

**Improving Access To The Operating Room In The Largest Tertiary Hospital In The  
United Arab Emirates (UAE)**

by

Ammar Najjar

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## **Abstract**

Access to the operating room within the priority target time frame significantly correlates with the capacity, demand, scheduling, and prioritization culture. The result of this project shows that the prioritization and scheduling culture along with subjective preference are the most influential factors affecting the access to the operating room (OR).

This project involves a workflow review and Mind-Mapping of the operating room process at Sheikh Shakhbout Medical City (SSMC) Abu Dhabi/United Arab Emirates. Results show that substantial gains can be realized by improving the compliance with the objective surgery prioritization while clinical decisions influence resource optimization and access to care. Also, matching the demand with capacity will reduce the overutilization in the inpatient capacity due to the limitation of access to the OR.

The recommended actions to improve the access to the OR are to create a workgroup with a focus on access to care, to make data transparent, to digitalize the booking process, and to match the capacity with demand for emergency volumes. This project dramatically improved the compliance with access to the OR from 32% during the first quarter of 2020 to 79% during the same period of 2021.

The primary beneficiaries of this improvement are the emergency patients who require immediate access to surgery to optimize their clinical outcomes and reduce their unnecessary hospital stay. The benefits extend to the organization and health system by optimizing resource utilization and matching the right acuity to the correct level of care.

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## PROJECT SCOPE

Shaikh Shakhbout Medical City (SSMC) is the largest tertiary hospital in the United Arab Emirates (UAE) with a total capacity of 750 bed. The operating room department at SSMC has a block schedule with maximum capacity to run up to nine operating rooms per day with the current workforce from nursing, anesthesia and support services. These nine operating rooms cover the elective and emergency surgical demands during the elective prime time (08:30-16:30) five days per week, Sunday through Thursday. Recently, SSMC acquired new service lines from other SEHA healthcare facilities, which adds pressure on the operating room department to readjust the block schedule to accommodate the additional demand. The operating room department at SSMC consists of 18 operating rooms as follows:

- One hybrid room (located in the main OR complex)
- One Endo-Urology room (located in the main OR complex)
- Thirteen rooms assigned per specialty (located in the main OR complex)
- One burns operating room (located in the burns unit)
- Two cesarean operating rooms (located in the labor and delivery suite)

The operating room is considered one of the most expensive and critical hospital assets since many hospital admissions require surgical interventions (Guerriero & Guido, 2011). The management of an operating room is a complex adaptive process: the use of mathematical, quantitative techniques, and strong leadership play a significant role in daily operations.

**Surgery waiting time** is defined as the time from the surgery/procedure decision to the time patient enters the operating/procedure room: starting with how long the patient waited from

deciding with the surgeon to proceed with surgery, up until entering the operating/procedure room.

The requests for emergency surgery are stochastic, can occur at any time throughout the day, and the nature of emergency surgery requires the hospital to gather the necessary resources within a limited time frame. The length of this limited time frame depends on the surgery's priority level (I, II, III, IV). While emergency patients and their clinical conditions are uncontrollable, this random variability can be predicted based on historical analysis and accommodated with resilient capacity and workflow.

O'Leary and colleagues (2014) found that delays in access to care for emergency surgeries have significant clinical and financial implications due to complications and hospital length of stay. The surgical priority is determined by the Most Responsible Physician (MRP) or the attending physician based on evidence from the patient assessment and investigation reports. Dexter and colleagues (1999) showed that effective sequencing of non-elective cases might be essential to maintain patient safety, enhance patient satisfaction with their surgery's timeliness, and minimize surgeons' complaints.

## **CURRENT STATE AND DATA COLLECTION**

During the period from January to June 2020, around 2027 emergency surgeries were completed at SSMC. The daily average number of emergency cases was 17 cases per day (range of a minimum of 12 to 22 cases maximum per day). During the same period (January-June 2020), the average compliance rate for level I and II emergency cases was 50%, indicating that half of level

I and II cases did not get access to the OR within the recommended clinically accepted time frame.

Level (I)	Level (II)	Level (III)	Level (IV)
Limb/ life-threatening condition, shall be operated on within one hour.	Patient condition will deteriorate significantly if not operated on within two hours.	Case cannot wait until the next day elective schedule, and patient should be operated on within eight hours.	Inpatient admitted in the hospital and should be operated on as urgent before discharge.

Figure 1. Four emergency prioritization levels.

The current operating room volume consists of 50% elective and 50% emergency surgeries. The volume distribution means that 50% of the volume was unscheduled. The case distribution during the period January-October 2020 is depicted in Figure 2.

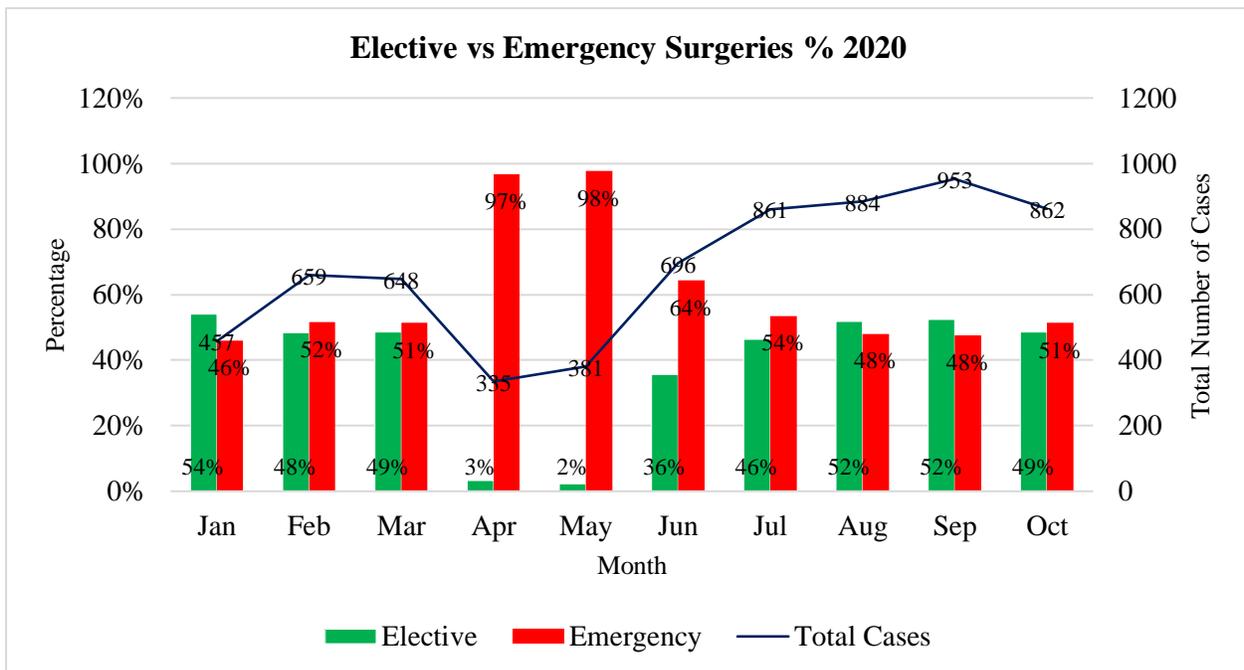


Figure 2. Elective vs Emergency surgeries percentage (January - October 2020). The artifact in the second quarter trend was attributed to the COVID-19 surge and the subsequent suspension of elective surgeries.

This project investigates, analyzes, and enhances patients' access to the operating room and provides an optimization solution proven statistically. The optimal block distribution is the block that achieves the emergency access within the timeframe and maintains the elective block utilization above 70% among services based on their demand and capacity. The project will aim to identify and reduce bottlenecks.

There are challenges anticipated in this project related to data collection, validation, and analysis. Providers buy-in of the analysis results and the proposed changes will affect their daily assignments and schedules. The last challenge will be the change and shifting the culture from the individual view to the service view. Overall, the operating room ecosystem is complex from both process and organizational aspects. The volume and case mix add complexity in accommodating the variable patient needs.

In this project, every surgery is considered part of an overall project of grouped activities. Some sets of resources and methods can only perform activities at a specific capacity. The resources' availability determines the activity time and method, and all the resources have their availability schedule.

The emergency scheduling policy at SSMC stipulates that any emergency case that cannot be placed in an emergency OR within the agreed time frame then requires that an elective case for the same service be delayed to accommodate the emergency case. If there are no elective cases of the same service, then the first available OR of any service will be delayed to accommodate the emergency case.

## DATA ANALYSIS AND TEAM BUILDING

The project started in May 2020 with retrospective data from 2019 and January to May 2020.

Retrieved data from the surgical request forms were validated by the electronic surgery orders and the scheduling module's case entry. The timestamps were captured precisely to reflect the surgeon's decision for surgery, surgery request form receiving date and time to the OR, and when the patient entered the OR. Data were entered and analyzed in Excel statistical solution.

In 2019 and the first quarter of 2020, an average of 60% of the emergency cases were level I and II, with a 32% compliance rate for the emergency time frame. During the second quarter of 2020, the perioperative leadership team highlighted the importance of compliance with the emergency definition and addressed the prioritization in several leadership meetings.

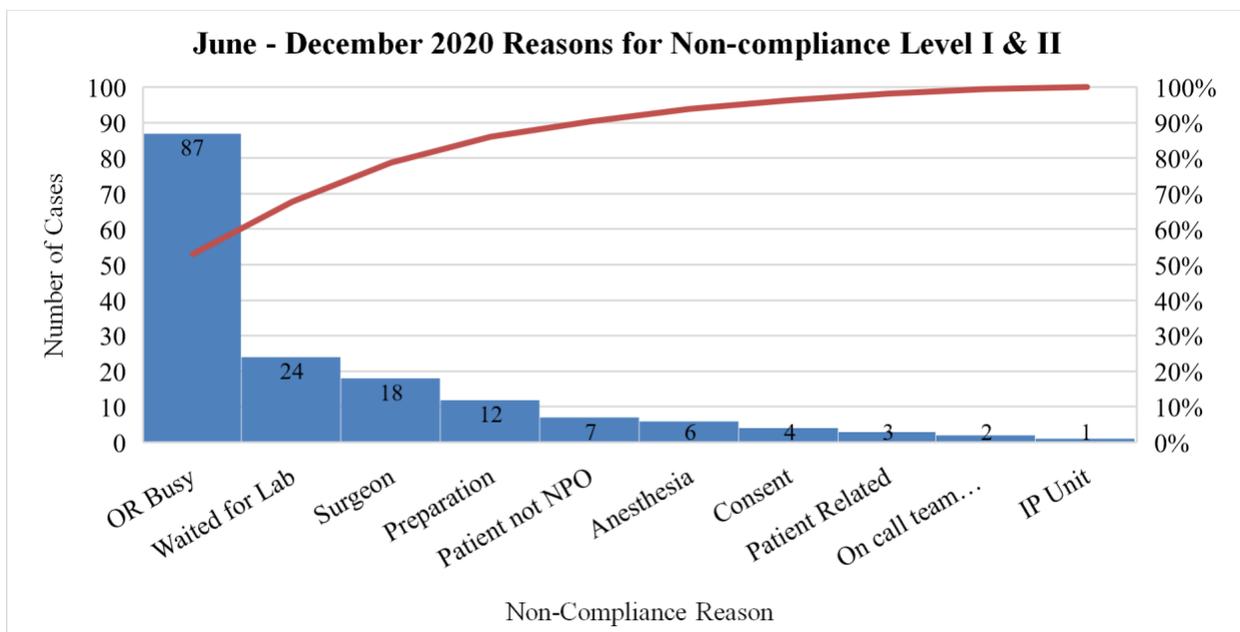


Figure 3. The average monthly non-compliance reasons for level I and II emergency surgeries (June-December 2020). The primary constraint in the system 87/164 (53%) is attributed to the availability of OR capacity.

The operating room's main challenge is responding to emergency needs within the priority time frame due to the random variability and uncontrolled emergency volume. There are two operating rooms allocated 24/7 for the emergency needs at SSMC, excluding the labor and delivery emergency operating room. One of the two emergency ORs is assigned for trauma level I emergencies due to the volume of emergencies and trauma center designation.

During the interview sessions conducted with the surgical service's leadership at SSMC, there was consensus among the interviewed members that access to the operating room and level of emergency preparedness need urgent attention, as well as senior leadership support, in order to find a sustainable solution for increased volume with limited resources. The same members highlighted the scheduling prioritization and variability among surgeons as a problem area.

<b>Stakeholder</b>	<b>Reason for Selection</b>	<b>Interview Notes</b>
Chief of Surgical Services	Dr. Salem is the chairman of the surgery and procedural committee at SSMC and the surgery committee chair across the SEHA system.	"Access to care is the Surgical and Procedural Committee and system's priority."  "We have cases that should not be on the emergency list."  "The majority of the level I and II emergency cases are not really level I and II."
Chief of Anesthesia Services	Dr. Ahmed is the medical director for the operating room and post-anesthesia care unit. He is also the floor manager in the OR and manages the list sequence, challenging the surgeons when needed to prioritize resources and sequence.	"The number of emergency cases that we have is high, and we expect to have an influx of emergency cases after the service line move in and the integrated service model with the system."  "We have a problem in accommodating emergency cases within the priority time frame due to the volume and inconsistency in prioritization and subjective variability."
Charge Nurse – Operating Room	Responsible for coordinating the traffic and case sequence management	"I have seen inconsistency in scheduling emergency cases." Many patients don't have access to the OR within their priority target time frame."

	with the chief of anesthesia services.	"It is a problem; we had several incidents where the patient's condition deteriorated due to delay in access to OR."
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Figure 4. The statements of the surgical services leadership members included in the interview sessions.

Related literature found a strong correlation between access to the OR, mortality rates, postoperative outcomes, and OR efficiency; therefore, access to the OR has clinical and operational implications. (Acharya et al., 2014; Daniel et al., 2019; Guerriero & Guido, 2011; Marilyn & James, 203; O'Leary et al., 2014; Sobolev et al., 2013).

During the data validation, it is imperative to highlight the importance of electronic data capture for the surgery scheduling process. The integration of both paper and electronic processes in the surgery workflow adds a risk of reliability and delays OR notification. Therefore, another project has been initiated to automate the surgery booking process through EMR to eliminate the paper process.

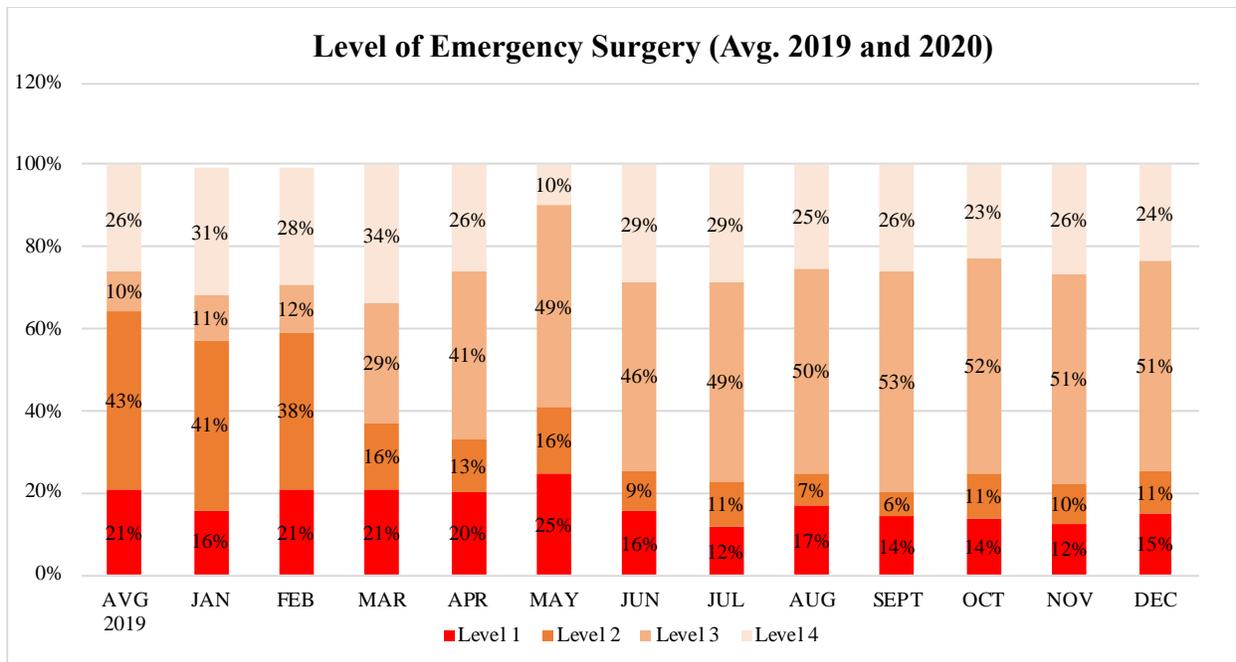


Figure 5. The average (mean) percentage per level of emergency surgery (Avg. 2019 and Total 2020). The dramatic reduction in level II percentage throughout 2020 linked to the increase in level III emergency patients.

Individual interviews and data analysis showed that most interviewed surgeons had a subjective view of the emergency surgery prioritization criteria; subsequently, providers' personal preference caused the high volume of level I and II emergencies during 2019 and the first quarter of 2020. During the first quarter of 2020, an average of 50% of the total emergency patients were categorized as level I and II emergencies.

Delays in access to the operating room are multifactorial, and their measurement from the existing electronic medical record can lack pertinent details. For this reason, another project was initiated to digitize the scheduling process. From a capacity perspective, the availability of surgeons, anesthesiologists, and other staff in surgical teams and the required medical equipment affect response activity rates.

## **PROPOSED SOLUTION**

Data in Appendix B-1 and B-2 showing that around 70% of the emergency (level I, II, and III) bookings during working hours are being sent to the OR between 05:00 – 08:00 in the morning. Further review and tracing found that 80% of the patients were admitted a day before or earlier. There were two hypotheses related to this trend; firstly, the surgeons plan their cases for the next day and hold the bookings to be released to the OR between 05:00-08:00 to have priority to operate first on the list during working hours. The second hypothesis is that the surgeons hold their surgical plans to the next day in order to review the new admissions and re-prioritize their cases according to the capacity and patients' needs. Both hypotheses require further study and review as each hypothesis would require a different action plan.

The data shows that 25% of the volume during working hours attributed to the level I, II and III emergency cases does not correlate with the provided capacity to accommodate this category of patients. There are two operating rooms allocated to accommodate the emergency volume 24/7. Thus, compliance with the priority time frame is hindered, especially when long cases occupy these rooms.

The proposed solution will be carried out in three phases:

### **Phase I**

1. Create Access Work Group (WG): The WG will include a representative from anesthesia, administration, surgeons, nursing, and senior leadership from the medical office. The WG objectives are to streamline emergency access to the OR, to optimize resources, and to review capacity.

During the initial meetings with the stakeholders, there was great engagement from the senior leadership team in addressing the OR access. The engagement has brought a dramatic improvement in access to the OR for emergency patients.

2. Share the data findings broadly through the SPC and monthly OR meetings. The primary purpose of sharing the data at this scale is to shed light and attention on how serious the access to the OR could be, while having the surgeons collectively address the demand and capacity issues. As mentioned by the Chief of Surgery, "Even if you expand the capacity, there will be a case one day that will require access to OR when all ORs are occupied. The surgeons collectively need to address this issue to prioritize the patient's need over any subjective preference" (Dr. Al Harthi).

## **Phase II**

1. Process Automation and Digitalization: Despite the project's scope addressing level I and II emergency cases, the need for a comprehensive electronic surgery scheduling system is critical for sustainability and continuous improvement. The current scheduling process is redundant for both elective and emergency categories. Automation will provide accurate data on the timestamps throughout the surgical journey for future improvement projects.

In October 2020, the automation and digitalization workgroup began an initiative to convert the surgery booking process from paper to digital format. There has been significant progress with the stakeholders in mapping the process, navigating the patient's journey for both elective and emergency categories, and building the electronic module

within the electronic medical record (EMR). The automation process is planned to go live during the second quarter of 2021.

### **Phase III**

1. Capacity, Demand and Block Schedule Review: The Surgery and Procedural Committee (SPC) will review the current capacity, demand, and block schedule allocation strategy. The OR capacity is divided into blocks of four hours each. The block schedule is assigned for surgeons during working hours (Sunday-Thursday) from 08:30-16:30. Shifting the block allocation from individual surgeon to specialty block allows each service line to take the lead in distributing the allocated surgical slots among the service providers based on volume, demand, service coverage and community needs. The chiefs of services will lead the allocation of the approved capacity among the privileged surgeons in the specialty to ensure service coverage for both elective and emergency surgeries throughout the patient's journey.

The transfer of block responsibility from the SPC to the service lines aims to promote accountability among the specialty to utilize their allocated block effectively and achieve greater than 70% utilization. Simultaneously, to accommodate any emergency needs within the specialty allocated block schedule whenever the emergency ORs are occupied. Decentralizing the elective block schedule will bring the service lines onboard in addressing the non-compliance related to factors other than the OR capacity. The non-compliance with the priority time frame varied between specialties, some specialties (e.g., general surgery, plastic/burns, orthopedic, neurosurgery, and pediatric) accounting for 80% of the total non-compliance during the period from January – December 2020. The

proposed block reallocation will take into consideration the specialties with the high percentage of non-compliance to allow the allocated blocks to accommodate the emergency needs.

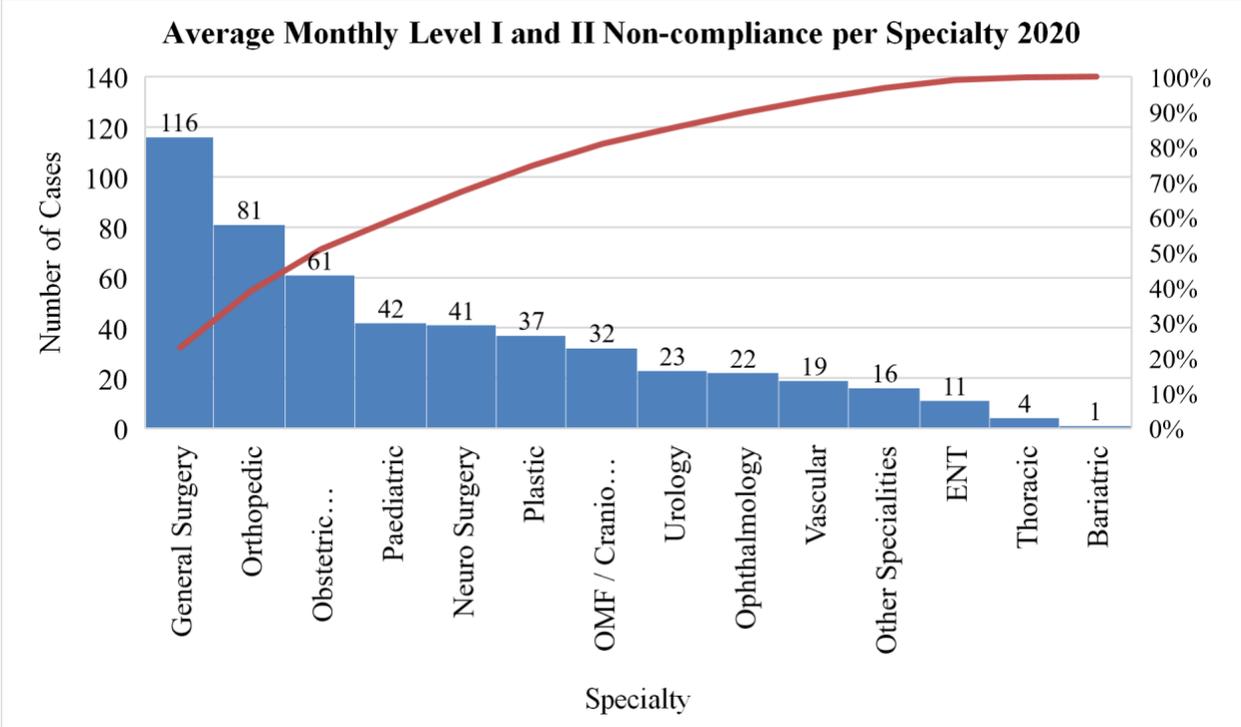


Figure 6. Average Monthly Level I and II Non-compliance per Specialty (2020).

2. Align the capacity with the demand during working hours for managing the stochastic emergency demand. This alignment will be achieved by continuous demand and capacity data modeling, block reallocation and open additional OR capacity to meet the demand. The alignment will reduce delays and provide capacity for additional elective volume. The alignment aims to reduce the number of emergency patients (level I and II) exceeding the recommended waiting time frame (mean 32% in 2020) illustrated in Figure 7. Besides, it will reduce the inpatient capacity waste due to the limited access to the OR and length of stay postoperatively.

3. Exploring the option of relocating the satellite operating rooms (burns, labor and delivery) under the respective service line's management. The responsibility relocation will reduce the daily load on the OR to accommodate other emergency needs. By considering these recommendations, it will improve OR resource optimization through using the advanced resources for the complex cases while promoting value-based care through matching of patient needs with the level of care.

Looking into the case distribution during working hours (2020), an average of 27% of the volume is random and unpredictable on all levels I, II and III. Based on the provided capacity of ten ORs (eight for elective and two for emergency needs), the capacity distribution does not meet the actual demand for emergency needs in order to respond within the recommended time frame. The actual demand suggests that SSMC requires three emergency operating rooms during working hours to keep the compliance above 90% for all emergency levels.

### **IMPLEMENTATION AND RESULT TO DATE**

The implementation phase was started in the first quarter of 2020 by highlighting the non-compliance with access to the OR within the clinically recommended time frame through the surgery and procedural committee and the OR departmental meetings. Raising awareness about the importance of objective prioritization and the limited capacity in the OR has contributed to the dramatic reduction of level I and II emergencies during the second quarter of 2020.

The awareness efforts conducted to highlight the clinical and operational implications of subjective prioritization and its effects on other patients lacked vision and solid data. During the

third quarter of 2020, an intensive retrospective data collection activity was conducted to understand the complete picture of non-compliance and the contributing factors. The data collection phase took place amid the COVID-19 surge, where a negative PCR test result was mandated for all elective surgeries. There is no clear evidence of how COVID-19 contributed to the dramatic reduction in level I and II emergency procedures or the dramatic improvement in compliance with the time frame; this will require separate analysis and further review.

The project's complete picture was pulled together in the last quarter of 2020 following the comprehensive data collection, validation, and analysis. The stakeholders came together for a brainstorming session to analyze the constraints and improve access to the OR. Following a series of meetings, a new action plan was introduced with clear objectives and timelines. The steps of the new plan were driven by the Mind-Mapping session where leadership brainstormed different solutions. The results of the Mind-Mapping session are discussed below.

- **Scheduling:** The scheduling digitization process reached the final step in the transformation process, specifically revenue cycle management (RCM). The electronic process will replace the current paper-based scheduling process and allow the surgeon to place the surgery request through his/her electronic notes. The EMR system will generate the surgery request order from the surgeon's notes and place the request on the surgery master waiting list for verification and scheduling. The digitization process will be ready to go live by May 2021 across the healthcare system.
- **Additional Operating Room Capacity:** During the WG meeting with the senior executive team in February 2021, the executive team approved the proposal to open two additional

operating rooms dedicated for emergency cases. The recruitment process of nurses, anesthetists, and allied health practitioners has started, intending to open the additional rooms by the end of May 2021.

Access to the operating room has been highlighted in different forums. Presentations were conducted in order to increase awareness in regular SPC meetings, OR monthly meetings, and the WG meetings. These have all brought the senior leadership attention and support to enhancing access to the OR and addressing the subjective variability and the importance of communication between providers and the OR.

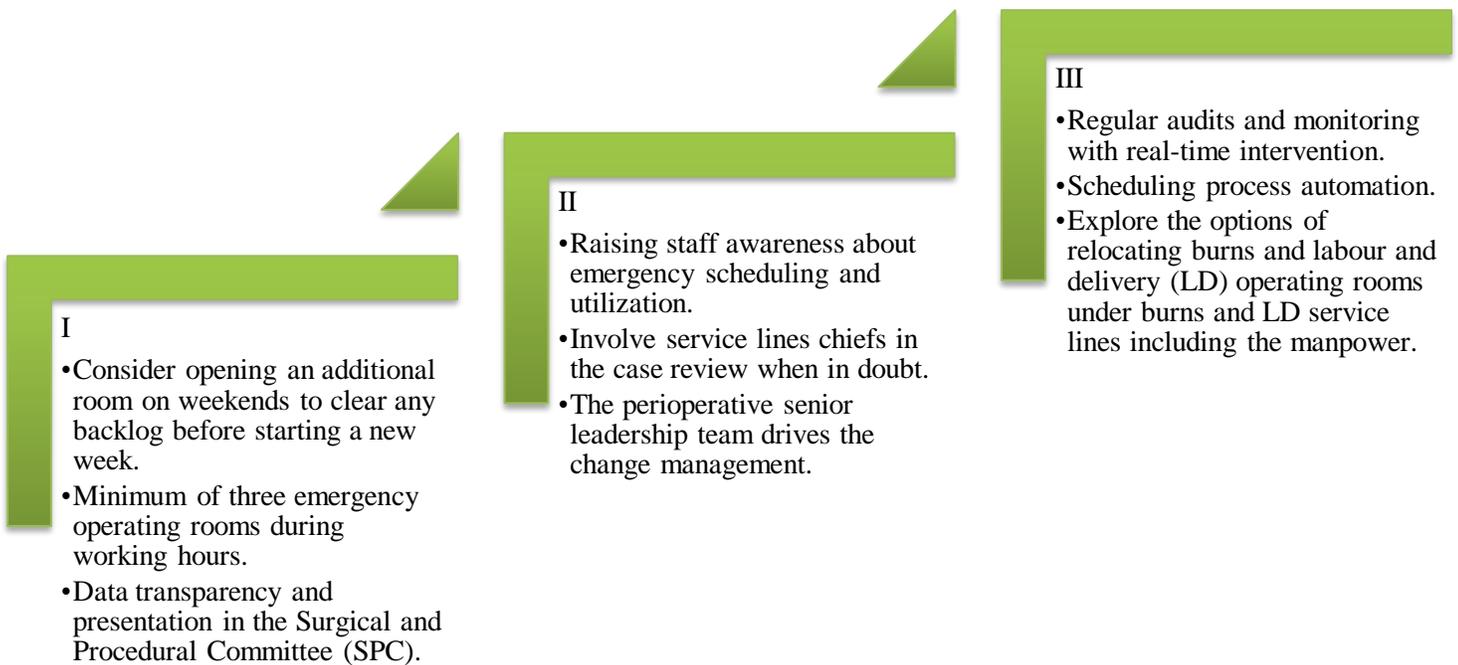


Figure 7. Summary of the action plan.

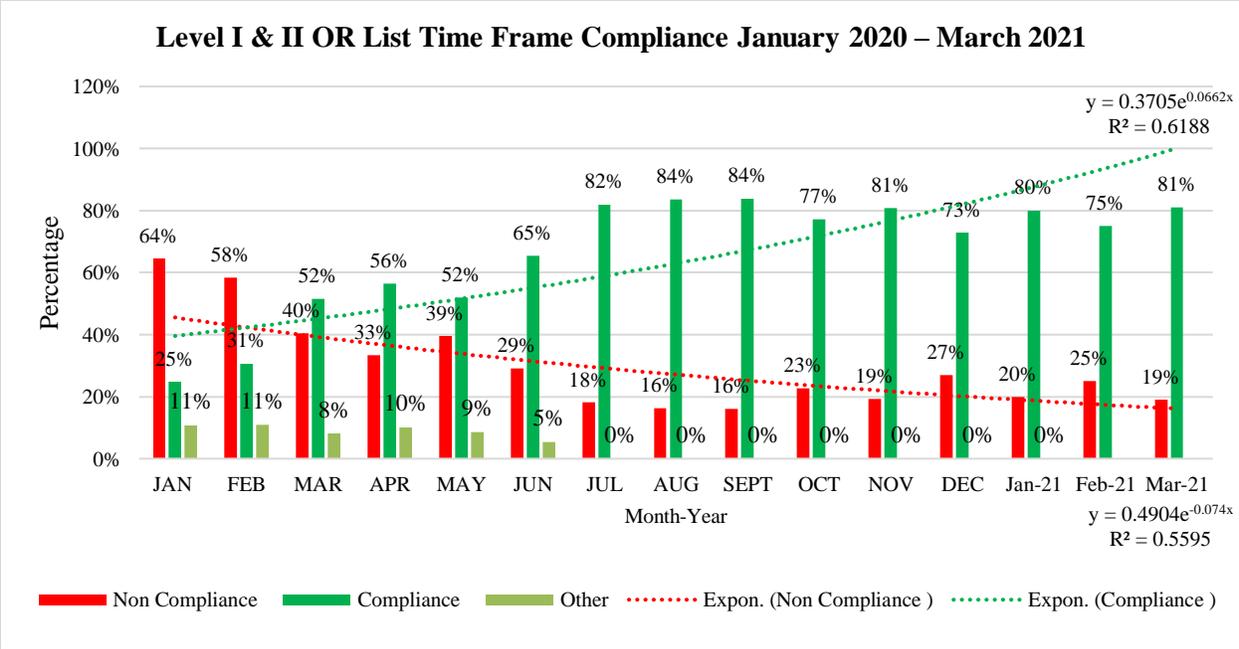


Figure 8. Level I & II Compliance with the time frame (January 2020 – March 2021). There has been a dramatic improvement throughout the year despite the COVID-19 surge.

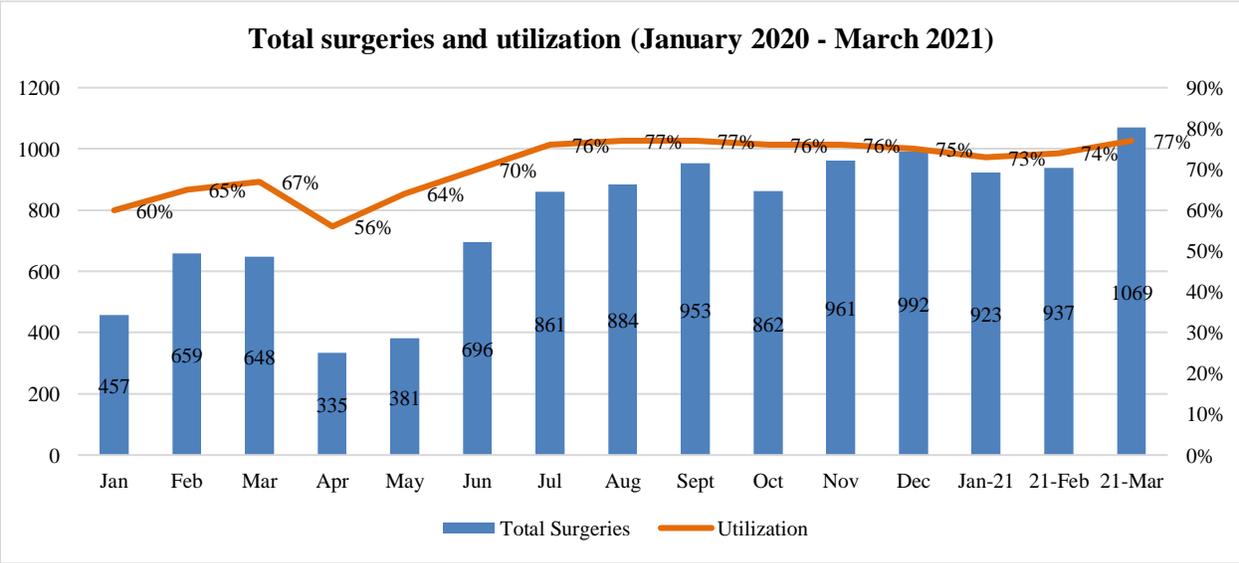


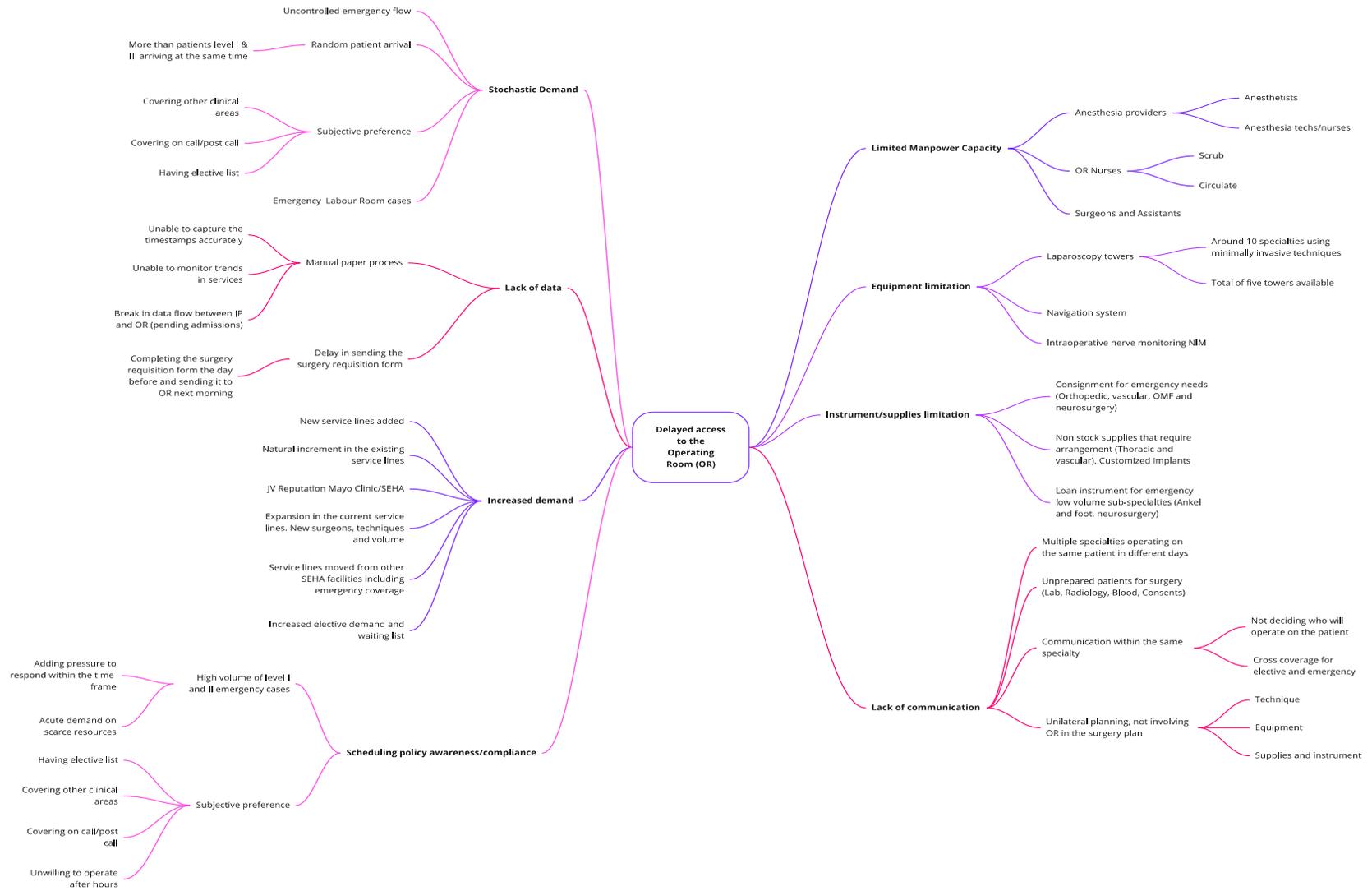
Figure 9. Total number of surgeries and OR utilization (January 2020 – March 2021).

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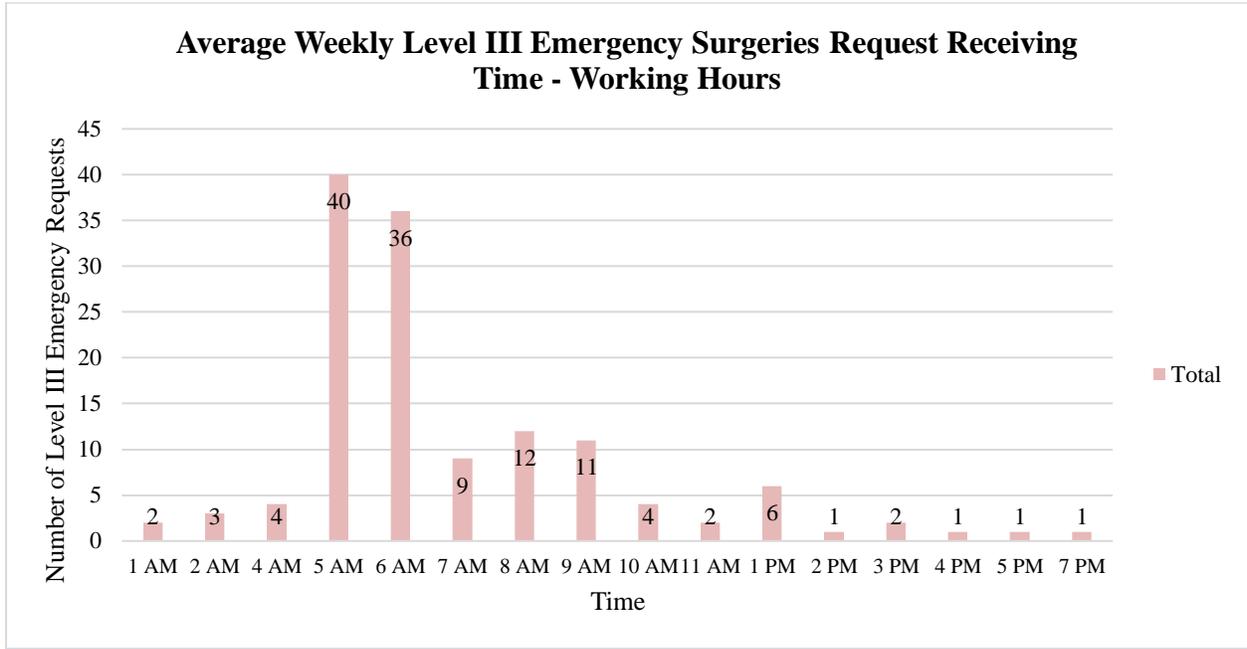
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# Appendices

## Appendix A – Mind Mapping for the delayed access to OR within the time frame



**Appendix B-1 – The Average Weekly Level III Emergency Surgeries Request Receiving Time - Working Hours**



**Appendix B-2 – The Average Monthly Level I and II Emergency Surgeries Request Receiving Time**

