

Reduction of In-Hospital Preoperative Waiting Time of Elective Surgeries in the Amidst of COVID-19 Pandemic: Experience from Ethiopia

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Background: The higher demand for surgical services during the advancement of the COVID-19 pandemic has resulted from the need for a pre-admission negative result, the need for extra resources, and a shortage of skilled expertise. This quality improvement project aimed to reduce the in-hospital preoperative waiting time of elective cases to less than 24 hours.

Methods: The study was conducted in a tertiary care center. Following the collection of baseline data, we formed a multidisciplinary team to analyze the root causes and intervention ideas of delay using fishbone and driver diagrams, respectively. We prioritize key drivers and implemented several low-cost interventions using Plan-Do-Study-Act (PDSA) model. We monitored the average in-hospital preoperative waiting time of patients.

Results: Overall, in-hospital preoperative waiting time for elective cases has been reduced from a baseline of 4.89 days to 1.32 days on average by the end of 10 months of initiating the project. Similarly, monthly elective case cancellation rate due to COVID-19-related reason has been reduced from baseline 62.5% of the total cancellation to 0%. Due to this, the average monthly inpatient bed utilization has increased from 2.21 patients per month during pre-COVID-19 period to 5.9 patients per month in each bed of the surgical ward by the end of the project.

Conclusion: The implementation of a quality improvement project can optimize operation theatre efficiency, inpatient bed utilization, and reduce the surgical backlog. Meticulous and rigorous effort has to be laid down to do root cause analysis, generate feasible change ideas, and continuous follow-up, and testing of multiple PDSA cycles is required to impact an improvement and sustain it in the long run. The emergence of COVID-19 pandemic could be used as an opportunity to reduce the length of stay in the hospital.

Keywords: quality improvement, PDSA, COVID-19, in-hospital preoperative waiting time, elective surgery, Ethiopia

Introduction

More than 2 years have elapsed since COVID-19 was announced as a public health emergency of international concern by the World Health Organization.¹ In Ethiopia, the first confirmed case of COVID-19 was reported on 13 March 2020.²

COVID-19 poses a great deal of challenge in the healthcare system worldwide in both delivering services to affected individuals and running an already existing essential healthcare service.³ Essential surgical services like outpatient visits and emergency and elective surgeries have been affected significantly. A study done in Switzerland showed a 39% and 43% decrement in emergency and elective operations, respectively, while in Ethiopia, elective surgeries were affected substantially (24% – emergency vs 56.3% – elective operation reduction during the pandemic).^{4,5}

Quality improvement (QI) in healthcare is all about understanding of the complex healthcare system; using a methodological approach to problem solving; designing, testing, and implementing changes using real-time measurement; and improving safety, effectiveness and experience of patient care.⁶ PDSA (Plan-Do-Study-Act) is one of the QI models used widely to improve surgical services: it refers to a systematic approach to testing and measuring ideas in an iterative manner that may lead to an improvement in the processes or outcomes.⁷ PDSA can be used in various surgical

context and objectives such as to improve the quality of postoperative procedures, process mapping and finding improvable points in surgery, to improve communication between patient and medical staff, and to reduce patient waiting time before surgery.⁸

Preoperative waiting time was lowered from 0.46 days to 0.29 days in 2008 following the implementation of a surgery admission unit for patients undergoing major elective surgery in Spain.⁹ A study conducted at a university hospital in the Netherlands showed, initiation of an outpatient preoperative evaluation reduces preoperative admission time by a factor of 0.89 (95% CI, 0.88–0.91), rate of same-day admissions increased from 5.26% (692/13,162) to 7.72% (542/7024), and cancellation rate for medical reasons only reduced from 1.95% to 0.93%.¹⁰

On top of the underlying large elective surgical backlog volume, COVID-19 pandemic put extra burden on the surgical backlog. This is due to the need for a timely pre-operation negative result for COVID-19, scarcity of expertise and resources due to COVID-19 response, and patient absence for admission after call due to fear and low healthcare-seeking behavior in times of the pandemic on top of temporary postponement of elective procedures in the earlier phase of the pandemic. All this together leads to long in-hospital preoperative stay and increased cancellation. So as to manage and improve this complex surgical backlog list and shorten in-hospital preoperative waiting time, meticulous, safe, feasible, effective, and efficient quality improvement project has to be designed and implemented.

This quality improvement project aimed to reduce the average in-hospital preoperative patient waiting time of elective cases to less than 24 hours from a baseline of 117.36 hours over a period of 10 months (January 1–31 October 2021).

Methods

Study Setting

This quality improvement project was conducted at the department of surgery, SPHMMC. It is located in Addis Ababa, the capital city of Ethiopia. The Department of Surgery is offering specialty and subspecialty services which are organized in three wards: general surgery, pediatric surgery, and urology wards. The department currently has 53 inpatient beds, which is scaled down from its initial 109 beds due to the COVID-19 pandemic emergence. It has one operation theatre equipped with six OR tables.¹¹ The department performs over 3824 major surgeries to emergency and elective cases in the three wards annually.¹² The project was conducted from 1 January to 31 October 2021.

Team Selection

A multidisciplinary team (MDT) from the inpatient service directorate, surgery department, anesthesia department, liaison office, and healthcare quality improvement team was established. The team consists of five physicians (one anesthesiologist, two surgeons, one quality officer, and one general practitioner), one anesthetist, two scrub nurses, and two liaison officers (one nurse and one health officer).

Study Design and Method

Institution-based interventional quality improvement study design was employed. This study was conducted with continuous, detailed meetings and discussions to prepare a process map, identify root causes and generate intervention ideas for long in-hospital preoperative waiting time. Following this, the PDSA model for quality improvement was applied to test intervention ideas and followed for an improvement in the processes or outcomes in the project with specific measures.

Data Collection and Analysis

Baseline, as well as follow-up in-hospital preoperative waiting time, number of elective surgeries performed, and cancellation rate, were collected from patient medical charts and registries. Data were coded, entered, and cleaned using SPSS version 24 software package by the project coordinator. Simple descriptive statistics such as frequency distributions were computed. The Chi-square test was done as appropriate, and the result was presented in tables, graphs, and run chart.

Strategy and Implementation

The MDT studied the complex process of getting elective surgery, do root cause analysis of long in-hospital preoperative waiting time, plot possible intervention packages with subsequent implementation sequentially, and follow-up of the project.

Process Mapping

The process map of patient flow requiring surgical intervention during COVID-19 pandemic at SPHMMC is redesigned as follows to ease and get the utmost efficient surgical service for elective cases (Figure 1).

Root Cause Analysis/Fishbone Diagram

Based on the process map illustrated in Figure 1, factors contributing to long in-hospital preoperative waiting time for elective cases during COVID-19 pandemic at SPHMMC were identified using a fishbone analysis diagram (Figure 2). More than 32 underlying root causes categorized into four groups as patient factor, provider-related factor, work process-related factor, and facility/supply-related factors were identified.

Driver Diagram

Depending on the root causes identified (Figure 2), two primary drivers, six secondary drivers, and 27 change/intervention ideas were schemed to achieve an in-hospital preoperative waiting time of less than 24 hours for elective surgical cases in the hospital (Figure 3).

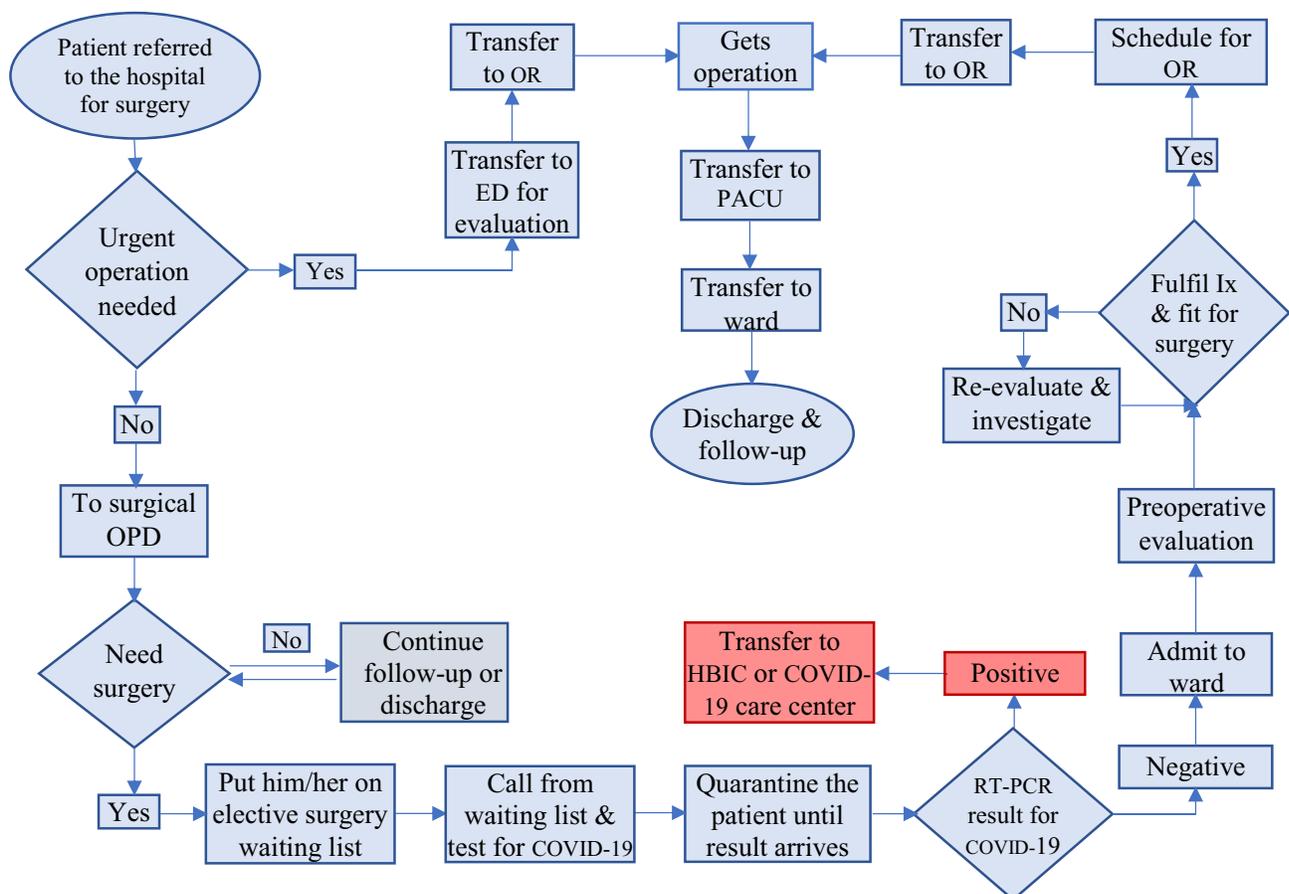


Figure 1 Process map depicting all steps in getting surgical operation at SPHMMC during COVID-19 pandemic.

Abbreviations: OPD, outpatient department; ED, emergency department; RT, PCR-real-time polymerase chain reaction; HBIC, home-based isolation and care; Ix, investigation; OR, operating room; PACU, post anaesthesia care unit.

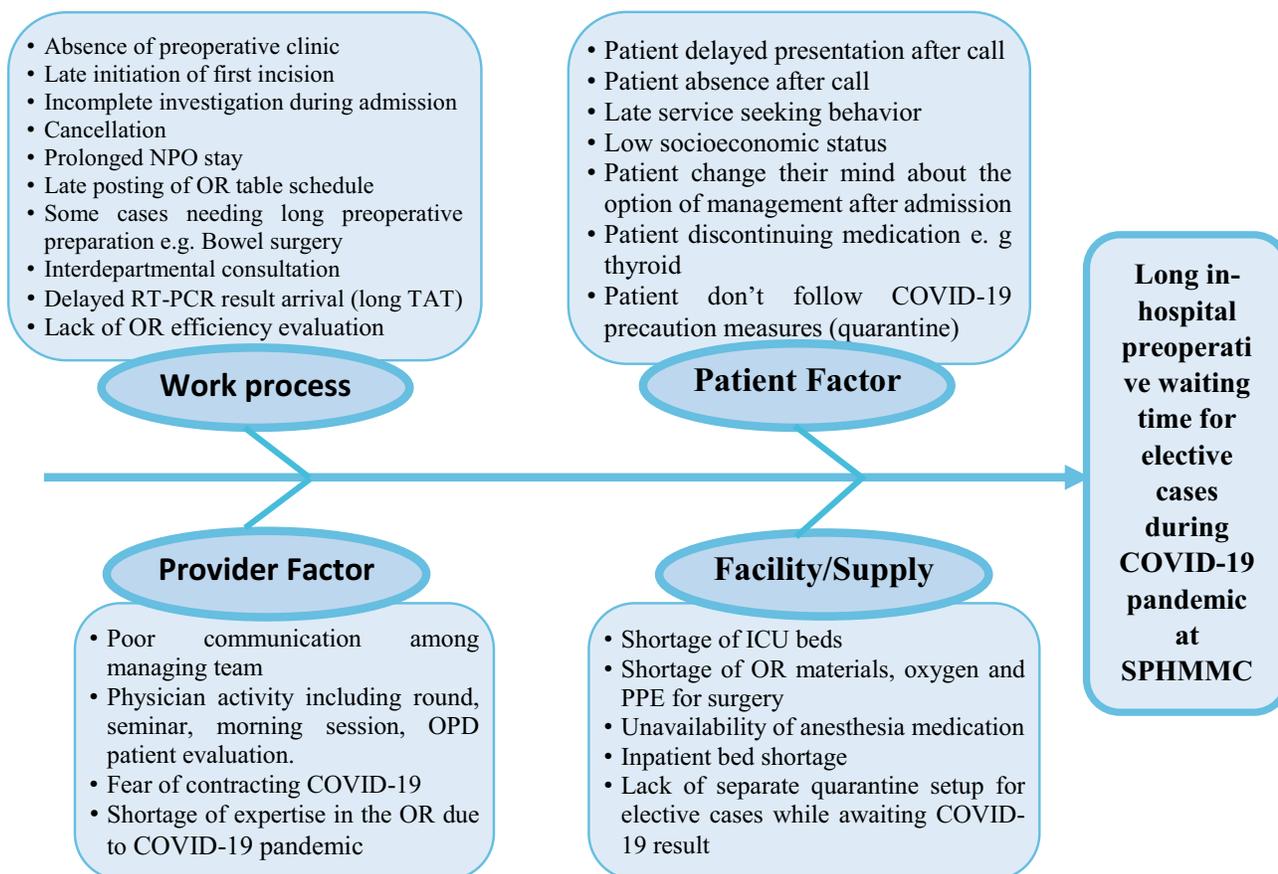


Figure 2 Fishbone diagram illustrating root causes of long in-hospital preoperative waiting time for elective cases during COVID-19 pandemic.

Abbreviations: NPO, nothing per oral; OR, operating room; OPD, outpatient department; ICU, Intensive Care Unit; PPE, personal protective equipment; RT-PCR, real-time polymerase chain reaction; SPHMMC, St. Paul's Hospital Millennium Medical College.

Measurement

Process Measures

1. Percent of elective cases seen at preoperative clinic among admitted patients.
2. Cancellation rate due to COVID-19-related reasons.

Outcome Measures

The mean in-hospital preoperative waiting time.

Balancing Measures

1. Frequent alerts, meetings, and extra work to residents, nurses, liaison officers, and COVID-19 test sample collectors on different activities and interventions of the QI project led to increased workload.
2. Availing RDT for COVID-19 and establishing a preoperative clinic requires robust financial, human resource, and facility cost.
3. Incidence of surgical site infection might decrease while trying to shorten preoperative stay.¹³
4. Compromise of academic activities to undergraduate students and residents due to short stay of patients preoperatively.

PDSA Implementation

Based on the driver diagram in Figure 3, we select five change ideas that have higher score using a focusing matrix to implement and test using a PDSA cycle (Table 1). Each change idea were implemented starting from January 2021 consecutively every 10 weeks while keeping the previous intervention in place (Table 2). We record and track all elective

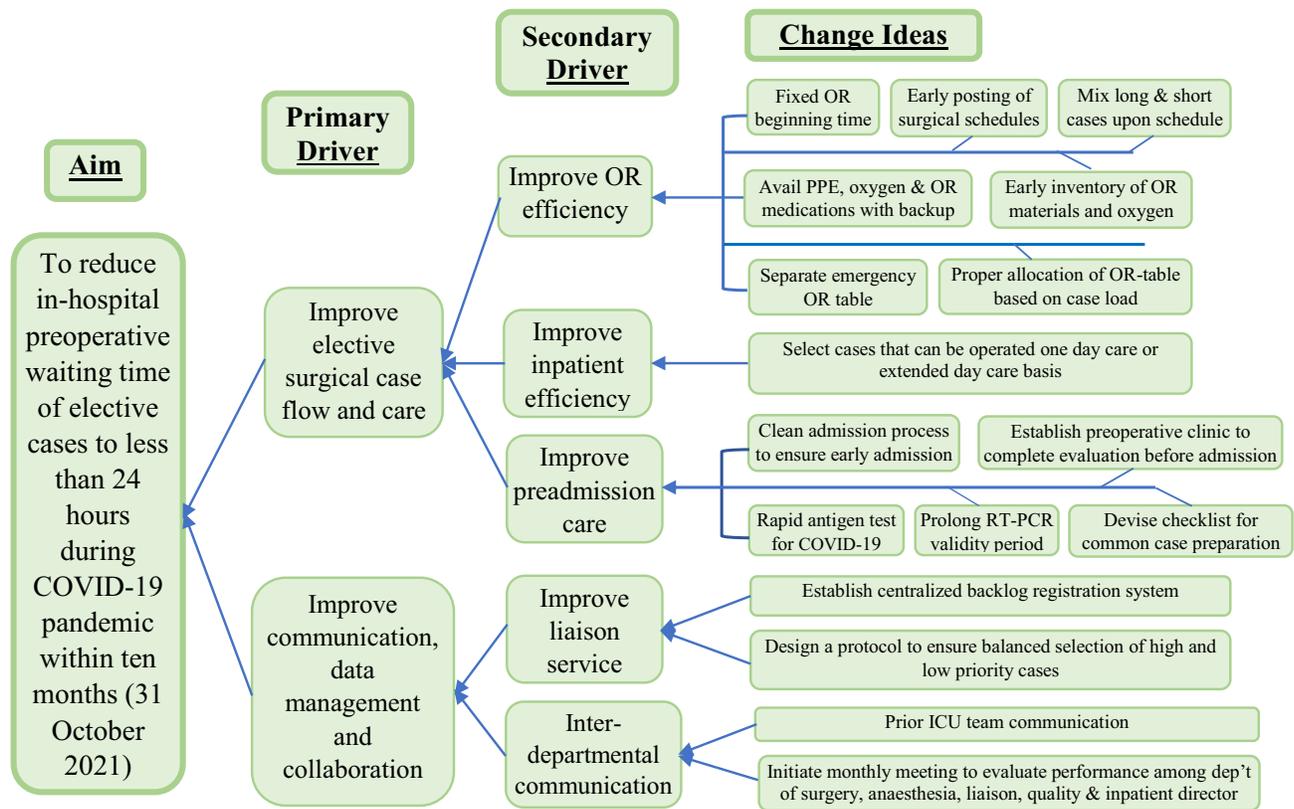


Figure 3 Driver diagram showing the AIM, primary and secondary drivers, and intervention/change ideas to improve in-hospital preoperative waiting time of elective cases. **Abbreviations:** OR, operating room; ICU, Intensive Care Unit; PPE, personal protective equipment; RT, PCR-real-time polymerase chain reaction; COVID-19, coronavirus infectious disease 2019.

cases admitted and operated on for preoperative stay, the type of pathology they have, the area of admission, and cancellation rate on a weekly base. Depending on the findings, we made an iterative assessment of each PDSA cycle to sustain strengths and devise solutions to drawbacks for a better outcome.

Results

Overall, the in-hospital preoperative waiting time for elective cases has been reduced from a baseline of 4.89 days (117.36 hours) to 1.32 days (31.68 hours) on average by the end of 10 months of initiating the project (Figure 4 and Table 3).

Table 1 Change Idea Prioritization to Test and Implement Using a Focusing Matrix

Change Idea	Effectiveness	Impact Magnitude	Feasibility	Total Score
Increase COVID-19 test validity period	12	11	12	35
Preoperative evaluation clinic initiation	15	15	13	43
Availing and prioritizing supplies to OR	11	7	11	29
Case selecting team formation and engagement	14	13	12	39
Start COVID-19 rapid antigen test	13	10	9	32

Notes: A 1–15 scale scoring is used for each parameter; a score of 15 means a highly effective measure, has a wider impact, and can be implemented easily with low financial and human resource costs.

Abbreviation: OR, operating room.

Table 2 Summary of PDSA Cycles on Reducing the In-Hospital Preoperative Waiting Time of Elective Cases During COVID-19 Pandemic

PDSA Cycle	Plan	Do	Study	Act
PDSA: Cycle-1: Preoperative evaluation clinic initiation	Establishing preoperative clinic for thorough evaluation of patients immediately prior to admission can shorten preoperative LOS.	We established a preoperative clinic and started evaluating all elective cases prior to admission by anesthesia and surgical team.	We identified cancellation rate because of incomplete evaluation and investigation has decreased and identified extra workload on physicians.	Limiting patient evaluation time in the morning from 9–11 am in all the days to overcome shortage of physician.
PDSA Cycle-2: Team formation from managing and liaison team	To establish a team from surgical and liaison units that facilitates patient scheduling and a mix of case varieties.	Thorough patient selection and appropriate mix of procedures that take long hours with the ones that take few hours was done.	Rational selection of long and short cases up on admission made efficient utilization of OR tables and reduces preoperative waiting time.	Trying to give priority for patients who have longer waiting time from the backlog irrespective of mixing the cases as much as possible.
PDSA Cycle-3: Increase test validity period	Extending RT-PCR result validation time to operate within three days of a negative sample in order to reduce cancellation rate.	Following a thorough discussion on evidences and strict adherence of precaution measures between all stakeholders involving in the OR, PCR test result validity time to perform surgery was extended to 72 hours of giving the sample.	The cancellation rate due to the absence of negative result within the specified validity period has decreased notably. There is an increased risk of acquiring the virus with an extended validity time interval.	We set up a separate quarantine ward with the necessary facility and precaution measures for all elective cases to stay after giving COVID-19 sample until they get operation.
PDSA Cycle-4: Start COVID-19 rapid antigen test	Starting COVID-19 antigen rapid test could shorten the test result arrival time for elective cases (15–30 minutes).	COVID-19 antigen rapid test service has been established and it started to be the testing modality for elective cases prior to surgery.	The accuracy of the test in asymptomatic cases is low, relying on it alone might increase the risk of transmission.	Do RT-PCR test for those who have strong clinical suspicion irrespective of the antigen rapid test result
PDSA Cycle-5: Availing PPE &supplies in the OR	Availing PPE to staffs in the OR	Allocate PPE & other supplies with backup.	The shortage of PPE & oxygen supply during the third wave of the pandemic has affected elective surgery immensely.	Put operation theatre as one of the units that needs priority upon PPE quantification and oxygen supply.

Abbreviations: PDSA, Plan-Do-Study-Act; LOS, length of stay; MDT, multidisciplinary team; RT, PCR-real time polymerase chain reaction; COVID-19, coronavirus infectious disease 2019; WHO, World Health Organization; PPE, personal protective equipment; OR, operating room; TAT, turnaround time.

Following the implementation of the first PDSA cycle (preoperative evaluation clinic initiation), the average preoperative stay has been reduced to a median of 40.8 hours from a baseline of 117.36 hours. Similarly, subsequent PDSA cycles were able to reduce preoperative waiting time to a median of 39.6, 32.4, 28.9, and 33.1 hours, respectively (Figure 4).

In-hospital preoperative waiting time at the department of surgery has been reduced from 3.49 to 4.5 days range to 1.21–1.7 days on a monthly basis while implementing the project as compared to similar 6 months in the pre-COVID-19 period (2019) ($p < 0.00057$). Unit wise, waiting time has been reduced from a range of 3.43–5.3 days to 1.09–1.32 days ($p < 0.000175$), 2.14–4.5 days to 1.85–3.28 days ($p < 0.047349$), and 2.1–4.11 days to 0.9–1.26 days ($p < 0.001164$) in general surgery, pediatric surgery, and urology units, respectively (Table 3).

The average monthly inpatient bed utilization has increased from 2.21 patients per bed per month during the pre-COVID-19 period to 5.9 patients per bed per month in the surgical ward by the end of the project, which is more than 2.5 times efficient utilization of beds for both elective and emergency cases (Table 4).

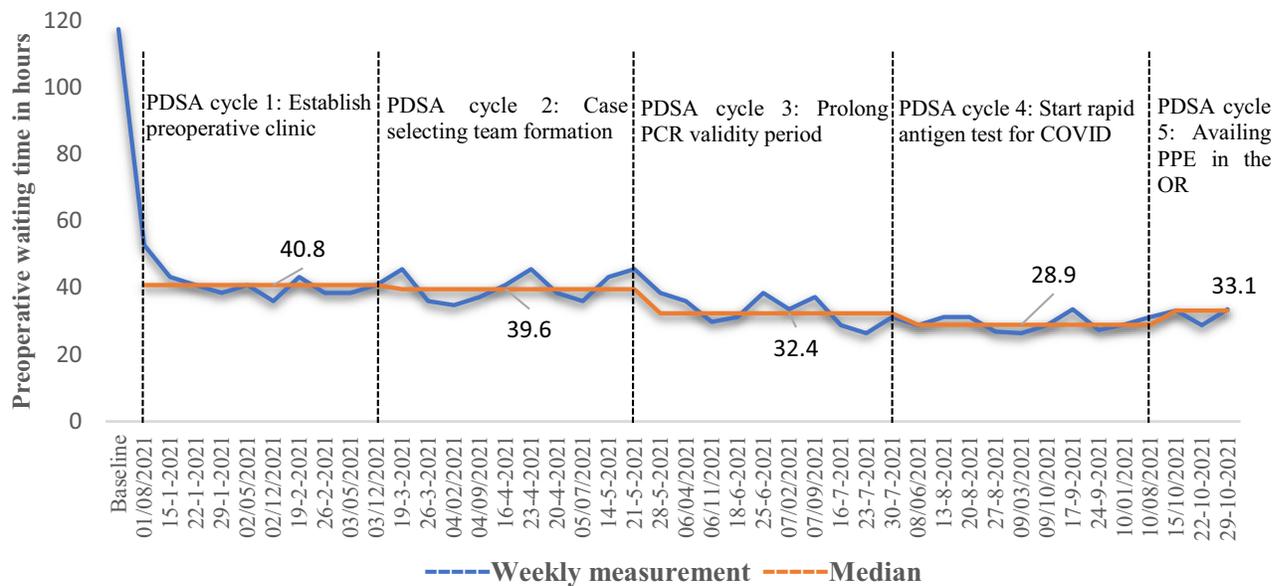


Figure 4 A run chart showing implementation of PDSA cycles with its impact on in-hospital preoperative waiting time (in hours) among elective surgical cases at SPHMMC.

The overall operation theatre case cancellation rate has varied during the entire 10 months of the project stay. However, the cancellation rate due to delayed COVID-19 result or positive result has reduced progressively in the later phase of the project and when it is compared with the baseline data in the earlier phase of the pandemic in 2020 (Figure 5).

Discussion

The in-hospital preoperative waiting time has been reduced by a factor of 0.27, which is a significant reduction as compared to a study done in Spain and the Netherlands where reduced preoperative waiting time is reduced by a factor of 0.63 and 0.89, respectively.^{9,10} But as compared to a study done in Spain, the overall preoperative waiting time for elective cases in our study is still high (0.29 days vs 1.32 days).⁹ This could be due to the fact that there are resource limitations and the presence of academic activities like bedside, round, and other teaching sessions for undergraduate medical students in our setup.

Table 3 In-Hospital Preoperative Patient Waiting Time of Elective Cases in Different Units of the Surgical Department Measured in Days with the Total Number of Surgeries Performed

Surgical Unit	May	June	July	August	September	October	P-value	Chi-Square value
General surgery								
2019	3.43 (114)	4.34 (105)	3.9 (97)	4.2 (95)	5.3 (97)	5.2 (96)	0.00018*	0.01326
2021	1.32 (84)	1.11 (133)	1.14 (134)	1.15 (127)	1.09 (117)	1.13 (142)		
Pediatric surgery								
2019	4.5 (20)	2.14 (17)	3.8 (31)	3.19 (27)	3.9 (25)	3.15 (25)	0.04735*	0.82083
2021	3.28 (30)	2.75 (42)	2.9 (23)	1.85 (39)	2.15 (30)	2.5 (41)		
Urology								
2019	4.11 (66)	2.1 (48)	3 (65)	2.49 (68)	2.95 (41)	2.4 (62)	0.00116*	0.24266
2021	1.23 (33)	1 (43)	1.13 (53)	1.26 (63)	0.91 (50)	0.9 (54)		
Average								
2019	3.76 (200)	3.49 (170)	3.58 (193)	3.44 (190)	4.5 (163)	3.97 (183)	0.00006*	0.094076
2021	1.7 (147)	1.41 (218)	1.31 (210)	1.23 (229)	1.21 (197)	1.32(237)		

Note: *Significant association (p-value < 0.05).

Table 4 Comparison of the Total Number of Elective Surgeries Performed with the Number of Surgical In-Patient Beds per Month During Similar Six-Months Period (Pre COVID-19 and While Implementing the QI Project)

Year	May	June	July	August	September	October	P-value	Chi-Square value
2019 (Pre COVID-19)	2.68	1.62	2.5	2.45	2.25	2.34	0.00017*	0.000073
2021 (QI project)	4.32	5.32	5.4	5.66	5.25	5.9		

Note: *Significant association (p-value < 0.05).

All the five interventions tested has its own impact on reducing preoperative waiting time, but initiating preoperative evaluation clinic took the largest impact making the reduction by a factor of 0.35.

In-patient bed utilization has been increased by 2.5 times and the cancellation rate due to COVID-19-related reasons has been reduced progressively following the implementation of this project. This could be majorly due to the reduction of in-hospital preoperative waiting time.

These improvements are the results of the execution of proper change ideas under the right circumstance, regular feedback and communication between stakeholders, continuous follow-up for sustainability, dedicated MDT & leadership, and the presence of regular support from the hospital management.

Despite the enormous challenges paused by COVID-19 to the surgical service, on the flip side this quality improvement project showed that it can be used as an opportunity to curve long in-hospital preoperative waiting time to avoid COVID-19 acquisition and transmission in the hospital.

Quality improvement projects can put forward elective surgical care with minimal cost and collaborative effort of the multidisciplinary team within a short period in times of crisis without compromising the quality of care.

Strengths and Limitation

Utilizing a quality improvement project (PDSA cycle) in times of crisis with a combined effort of a multidisciplinary team and minimal cost to reduce the in-hospital preoperative length of stay has shown us a lot can be done with this kind of initiative to improve the quality of patient care. The strengths of this project include the use of validated QI methods in the entire process of the project; the presence of high-quality baseline data to support our change ideas, and ongoing

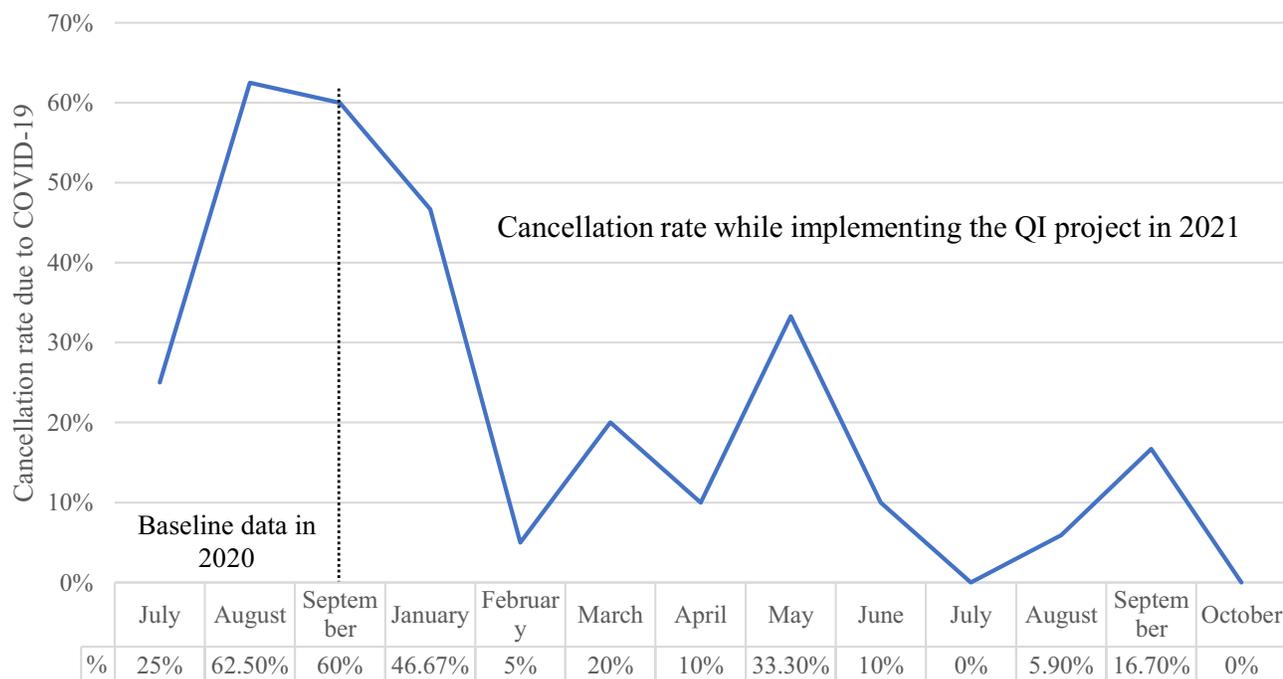


Figure 5 Monthly elective case cancellation rate due to COVID-19-related reason at the surgical department of SPHMMC.

regular data review and response using PDSA cycles; Implementing several PDSA cycles over a short period; and team-based approach between different service units of the hospital.

The need for a continuous effort to discuss, identify loopholes, and extensive data collection at every step of implementing the project has taught us to employ techniques that can reduce extra effort, cost, and time utilization.

It has been 10 months since we start the implementation of PDSA cycles, which has shown improvement in the preoperative stay, but we could not achieve the target. So, achieving the target and sustaining the project in the long-run has to be considered a limitation.

Conclusion

The implementation of this quality improvement project has optimized operation theatre efficiency, inpatient bed utilization, and reduction of surgical backlog of elective cases during the COVID-19 pandemic. All these improvements were seen from implementing and testing change ideas iteratively through meticulous and rigorous PDSA cycles. Establishing preoperative evaluation clinic, extending test validity period to 3 days, starting COVID-19 rapid antigen test, availing PPE & other supplies like oxygen, medications and materials with backup in the operation theatre, and establishing MDT to select elective cases from surgical and liaison team were the interventions that were implemented to bring all the changes seen in this project.

Ethical Consideration

Ethical approval and consent were obtained from the institutional review board of SPHMMC.

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Disclosure

The authors report no conflicts of interest in this work.

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