



ISSN (E): 2277-7695

ISSN (P): 2349-8242

TPI 2024; 13(1): 160-165

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Received: 08-11-2023

Accepted: 18-12-2023

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## A study of the major Saudi tertiary hospital emergency department handles COVID-19 disaster

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### Abstract

**Background:** The COVID-19 epidemic has shown how important EDs are for handling public health emergencies. After the COVID-19 pandemic hit Saudi Arabia, this study article delves into how the emergency department of a large tertiary hospital dealt with the situation. The COVID-19 pandemic had a devastating impact on Saudi Arabia. The emergency department (ED) of Riyadh's King Faisal Specialist Hospital & Research Centre took the initiative to handle the situation.

**Methods and Patients:** Through a combination of our knowledge gained from handling an earlier outbreak & search of the worldwide literature, we were able to develop safe procedures for our emergency department patients.

**Results:** ED changes improved patient care, avoided unnecessary admissions, reduced cross infection risk, and increased staff safety.

**Conclusions:** COVID-19 patients were better served by the streamlined emergency department procedures supported by integration.

**Keywords:** COVID-19, hospital, patients, emergency department

### 1. Introduction

The emergence of the COVID-19 disaster has posed unprecedented challenges to healthcare systems worldwide, demanding rapid and effective responses from hospitals and emergency departments. This study aims to investigate the strategies, protocols, and experiences of a major tertiary hospital in Saudi Arabia in managing the surge of COVID-19 cases within its emergency department. Saudi Arabia, like many other countries, faced the daunting task of adapting its healthcare infrastructure to cope with the overwhelming influx of COVID-19 patients. Tertiary hospitals, being at the forefront of critical care and emergency services, played a pivotal role in the national response to the disaster. Understanding how these healthcare institutions navigated the complexities of the crisis provides valuable insights for enhancing future preparedness and response efforts.

The emergency department of a major Saudi tertiary hospital became a crucial battleground in the fight against COVID-19. This study seeks to explore the following key aspects:

**Preparedness and Planning:** Investigating the hospital's preparedness measures before the surge of COVID-19 cases, including the development of protocols, training of staff, and allocation of resources.

**Operational Challenges:** Examining the operational challenges faced by the emergency department during the peak of the disaster, such as patient triage, resource shortages, and the implementation of infection control measures.

**Clinical Management:** Assessing the strategies employed for the clinical management of COVID-19 patients within the emergency department, including the use of advanced medical technologies, treatment protocols, and the coordination with other healthcare units.

**Staff Well-being:** Considering the impact of the disaster on the well-being of healthcare professionals working in the emergency department, including psychological stress, workload, and coping mechanisms.

**Community Engagement:** Evaluating the hospital's efforts in engaging with the local

community to disseminate information, address concerns, and encourage compliance with public health measures.

The initial report of COVID-19 occurred in China on December 31, 2019. The first confirmed incidence in the Kingdom of Saudi Arabia (KSA) occurred on March 2, 2020<sup>[1]</sup>. On March 11, 2020, the World Health Organization (WHO) proclaimed it a disaster. Worldwide, 3, 77, 388 people have lost their lives and 6, 799, 713 cases have been confirmed as of June 8, 2020. At the time of writing, KSA has recorded 98,869 confirmed cases, including 676 fatalities<sup>[2]</sup>. The COVID-19 pandemic rapidly overwhelmed the world's most sophisticated emergency response systems<sup>[3]</sup>. There was a real danger that these infected individuals might overwhelm the already overburdened EDs<sup>[4]</sup>. In response to this catastrophic event, several emergency plans were put into place around the world<sup>[5-7]</sup>. The steps that our emergency department took were in line with the global guidelines. Our goal in doing this literature review was to document the measures taken by our emergency department in response to the COVID-19 pandemic and to identify any specific international emergency protocols that may be applicable.

### 1.1 Research Method & Patients

The method of research describes the study design, data collecting, and analysis. Ethical considerations, data collection methods (including interviews, questionnaires, or paper evaluation), & process for selecting the hospital are all detailed in the report. We used the basic research approach to search the US National Library website (NCBI) utilizing terms such as COVID-19, COVID-19-related ED procedures. After reviewing the abstracts of all 720 publications we found, we narrowed it down to 25 that were directly related to our research issue. For this work, we studied each of the referenced articles in its entirety. "COVID-19 [All Fields] AND ([emergency service, hospital]) OR ([emergency service, service]) AND ([emergency hospital]) OR ([emergency service, service]) AND ([emergency service, department]) OR ([Emergency department]) AND ([emergency service, process]) AND ([emergency service, steps])"

## 2. COVID-19-related ED procedures

When it comes to cancer and transplants, the most patients are seen at King Faisal Specialist Hospital & Research Centre, KSA's biggest tertiary care facility. Therefore, it is prepared to handle complicated clinical circumstances including advanced sepsis in its emergency department. The deadly "Middle East Respiratory Syndrome" (MERS CoV-1) began in Saudi Arabia, and from 2014 to 2018, it was a leading authority in handling the virus<sup>[6]</sup>. Applying what it had learned from that mild outbreak, it fortified itself to face the enormous challenge posed by the COVID-19 pandemic. After the COVID-19 pandemic, our emergency department took the following crucial actions:

### 2.1. ED admission screening

Nurse aides were stationed at each entry leading to the EMS building, and they screened all individuals entering. They offered surgical masks, hand sanitizer, & non-touch temperature monitoring equipment.

### 2.2. ED waiting room COVID-19 safety protocols

The audiovisual safety advice was shown on posters &

computer screens. According to the "social distancing principles," the seating arrangement was changed. The waiting room now has a dedicated space for people with respiratory issues to sit. There was a strict limit of one patient attendant per facility.

### 2.3. Pre-hospital Staff

The hospital's ambulances staff received simulated training on how to identify symptoms, provide organized pre-alerts, & transport a patient suspected of having COVID-19 to the ED. It was imperative that the ambulances adhere rigidly to the prescribed disinfection protocols while in transit.

### 2.4 Outside ED decontamination tent

A tent was set up outside the emergency department to screen patients in anticipation of a large-scale presentation of COVID-19 cases. A portable oxygen supply & place to draw diagnostic swabs were available in this tent.

### 2.5. ED screening area at the front ends

Prior to their appointment, all new patients were examined at the registration counter for signs of infectious diseases. Patients were categorized based on their risk using the Severe Acute Respiratory Index (SARI) (Fig. 1). Patients who did well on this validated assessment were moved to the screening area's negative pressure cubicles.

### 2.6. Triage suspected patients

Skilled triage nurses were quickly sent to surround a possible patient, evading the screening process. They were promptly assigned a suitable clinical area & brought to the notice of the emergency department physician.

### 2.7. Allocation of clinical space

Specifically for COVID-19 patients, the emergency department designated four rooms with negative pressure. Portable "HEPA-filters" were also present in other cubicles. Healthcare providers were instructed to apply the proper protective gear before enter the examination cubicles, which had airborne precautions posted on their doors.

### 2.8. The field of respiratory diagnosis & therapy

A "respiratory screening area" consisting of 11 cubicles was set up outside the main emergency department to safely transfer ambulatory individuals suspected of having COVID-19 to a diagnostic center. They were treated according to their clinical symptoms, and most of them were sent home while they waited for the results of the COVID-19 test.

### 2.9. Emergency room patients with COVID-19 can access fast PCR testing

We maintained a 70-minute turnaround time for this test. If a patient's test came back negative, they might be swiftly transferred from the emergency department to their inpatient beds. A specialized group transported the patients who tested positive to the hospital's COVID-19 ward. It was also determined that POCT for COVID-19 was valid for use in emergency departments. One CT scanner was set aside just for patients with COVID-19, & examination cubicles were used to organize the chest X-rays.

### 2.10. ED staff

Every member of staff had an in-house fit exam for N95

respirator masks, also known as "Powered Air Purifying Respirators" (PARP). Also anticipated was the N95 mask scarcity, which led to the initial activation of regulated distribution. The emergency department personnel were asked to use the department's N95 masks, while the specialists were asked to bring their own masks from where they were from. There was a prominent sign outside the emergency

department cubicles reminding staff to wear safety gear during aerosol operations. In addition, these preventative measures were covered during the daily staff meetings. The screening for COVID-19 was conducted with a focus on the suspected workers in the emergency department. A specially designed housing complex was used to segregate any affected expatriate staff.

Clinical Signs and Symptoms and Medical History:		
Fever or recent history of fever	<input type="radio"/> Yes <input type="radio"/> No	
Shortness of breath (new or worsening)	<input type="radio"/> Yes <input type="radio"/> No	
Cough (new or worsening)	<input type="radio"/> Yes <input type="radio"/> No	
Nausea, vomiting, and/or diarrhea	<input type="radio"/> Yes <input type="radio"/> No	
Chronic renal failure, CAD/heart failure, Immunocompromised patient	<input type="radio"/> Yes <input type="radio"/> No	
Exposure Risks:		Number of Exposure
A history of travel abroad during the 14 days prior to symptom onset	<input type="radio"/> Yes <input type="radio"/> No	<input type="text"/>
Visiting or being a resident of a high-risk area for COVID-19 in the kingdom during the 14 days prior to symptom onset*	<input type="radio"/> Yes <input type="radio"/> No	* (Riyadh, Holy City of Makkah, Madinah, Jeddah, Al-Hofuf & Al-Qatif)
A close physical contact with a confirmed case of COVID-19 or MERS-CoV in the past 14 days	<input type="radio"/> Yes <input type="radio"/> No	
An exposure to camel or camel's products (direct or indirect **) in the past 14 days	<input type="radio"/> Yes <input type="radio"/> No	** Patient or household
Working in a healthcare facility	<input type="radio"/> Yes <input type="radio"/> No	
Total SARI Score	<input type="text"/>	
<p>A score = 4 or above, ask the patient to perform hand hygiene, wear a surgical mask, direct the patient through the respiratory pathway and inform MD for assessment.                      MRSE-CoV OR COVID-19 testing should be only done according to case definitions</p> <p>* This screening form DOES NOT replace Physician assessment and decision-making                      * Consult with Infection Control &amp; Hospital Epidemiology (ICHE) as required</p>		
Patient/Sitter Instructions		
<b>Patient Instructions: Action Taken</b> <input type="checkbox"/> MD informed of SARI screening result <input type="checkbox"/> Patient given surgical mask to wear <input type="checkbox"/> Patient placed in negative pressure room	<b>Additional Comments</b> <input type="text"/>	
<b>Sitter/Accompanying Person Screened</b> <input type="radio"/> N/A <input type="radio"/> Yes <input type="radio"/> No	<b>Additional Comments</b> <input type="text"/>	

Fig 1: Adult SARI tool.

### 2.11 ED physicians

For the benefit of our junior doctors & related staff, our consultant-based emergency department assisted in organizing on-floor simulations. In those specific rooms, you could practice endotracheal intubation with both the emergency department & intensive care unit teamed together. Also practiced for COVID-19 patients was an altered CPR protocol. Emergency department consultants have finished a critical thinking course for "non-ICU physicians" online in order to be ready for the "hospital surge plan" (Fig. 2). The asymptomatic and those with mild symptoms were urged to

remain at home while the number of COVID-19 patients increased dramatically. A special COVID-19 virtual shift was set up for that exact reason, and a consultant from the emergency department communicated with all of the COVID-19 positive patients who had been released from the ED within the past twelve hours. Their symptoms were used to triage them. This physician's duties were shifted to exclusively consult with COVID-19 patients who were unwell, as another clinical team was established for this purpose (Fig. 3).

DEPARTMENT OF EMERGENCY MEDICINE COVID 19 SURGE PLAN (ADULT EMERGENCY MEDICINE)			
SURGE LEVELS	DEFINITION	TRIGGER	RESPONSE LEVEL
I. Pre-Surge	Cases reported at KSA or Risk imported cases	Risk but no cases	<ul style="list-style-type: none"> <li>Risk assessment initially and periodically</li> <li>Follow case definition</li> <li>Screening area pre-registration of patients and Ambulances</li> <li>Follow the hospital endemic sub-plan for Emergency Room</li> </ul>
II. Minor Surge	Low number of cases in ER Max 1 case intubated	2-5 cases in ER	<ul style="list-style-type: none"> <li>Positive Patients assigned to NPR in Main ER</li> <li>Clear Resuscitation Area from other patients and lock it</li> <li>Change Physician schedule to (12 hours)</li> <li>Re-assign residents to Adult Zone and LI</li> <li>Move admitted patients to Adult zone, Zone 4, Fast track and CDU</li> <li>Keep Rooms 1 to 21 vacant from regular patients and ready to be used for positive or high risk cases</li> </ul>
III. Moderate Surge	Moderate number of cases in ER	5-10 cases in ER More than 1 intubated	As level II, and, <ul style="list-style-type: none"> <li>Move Screening and Triage to outside ER</li> <li>Divert CAT A&amp;S to another facility</li> <li>Call extra staff to cover Reus (add 1 physician)</li> <li>Involve ICU early for possible assignment in ER</li> </ul>
IV. Major Surge	Large number of cases in ER	10-20 cases in ER	As level III and, <ul style="list-style-type: none"> <li>Divert CTAS 3 and stable to another facility</li> <li>Clear adult zone and move patients up to CDU/ FT</li> <li>Call extra staff for coverage (add 1 physician)</li> <li>Involving staff from other departments through MCA (nurs, med)</li> <li>DEM admin in ER 24/7 to oversee operation</li> </ul>
V. Large Scale Emergency	Large number of cases in ER	> 20 cases in ER	As level IV and, <ul style="list-style-type: none"> <li>Close ER to any patients except Resuscitation</li> <li>Extra staff to be called in</li> <li>Divide staff to team A and B</li> <li>Consider using Pediatrics area and Zone 4</li> <li>Consider using Halfway</li> </ul>

\*Diverting patients to another health care facility or closing ER is decided based on the department situation (Adult and Pediatric)

Fig 2: Plan DEM for Adult EMCOVID-19 Surge

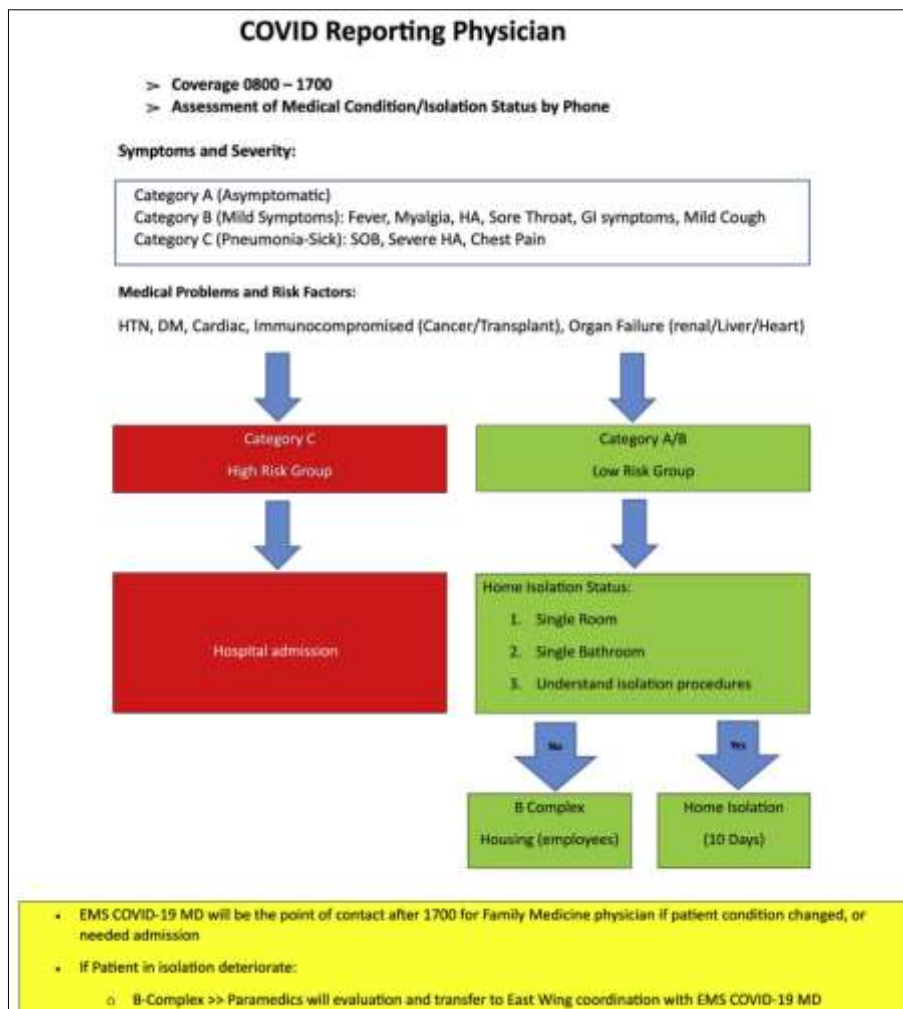


Fig 3: Medical reporting of COVID-19

### 3. ED COVID-19 patient reduction measures

#### 3.1. Patient awareness

ED visits due to the "Fear Factor" spiked following the COVID-19 pandemic announcement. The number of patients visiting the emergency department dropped dramatically after a public awareness campaign was launched through the media, the Ministry of Health's website, & enforcement of curfew (Fig. 4).

#### 3.2. Complete the COVID-19 drive-through

Bypassing the emergency department, this approach vetted the stable workers and patients.

#### 3.3. Online medical consultations

For a span of two months, the medical center cancelled all of the planned outpatient clinics. The two-pronged effect of this action reduced ED inflow. As an example, it halted the influx of admitted patients sent from clinics to the emergency department as a result of a shortage of hospital beds. Patients were also made more aware through the tele-consults that it is not always necessary to have a face-to-face clinical session.

#### 3.4. Clinic hotline accessibility

In order to address non-emergent matters, hospitalized patients were provided with direct phone connection to their appropriate primary care clinic.

#### 3.5. The COVID-19 clinic is set up

It was set up to check in with COVID-19 patients every day who were thought to be good candidates for home isolation.

#### 3.6. Hospital wing designated for COVID-19

The geographically isolated locale was ideal for housing & caring for the COVID-19 patients requiring inpatient care. Patients requiring ventilatory care also had access to a private intensive care unit. If the clinical condition of the COVID-19 patients being monitored at home were to deteriorate, they could be promptly transferred to their designated bed.

#### 3.7.3 Infectious disease expert & dedicated microbiological

The purpose of this was to speed up diagnostic testing, treatment decision-making, & provision of expert assistance, especially to frontline employees.

### 4. Discussions

The COVID-19 pandemic is a major health crisis. Its relative mortality rate is 10% lower than that of MERS CoV-1 (34.4%), but its transmissibility is significantly higher [7, 8]. Additionally, the manner of transmission for both scenarios is identical. The COVID-19 issue was handled in the same way as the MERS CoV-1 one. When it comes to handling surges, prior successes often pay off [9]. Emergency departments have a "major disaster plan" in place to coordinate responses to large-scale crises [10, 11]. The COVID-19 pandemic not only prompted a rapid response, but it also caused a sea change in the way hospitals handle emergencies [12, 14]. The "COVID-19 task force," comprised of influential members from across the hospital, oversaw a "command & control center" situated adjacent to our emergency department. To aid in the improvement of emergency department patient flow, all key departments collaborated and removed bottlenecks. In cases of mass casualty, this collaborative strategy yields positive results [14, 15]. In order to better care for COVID-19 patients,

the emergency department adjusted its "Cardio-Pulmonary Resuscitation" (CPR) protocols in accordance with worldwide guidelines. Early endotracheal insertion without initial bag & mask breathing was one example of how plans were adjusted to account for the possibility of airborne and droplet transmission of this disease. The risk of infection transmission can be decreased by implementing evidence-based clinical procedures [16, 17].

Given their heightened susceptibility, we screened all patients presenting to the emergency department with fever for COVID-19 as a preventative measure. Once the emergency department made the "decision to admit," we established a shared standard operating procedure (SOP) to ensure that the admission of patients by the specialties would not be delayed. A more proportional reaction can be fine-tuned via an anticipatory method that involves studying the disease pattern [18, 19]. Throughout the crisis, our emergency department did not experience any changes in patient mortality and did not record any safety incidents related to COVID-19. This could be due to the following factors: emergency department readiness, participation of senior physicians, strong transfer procedure, & ready availability of these processes, all of which contributed to a decrease in patient mortality [20]. Having a trained emergency department staff on hand is crucial for catastrophe management [21]. Lifesaving measures included effective screening, efficient use of space, barrier nursing, quick testing, and treatment. ED ensured the safety of its employees by providing them with detailed protocols, PPE, frequent exercises, & daily situation updates [22]. Consequently, during weekly audits, the majority of the emergency department staff were discovered to be following the department's standard operating procedures.

Our organization adjusted its approach based on the evolving situation. When making plans, the hospital's "command & control" center prioritized the emergency department's position. This allowed the emergency department to decant more smoothly & handle any unexpected surge in patients more effectively. A key factor in managing surge is the priorities established by leaders and those in charge of the health system [23]. As a result of COVID-19, emergency department personnel have altered their practices. It has inculcated Behaviours such as maintaining a safe distance, regularly washing hands, & wearing protective gear. It has also made people feel physically and psychologically ready for anything like this. In the face of this novel threat, EDs' resiliency, dedication, and integrated strategy proved invaluable. The spread of COVID-19, which is here to stay for the foreseeable future, was slowed down by these best practices [24].

### 5. Limitations

These procedures may not be applicable to smaller emergency departments since they were developed for a large tertiary center with an unusual patient population.

### 6. Conclusions

ED's reaction to the COVID-19 pandemic at Major Saudi Tertiary Hospital has taught us a lot about the difficulties and solutions to worldwide health crises. The hospital's dedication to provide top-notch treatment is evident in its capacity to adjust current methods & come up with innovative solutions in response to the specific elements of COVID-19. When dealing with a crisis, efficient ED procedures are invaluable.

In order to effectively manage a complex scenario like COVID-19, careful planning & an integrated strategy are essential. Any comparable future events can benefit from the procedure & practices implemented by the Emergency staff.

### 7. Ethical Consideration

All applicable international standards of ethics have been considered throughout the writing of this work.

### 8. Declaration of competing interest

There are no apparent conflicts of interest, as the writers have stated.

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