unfamiliar with various underlying diseases (P11)." "During the initial peaks, due to the fear and anxiety prevailing at that time, everyone was focused on treating COVID-19, neglecting patients' underlying diseases, which significantly jeopardized the health of patients, especially the elderly (P6)."

Subcategory: Supervision

According to participants' statements, one factor threatening the safety of hospitalized patients was the ineffective implementation

of medical equipment maintenance programs and inefficiencies in procuring and distributing personal protective equipment. In this regard, several participants stated: "Sometimes while working with a device, I noticed that it was not functioning properly, like suction machines or blood pressure monitors. Upon investigation, we found that these devices were not being periodically evaluated; naturally, when a device does not perform its function correctly, patient safety is compromised (P8)." "Defective equipment from medical supplies often went unrepaired; sometimes it was just due to a missing small part that rendered the device unusable (P8)." "Each nurse was given two pairs of gloves per shift; therefore, nurses did not change gloves between patients and performed hand hygiene with the same gloves, which was ineffective. In non-COVID wards, three-layer surgical masks were distributed, while only N95 masks were provided for COVID wards. The maximum usage time for a three-layer mask is two hours if it does not get wet; however, due to a shortage of masks, nurses would use one mask until the end of their shift, which increased infection rates among staff and other patients (P4)." "The masks provided during each shift were limited; even those masks were so low quality that they would either tear or lack a nose clip (P9)." "The delayed arrival of personal protective equipment at the hospital meant there was not adequate distribution; we were always worried about whether we would receive protective gear from headquarters. Therefore, we asked our colleagues to conserve personal protective equipment (P22)."

Subcategory: Human Resource Maintenance

According to the participants' statements, one of the factors threatening the safety of hospitalized patients was related to insufficient support for infected staff,

workload pressures on nursing staff, staff fear and anxiety, and reduced human resources. In this regard, several participants stated: "If a nurse became infected but showed no specific symptoms, they would be asked to return to work quickly; if they did not comply, upon returning, they would be assigned a different ward or given heavy shifts (P15)." "Recently, they did not easily approve sick leave for staff, especially if someone became infected but showed no symptoms; approval was not granted at all (P17)." "Sometimes the number of patients assigned to each nurse during a shift was well above standard levels; we had no choice but to manage with fewer nurses. Given that each nurse was assigned more patients than standard levels during each shift, many care tasks were missed (P23)." "Many nurses and doctors feared infecting their family members; this made them less willing to be at patients' bedsides. After all, we all had families—whether children or elderly relatives—and conditions were difficult (P5)." "In the early days, fear and anxiety were evident in staff behavior; colleagues tried to be present less at patients' bedsides because they feared becoming infected (P7)." "When nurses and healthcare staff became infected and took sick leave, we faced a shortage of personnel; therefore, we had to increase the patient-to-nurse ratio so that each nurse covered more patients. This situation also jeopardized safety (P1)."

Subcategory: Processes and Protocols

According to participants' statements, one factor threatening the safety of hospitalized patients was related to executive instructions and medication protocols. In this regard, several participants stated: "Our hospital did not have an infectious disease department; I do not know how this hospital was chosen as a center for treating COVID-19 patients! When a hospital lacks an infectious disease department, its nurses certainly lack experience in caring for infectious disease

patients! (P19)." "During peak times, elective surgeries were canceled; after peak times, they would lift cancellations. However, not all elective procedures are cosmetic; many require prompt performance. While they were not emergencies, delaying them could harm patients (P8)." "Medication administration had become completely subjective; one doctor would prescribe medication while another doctor who came later would discontinue it without following any medication protocol (P23)." "Medication protocols changed frequently; one day they would say use remdesivir for treatment, while another day they would say use dexamethasone. This constant change led doctors not to trust protocols and instead follow their own judgment (P11)." "Unfortunately, due to a lack of unified treatment guidelines for COVID-19 patients, many patients resembled laboratory mice; everyone prescribed whatever medication they deemed appropriate for their patients (P10)."

Diverse cases were represented across participant roles (e.g., nurses vs. managers), revealing minor themes like 'cultural stigma around COVID-19' that, while less frequent, highlighted contextual variations and were discussed in relation to major categories. The four main categories—patient and disease-related, task-related, management, and organizational-infrastructure—did not operate in isolation but interacted synergistically. For example, disease-related factors (e.g., the unknown nature of COVID-19) exacerbated task-related issues (e.g., subjective medication administration) because diagnostic uncertainty forced clinicians to make ad hoc decisions, driven by 'why' factors such as overwhelmed resources and fear of transmission. This interaction eroded standardized protocols, creating a feedback loop in which management failures (e.g., poor supervision) further amplified risks, illustrating how crisis conditions in LMICs like Iran can foster emergent safety

threats through systemic interdependencies.

5. Discussion

The present study aimed to identify the factors threatening patient safety in hospitals affiliated with Mashhad University of Medical Sciences that admit COVID-19 patients. The findings reveal not only isolated threats to patient safety but also their interconnected dynamics within Iran's resource-constrained healthcare system during the COVID-19 pandemic. For instance, patient-related factors (e.g., mental health issues) interacted with task-related factors (e.g., inadequate nutritional support) to exacerbate vulnerabilities, creating a cascade of risks that undermined overall care quality. This interplay highlights how individual-level stressors amplify systemic failures, necessitating interpretive lenses from safety science to understand emergent risks rather than viewing them as discrete events.

In this study, four main categories were identified as threats to patient safety: patient- and disease-related factors, task-related factors, managerial factors, and organizational and infrastructural factors. For Patient and Disease-Related: This category signifies how intrinsic vulnerabilities (e.g., mental health) intersect with epidemic unpredictability, informing policy on integrated psychosocial support in crisis care. For Task-Related: "These factors highlight communication breakdowns as amplifiers of risk, advocating for resilience-focused training in healthcare protocols. For management: "Management lapses reveal gaps in crisis leadership, with implications for ethical governance reforms in resource-limited systems. For Organizational-Infrastructural: "Infrastructural deficits underscore the need for scalable investments, aligning with global health equity theories.

The current study found that patient-related safety threats include patients'

psychological condition, underlying diseases, and a tendency to be discharged against medical advice (AMA). Additionally, disease-related safety threats were identified as the unknown nature of the disease and challenges in diagnosis.

Psychological problems among COVID-19 patients were identified as a safety-threatening factor. Consistent with this finding, the results of a study by Roy et al. indicated that COVID-19 infection and hospitalization increase stress and anxiety levels, which negatively affect the mental, psychological, and physical states of patients. It can influence treatment outcomes and the overall prognosis of patients (31).

The unknown nature of the disease was identified as one of the factors threatening patient safety. Consistent with this finding, the results of multiple studies indicate that COVID-19 was associated with a wide range of specific and non-specific symptoms, coupled with an unknown and multifaceted nature, which posed significant challenges to the processes of diagnosis, hospitalization, and treatment (32). Kamali et al. identified insufficient knowledge of COVID-19 treatment as one of the major challenges in managing the pandemic (23). Failure to diagnose the disease was also recognized as a safety-threatening factor. In line with this finding, a study found that the novel nature of COVID-19 and the limited information available on its prevention, diagnosis, and treatment led to widespread fear among healthcare personnel, which, in turn, affected patient safety (33).

The findings of the present study indicated that task-related threats to patient safety fall into two categories: patient-related communication factors and non-patient-related factors. The findings showed that patient-related communication factors include: preference-based medication practices; weaknesses in nutritional assessment and support; issues related to patient visits; unsafe patient transfers;

unsafe patient discharges; ineffective delivery of care and treatment services; and the failure to implement two-tier triage systems. Non-patient-related factors include: improper waste management, inadequate cleaning and disinfection of environments and equipment, and insufficient adherence to standard precautions by staff.

Preference-based medication practices were identified as one of the safety-threatening factors. Consistent with this finding, the present study's results indicate the use of various herbal and industrial medicines in the treatment of COVID-19 patients (34). In this context, a study conducted in Saudi Arabia reported that a significant percentage of respondents used herbal remedies to prevent infection during the COVID-19 outbreak (35).

Nutritional assessment and support deficiencies were identified as one of the factors threatening patient safety. A meta-analysis revealed that vitamin D deficiency could increase the risk of hospitalization and mortality in COVID-19 patients (36). Similarly, Grant et al. provided evidence that vitamin D supplementation reduces the risk of influenza and COVID-19, as well as mortality rates (37).

Issues related to patient visits were also identified as a safety-threatening factor. In line with this finding, numerous studies show that the doctor-patient relationship and effective bedside communication play a significant role in enhancing patient safety (38). It is evident that the time physicians devote to each visit directly impacts patient safety. When physicians are required to see a large number of patients in a short period, the likelihood of medical errors and misdiagnoses increases. Physicians under pressure may not have sufficient time to thoroughly assess the patient's condition, leading to incorrect diagnoses or inappropriate prescriptions.

Unsafe patient transfers within the hospital were also identified as a safety-

threatening factor. Intrahospital transfers are an essential component of hospital care; however, they carry significant risks to patient safety due to the possibility of adverse events (39). Safe transfers require experienced staff, appropriate equipment, and adherence to standard guidelines (40). A particularly important consideration for COVID-19 patients is the risk of disease transmission to those involved in the transfer process. This risk can be mitigated through pre-established care protocols, the provision of necessary protective equipment and tools, and training for transfer team members. This training includes the proper use of personal protective equipment (PPE), infection control measures, coordination with other team members, documenting the patient's condition before and during the transfer, and managing the patient's condition throughout the transfer.

Unsafe patient discharge was identified as another factor threatening patient safety. In this regard, the findings of Matthias Marsall et al. demonstrated that a high-quality and safe discharge process is associated with fewer adverse events and better patient outcomes (41). Based on the results of this study, it appears that factors such as inadequate patient assessment before discharge, insufficient education on home care, stressful experiences and concerns following hospitalization, and a lack of home care equipment and facilities contributed to unsafe hospital discharges of COVID-19 patients.

Ineffective delivery of care and treatment services to patients and failure to implement two-tier triage, were also identified as factors threatening patient safety. A scoping study by Gustafsson et al. found that inadequate evaluation of patients' clinical condition and the absence of healthcare providers at the bedside can lead to preventable diagnostic and treatment errors, thereby jeopardizing patient safety (42). It seems that factors such as fear of contracting

the disease and transmitting it to family members, shortages of PPE, lack of trust in the effectiveness of PPE, and insufficient training of staff on preventing infection contributed to the lack of consistent bedside presence by caregiving and medical staff for COVID-19 patients, resulting in inadequate patient evaluations.

Insufficient adherence to standard precautions by healthcare staff was identified as one of the non-patient-related factors in the safety threats category. In line with this finding, studies by Daniel Joseph E. Berdida (43) and Raffaella Dobrina et al. (44) indicated that the overall compliance with standard precautions among nursing staff during the COVID-19 pandemic was below the desired level. Since nurses were on the front lines of combating COVID-19, their lack of involvement in implementing infection control policies warrants further investigation, as failure to adhere to standard precautions jeopardizes not only their safety but also that of patients and colleagues.

The findings of the present study showed that organizational-infrastructural safety threats were categorized into three main groups: "laboratory services, drugs and medical equipment," "human resources," and "physical resources." Within the "laboratory services, drugs, and medical equipment" category, subcategories included shortages of capital medical equipment, drugs, and IV fluids, as well as problems related to laboratory services. The "human resources" category was divided into two subcategories: quantitative shortages and qualitative deficiencies. The "physical resources" category was also divided into "shortages in physical space and service facilities" and "inefficiencies in ventilation systems and inadequate oxygen delivery.

" Shortages of capital medical equipment, drugs, and IV fluids, as well as issues with laboratory services, were identified as factors threatening patient safety. The deadly spread of COVID-19 overwhelmed the existing

capacities of healthcare systems in many countries. As the pandemic accelerated, shortages in preventive, diagnostic, and treatment equipment became a major issue in hospitals. Studies indicate that a lack of hospital equipment, drugs, and diagnostic tools to address the needs of COVID-19 patients led to increased mortality rates and heightened psychological stress among healthcare workers (45).

Quantitative and qualitative shortages in human resources were identified as another factor threatening patient safety. Tabatabaee et al. reported that a lack of human resources, staff dissatisfaction, and fear of contracting COVID-19 were among the main challenges faced by hospitals admitting COVID-19 patients (21). Similarly, Kamali et al. found that one of the key challenges for hospitals during the COVID-19 pandemic was the need for adequately trained and sufficient personnel (23).

Shortages of physical space and facilities, and inefficient ventilation systems, were also identified as safety-threatening factors. Consistent with these findings, similar studies in Iran reported that a lack of physical space, inadequate ventilation systems, and equipment shortages were significant challenges in delivering patient care at the beginning of the COVID-19 pandemic (21, 23). As the number of patients and hospital visits increased, the signs of these risks became more evident. Hospital wards designated for suspected COVID-19 patients quickly filled, necessitating the addition of hospital beds and, subsequently, the establishment of new designated hospitals in affected cities and, eventually, across the country.

Inadequate oxygen delivery was also identified as another factor threatening patient safety. Similar studies have shown that providing sufficient oxygen for hospitalized patients, especially those in intensive care units, was one of the major challenges for hospitals during the COVID-19

outbreak (23). The treatment of COVID-19, as a respiratory illness, requires close monitoring of blood oxygen levels and ensuring sufficient oxygen supplies are available. Severe COVID-19 infections are often associated with hypoxemia, which can be life-threatening (46, 47). Thus, oxygen therapy is the cornerstone of treatment for moderate and severe cases of COVID-19. During the pandemic, one of the critical challenges for referral centers was ensuring an adequate oxygen supply for patients. Oxygen supply and delivery systems were often limited, underscoring the need for precise monitoring and maintenance of all structural and technical components of hospital oxygen generation systems.

The findings of the present study indicated that managerial safety-threatening factors can be divided into four categories: "planning and decision-making," "supervision," "human resource retention," and "processes and protocols." These findings showed that the planning and decision-making category includes "failure to separate COVID-19 and non-COVID-19 patients based on underlying diseases" and "separating COVID-19 and non-COVID-19 patients without considering underlying diseases." The supervision category includes "ineffective implementation of medical equipment maintenance programs" and "inefficiency in procuring and distributing PPE." The human resource retention category includes "insufficient support for infected staff," "nursing staff workload," "staff fear and anxiety," and "reduction in human resources." The processes and protocols category includes "operational guidelines" and "medication protocols."

Based on the findings of the present study and similar studies, it appears that separating rooms for COVID-19 positive and negative patients was necessary to improve the safety of patients and staff, to prevent disease transmission to other patients and staff. However, the experience from the present

study indicates that separating COVID-19 and non-COVID-19 patients without considering underlying diseases caused irreparable harm to patients. Given that individuals with underlying diseases were considered vulnerable, adopting policies that addressed both aspects of the disease could have improved patient safety.

Ineffective implementation of medical equipment maintenance programs and inefficiencies in procuring and distributing PPE were identified as safety-threatening factors. The structure and performance of the medical equipment department are strongly correlated and are of particular importance in hospitals and health-focused systems (48).

Insufficient support for staff infected with COVID-19, nursing staff workload, staff fear and anxiety, and reduction in human resources were identified as managerial factors threatening safety. The COVID-19 pandemic led to an increase in the number of hospitalized patients and, consequently, an increased workload for nurses (49). On the other hand, the increased workload for nurses and the imposition of excessive work burdens over long hours, given the limited number of nursing staff, resulted in fatigue and decreased performance (50). The findings of a study by Kamali et al. showed that the COVID-19 pandemic caused healthcare providers to face numerous psychosocial challenges, including fear, anxiety, stress, a sense of crisis and war, and concern due to a lack of knowledge about the disease and its treatment, as well as fatigue, burnout, and insufficient support from managers (23).

Operational guidelines and medication protocols were identified as managerial factors threatening safety. The study findings indicated that events such as the cancellation of elective surgeries, the absence of standardized medication protocols, and frequent changes to medication protocols were safety-threatening events, consistent

with the findings of Tylor et al. (19). These protocols were designed to reduce the risks associated with viral infections and improve the quality of patient care. In fact, given the diversity and severity of COVID-19, there was a need to standardize hospital treatment and care protocols to prevent medication errors and adverse effects. These guidelines include recommendations on prescribing specific medications, providing special care for high-risk patients, and managing and monitoring treatment for COVID-19 patients. Implementing these protocols has helped hospitals address the challenges posed by the virus's spread. (51).

5.1. Study Limitations

This study faced several important limitations that should be considered when interpreting the findings. First, some healthcare workers declined to continue participating in interviews due to fatigue and unwillingness, which necessitated participant replacement. This issue may have affected the diversity of perspectives collected. Second, adherence to health protocols and social distancing measures made conducting interviews challenging for researchers. Third, because the study was conducted only in hospitals affiliated with Mashhad University of Medical Sciences, generalizing the results to the entire country requires caution and underscores the need for further research in other regions. Several solutions are proposed to address these limitations. To overcome participants' reluctance, appropriate motivational strategies, such as providing participation certificates or financial incentives, could be used. Conducting interviews virtually could also reduce challenges related to social distancing. To enhance the generalizability of findings, similar studies in other hospitals across different geographical regions of the country are recommended.

Additionally, employing mixed-methods (qualitative and quantitative) in future

research could yield a more comprehensive understanding of patient safety challenges during pandemics. Implementing longitudinal studies could also help track changes in safety threats over time and assess the effectiveness of implemented interventions. Finally, establishing a national registry of patient safety incidents during health crises could provide more robust data for future research and policy-making.

6. Conclusion

The results of the conventional content analysis indicate that factors threatening the safety of COVID-19 patients can be divided into four main categories: patient- and disease-related factors, task-related factors, management factors, and organizational-infrastructural factors. These categories help identify various challenges affecting patient safety and include 11 subcategories and 33 sub-subcategories, each addressing specific issues within the healthcare system. These findings reflect the complexity and multidimensional nature of patient safety issues in crisis conditions. Factors related to patients and diseases include mental health issues, the status of underlying conditions, and misdiagnosis, all of which can directly impact treatment processes. Additionally, task-related factors such as communication weaknesses, arbitrary medication administration, unsafe patient transfers, and unsafe discharges clearly indicate a need for improved workflows and communication in healthcare settings. These issues not only affect the quality of services provided but can also lead to increased adverse effects and decreased patient satisfaction. At the management level, challenges such as inappropriate policies for integrating COVID-19 and non-COVID-19 patients, shortages of human resources, and medical equipment must be addressed.

Furthermore, organizational infrastructural problems, such as insufficient physical space and ineffective ventilation

systems, also impact patient safety. All these factors necessitate careful examination and fundamental reforms in policies and operational programs. Based on these findings, it is recommended that health policymakers develop standardized protocols to improve patient safety. Additionally, creating educational programs for healthcare workers to enhance awareness about patient safety is essential. Supporting human resources—such as increasing the number of nurses and providing suitable working conditions for healthcare staff—should be prioritized. Finally, attention to infrastructure and ensuring adequate medical equipment supply is vital for maintaining patient safety during critical situations like the COVID-19 pandemic.

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