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The impact of the COVID-19 pandemic on the surgical care continuum in Ethiopia: a national survey

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Abstract

Background The COVID-19 pandemic severely affected social welfare, the economy, and global health, making delivering even the essential health service impossible. Surgical and anesthetic care was one of the essential parts of the health system that the COVID-19 pandemic greatly affected. This study aimed to assess the impact of COVID-19 on surgical care provision and the effectiveness of recovery measures in Ethiopia.

Methods An analysis of trends in a subcategory of surgical procedures performed in the years before COVID-19 and after the COVID-19 pandemic, which was designated as phases 0, 1, and 3, was conducted for public hospitals in Ethiopia that provided surgical services for three consecutive years, from January 2019 to March 2021. There were 24 general hospitals, 24 referral hospitals, and 91 primary hospitals. The indicators for assessing the impact of COVID-19 on the surgical care continuum were surgical volume, delay for surgical admission, cesarean section rate, and surgical site infection rate. The national District Health Information System (DHIS-2) of the Ministry of Health of Ethiopia was used to retrieve selected surgical services performance indicators.

Results Comparing the first COVID-19 pandemic year to the year prior to the pandemic, the mean surgical volume in primary hospitals grew while the surgical volume at referral hospitals decreased. The average reported rate of cesarean sections during the epidemic years was 23.7%. When compared to the pre-pandemic (phase 0), the pandemic year 2020 (phase 1), the mean caesarian section rate increased for referral, general, and primary hospitals. During the post-pandemic year, there is a clinically significant delay in surgical admission for referral, general and primary hospitals.

Conclusion and recommendation Compared to the pre-pandemic period, COVID-19 significantly impacted the Ethiopian surgical care continuum, indicated by decreased surgical volume and increased surgical admission delays. To build a more resilient health system and meet community surgical service demand during public health emergencies, strengthening surgical service at primary health care units, such as primary hospitals and health centers with operation theatre blocks, should be prioritized.

Keywords COVID-19, Surgical service, Impact, Surgical care continuum, Ethiopia

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Background

The COVID-19 pandemic disrupted global health, social welfare, and the economy, resulting in the inability to provide essential health services. Surgical and anaesthesia care was a significant health system component substantially disrupted by the COVID-19 pandemic due to prioritization and redistribution of staff and resources to provide care for patients with COVID-19 [1, 2].

The first documented COVID-19 case in Ethiopia was noted on March 13, 2020 [3, 4]. Federal Ministry of Health of Ethiopia has been issuing mandatory measures like social distancing, quarantining, covering coughs and sneezes, hand washing, and use of face masks widely in the country after WHO declared COVID-19 as a Public Health Emergency of International Concern (PHEIC) [3].

A considerable impact has been felt on basic surgical services such as outpatient visits and emergency and elective procedures. In Ethiopia, elective procedures were greatly affected by the pandemic (24% emergency vs. 56.3% elective surgery reduction), according to a study conducted there. In Switzerland, emergency and elective surgery rates decreased by 39% and 43%, respectively [5, 6].

Another study on COVID-19's effects was conducted in Addis Ababa, Ethiopia. It revealed that elective and emergency surgery volumes sustained adverse effects (reductions of 32% and 19%, respectively), sharply increasing the number of patients on the surgical waiting list [7]. In the UK, a nationwide observational cohort study revealed a 33.6% reduction in the national volume of surgical activity [8].

A high-volume pelvic oncology hospital study reports the importance of surgical interventions for providing cancer patients with oncological care. This study found that the number of prostate biopsies decreased significantly from 420 to 234 (a 44.3% reduction), and the number of radical orchidectomies decreased considerably from 18 to 11 (a 39% reduction) during the COVID-19 pandemic [9]. A meta-analysis by Semagn et al. revealed a high global rate of postoperative mortality among COVID-19 patients of 20% and a postoperative ICU admission rate of 15% [10].

This study evaluated COVID-19's impacts on surgical care delivery and the effectiveness of recovery measures in Ethiopia. Additionally, it was intended to determine whether there were any beneficial lessons to be learned from the perioperative changes in practice during the COVID-19 pandemic, including the potential impact of a decline in surgical site infection with improved infection prevention protocol implementation. While the pandemic's effects on healthcare systems have been widely documented globally, there is limited data on its impact in sub-Saharan Africa, particularly in Ethiopia, where surgical services are already constrained. This study addresses a critical research gap by providing context-specific insights into how global health crises disrupt the surgical care continuum in low-resource settings. The study will support evidence-based policymaking and resource allocation to improve surgical care delivery in similar settings by filling this gap.

Methods

We conducted a national survey comparing surgical cases carried out before and during the COVID-19 pandemic at various levels of hospitals in Ethiopia after obtaining institutional review board (IRB) approval, including informed consent waivers by Saint. Paul Millennium Hospital Medical College, Institutional review board.

A total of 189 public hospitals–24 referral hospitals, 74 general hospitals, and 91 primary hospitals were included. Purposive sampling techniques (based on high surgical volume) were used to select hospitals to be included in this study. The national District Health Information System (DHIS-2) of the Ministry of Health of Ethiopia was used to retrieve selected surgical services performance indicators for the evaluation period from January 2019 to December 2021 across all quarters. The surgical care performance of facilities was reviewed over three consecutive years, from January 2019 to December 2021, to assess trends in selected surgical services performed in the pre-COVID-19 year and after the COVID-19 pandemic for two years.

The period from January 2019 to December 2019 was considered as the pre-pandemic year (phase 0). January 2020 to December 2020 was considered as the pandemic year (phase 1). From January 2021 to December 2021, the post-pandemic year (phase 2) was considered.

The indicators for assessing the impact of COVID-19 on the surgical care continuum were surgical volume, delay for surgical admission, cesarean section rate, and surgical site infection rate. Surgical volume was defined as the mean number of major surgical procedures performed annually by health facilities included in the study. Delay for elective surgical admission was also defined as the mean number of days that patients who underwent major elective surgery during the reporting period waited for admission (i.e., the mean number of days between the dates each patient was added to the waiting list until their date of admission for surgery). Cesarean section rate was defined as the proportion of cesarean sections performed in a hospital to the total number of live births in a study area. The monthly performance of the indicators was reviewed for public hospitals with the following inclusion and exclusion criteria.

Inclusion criterion: All Public Hospitals providing surgical services reported surgical care data using the national DHIS-2 system.

Exclusion criterion: On the National DHIS-2 system, public hospitals did not have complete monthly surgical care data.

Data analysis

Microsoft Excel 2017 was used to clean up the evaluated data before exporting it to SPSS version 26 for data analysis. The pandemic year (phase 1) mean performance for the surgical care metrics was compared with the pre-pandemic (phase 0) performance to evaluate the impact of COVID-19 on surgical services. On the other hand, the post-pandemic (phase 2) mean performance was contrasted with the pandemic year (phase 1) mean performance in evaluating the success of surgical service recovery efforts on surgical care services. The mean difference was computed with an independent student t-test to assess a difference in the mean performance of surgical services. A p-value < 0.05 was used to declare a statistical difference. Data normality was checked with a Q-Q plot. Moreover, charts were constructed by plotting monthly performance for the three years covering the pre-pandemic, pandemic, and post-pandemic periods to assess the performance change across the months.

Results

The trends of surgical volume during pre-pandemic, pandemic, and post-pandemic periods

During the pandemic (phase 1) in 2020, the mean surgical volume for referral hospitals decreased (mean difference=−419.58) with no statistically significant difference compared to the baseline date of the pre-pandemic (phase 0) year in 2019 (p-value > 0.05). There was no statistically significant increase in mean surgical volume in general hospitals. However, there was an increase (mean difference = 378.41) in primary hospital surgical volume comparing the pandemic to the pre-pandemic year (p-value < 0.05). Comparing the pandemic year to the post-pandemic year, an increase in surgical volume was observed in referral (mean difference = 3108.58), general (mean difference = 1243.75) and primary (mean difference = 310.75) hospitals (p-value < 0.05) (Table 1, Figs. 1, 2, 3).

Delay for surgical admission

There was no statistically significant difference between the pre-pandemic and pandemic year observed in delay for surgical admission in all three levels of hospitals (p-value > 0.05). Comparing the pandemic year to the post-pandemic year, there was a statistically significant decrease (mean difference=−24.97) in delay for surgical admission in general hospitals (p-value < 0.05). No statistically significant difference between the pandemic and the post-pandemic year was observed in delay for surgical admission in referral hospitals (p-value > 0.05). In primary hospitals, delay in surgical admission was increased (mean difference = 1.12) comparing the pandemic and post-pandemic period (p-value < 0.05) (Table 2, Figs. 4, 5, 6).

Caesarian section rate

The overall mean cesarean section rate reported in all pandemic years was 23.7%. The mean caesarian section rate significantly increased in referral (mean difference = 2.12), general (mean difference = 2.70), and primary (mean difference = 1.79) hospitals during the pandemic year (2020) compared to pre-pandemic year (p-value < 0.05). A statistically significant increment in the mean cesarean section rate (mean difference = 2.02) was observed during the post-pandemic year compared to the pandemic year in referral hospitals (p-value < 0.05). In general and primary hospitals, no statistically significant difference was observed in the mean cesarean section rate in the post-pandemic year compared to the pandemic year (p-value > 0.05) (Table 3, Figs. 7, 8, 9).

Surgical site infection rate

According to the results of the study, there was a statistically significant decrease in mean surgical site infection rate (mean difference=−1.51) in referral hospitals during the post-pandemic year compared to the pandemic year (p < 0.05) (Table 4)

Discussion

Since the beginning of the outbreak in China in December 2019 [11], the country has conducted several preparedness and prevention methods to combat COVID-19 [12]. National Disaster Risk Management Council, led by the deputy prime minister's office, enforced public health measures. The Public Health Emergency Management team at the federal and regional level in the multi-sectorial national task force has been established and played a crucial role in slowing the virus's spread to rural areas [12]. The Ethiopian government adopted many public health measures to prevent rising infection levels after the first confirmed case of COVID-19 in March 2020 [13].

Preventive efforts included a nationwide community awareness campaign, a nationwide need assessment of personal protective equipment, the establishment of a rapid response team, reorganization of the health service to mitigate needs [6], and the formation of the Covid 19 Advisory Council led by professional associations and USAID's Health Workforce Improvement Program (HWIP). The National COVID-19 Advisory Committee's role has been crucial, as it continuously reviews scientific evidence to revise and pass new preventive and therapeutic interventions. All schools were closed, and mass gatherings and movements of individuals were restricted. The key preventive measures the government

Table 1 Surgical volume during pre-pandemic (phase 0), pandemic (phase 1) and post-pandemic (phase 2) periods

Indicator	Health Facility	Phase 0 versus Phase 1		Diff3erence	*p*-value	Phase 1 versus Phase 2		Difference	*p*-value
		Phase 0 Mean (± SD)	Phase 1 Mean (± SD)			Phase 1 Mean (± SD)	Phase 2 Mean (± SD)		
Surgical Volume	Referral	6947.08 (± 882.67)	6527.50 (± 1764.93)	−419.58	0.469	6527.50 (± 1764.93)	9636.08 (± 344.88)	3108.58	0.001
	General	6237.08 (± 433.88)	6520.33 (± 765.56)	−283.25	0.277	6520.33 (± 765.56)	7764.08 (± 347.42)	1243.75	0.001
	Primary	1485.33 (± 217.11)	1863.75 (± 304.77)	378.41	0.002	1863.75 (± 304.77)	2174.50 (± 160.95)	310.75	0.005

SD Standard deviation

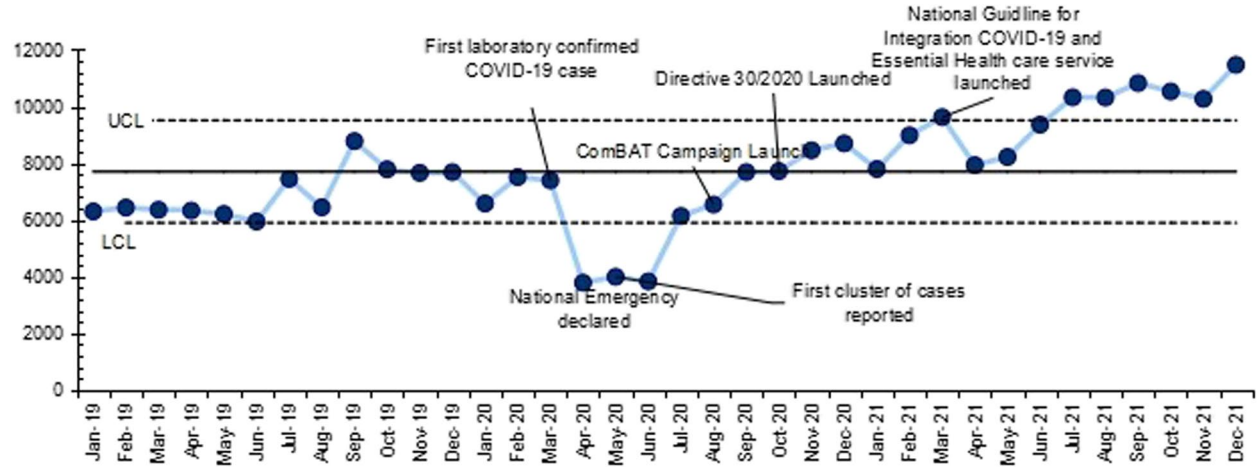

Fig. 1 Trend of surgical Volume in Referral Hospitals, 2019–2021 months

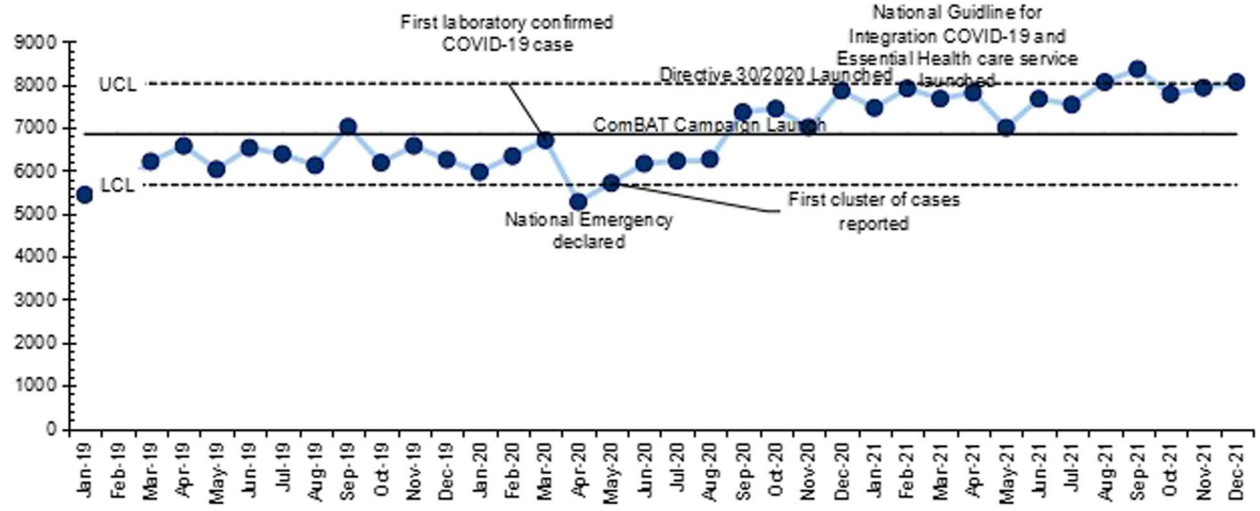

Fig. 2 Trend of surgical Volume in General Hospitals, 2019–2021 months

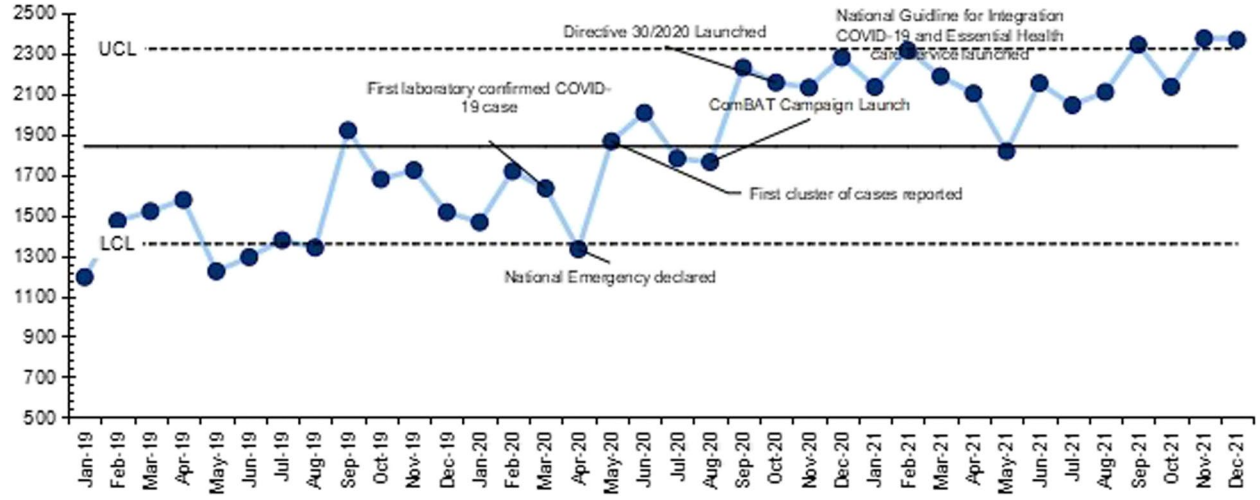

Fig. 3 Trend of surgical Volume in Primary Hospitals, 2019–2021 months

Table 2 Delay for surgical admission during pre-pandemic (phase 0), pandemic (phase 1) and post-pandemic (phase 2) periods

Indicator	Health Facility	Phase 0 versus Phase 1		Diff3erence	*p*-value	Phase 1 versus Phase 2		Difference	*p*-value
		Phase 0 Mean (±SD)	Phase 1 Mean (±SD)			Phase 1 Mean (±SD)	Phase 2 Mean (±SD)		
Delay for elective surgical admission	Referral	20.89 (±7.71)	28.20 (±13.45)	7.31	0.117	28.20 (±13.45)	28.81 (±13.57)	0.61	0.912
	General	20.74 (±11.68)	37.19 (±33.57)	16.45	0.123	37.19 (±33.57)	12.22 (±2.19)	−24.97	0.017
	Primary	1.75 (±1.66)	2.64 (±1.50)	0.89	0.186	2.64 (±1.50)	3.76 (±0.87)	1.12	0.036

SD Standard deviation

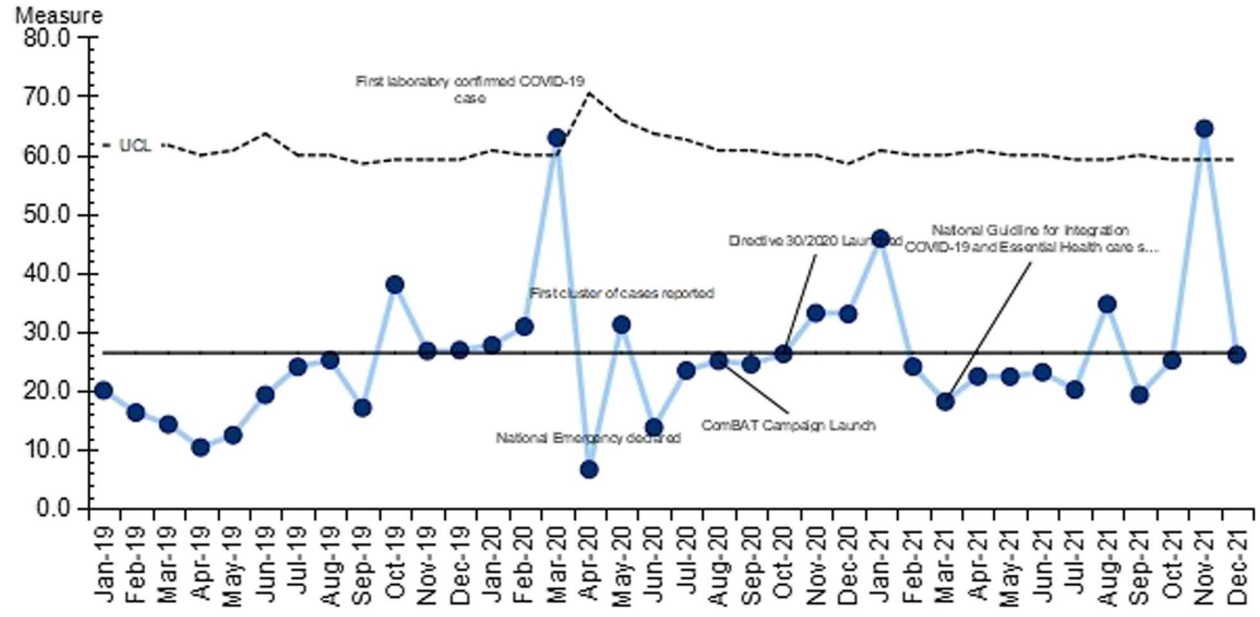

Fig. 4 Trend of Delay for elective surgical admission, referral Hospitals, 2019–2021 months

has disseminated to the general public through various media outlets have been staying at home, wearing masks, hand-washing, and social distancing. Communication channels and messages were adjusted for local settings to operationalize COVID-19 control guidelines [14].

Surgical volumes at referral hospitals decreased, whereas the mean surgical volume in primary hospitals increased during the phase 1 pandemic year compared to the year before the pandemic (phase 0). This was also explained by the nationwide restriction movement, which led to a decline in surgical case referrals and a shift of patients to primary hospitals with large patient volumes. Therefore, the population's surgical service-seeking behavior shifted towards primary health care units rather than tertiary health facilities. Prior government initiatives to increase the capacity of the primary healthcare system for surgery and the laboratory system, as well as efficient interventions by Ethiopia's health extension experts to make door-to-door visits to connect surgical patients, helped to ease this burden. In contrast, there was widespread cancellation and postponement of surgical cases to mobilize medical supplies and relieve the healthcare system load imposed by COVID-19. South Africa study supported by a report of the total number of general surgery operations decreased by 44% between 2019 ($n = 3\,247$) and 2020 ($n = 1\,810$) ($p < 0.001$) [15].

The Ethiopian government launched a "Directive issued for the Prevention and Control of the COVID-19 Pandemic" No. 30/2020" and the "ComBAT campaign" and a statewide community mobilization, testing, and prevention program during the midterm of the phase 1 year (2020), to slow the spread of the pandemic through active public engagement [16, 17]. The directive and campaign served as a national public awareness platform and conducted extensive COVID-19 testing. This directive allows increased COVID-19 testing and the identification of positive surgical patients, preventing further contamination of the surgical workforce and operating room facilities.

This study found an increase in mean surgical volume between the phase 2 year (2021) and the First phase 1 year (2020) for referral, general, and primary hospitals. Prior interventions and preparations explained this before the pandemic, which improved the utilization of primary hospitals for surgical services as part of building a strong primary healthcare system. In line with this finding, a study conducted in two referral hospitals in

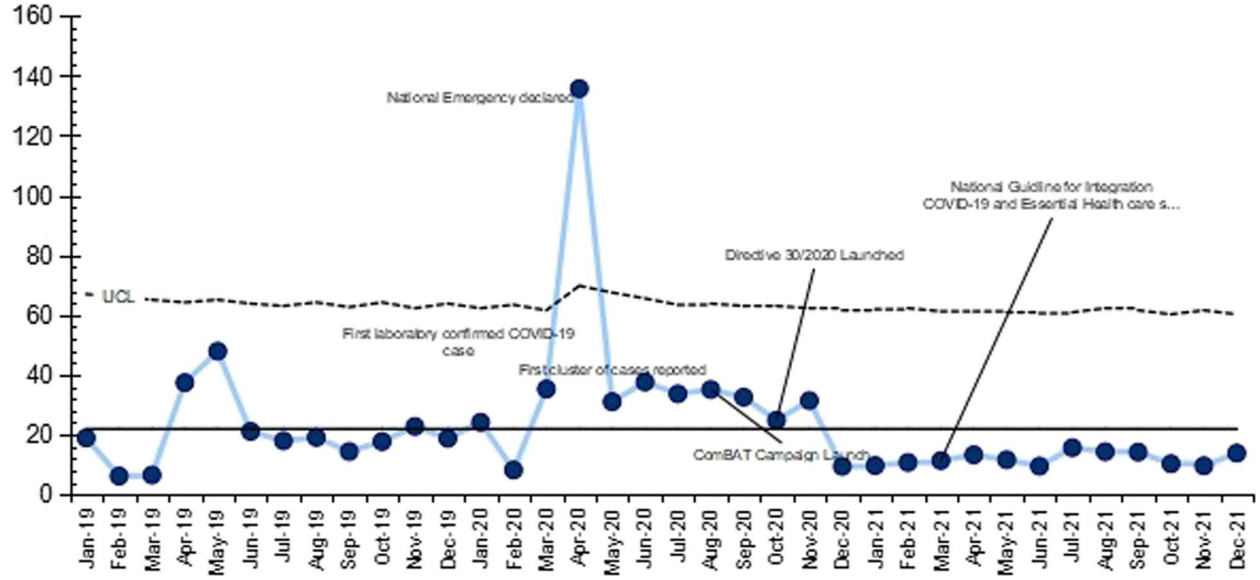

Fig. 5 Trend of Delay for elective surgical admission, General hospitals, 2019–2021 months

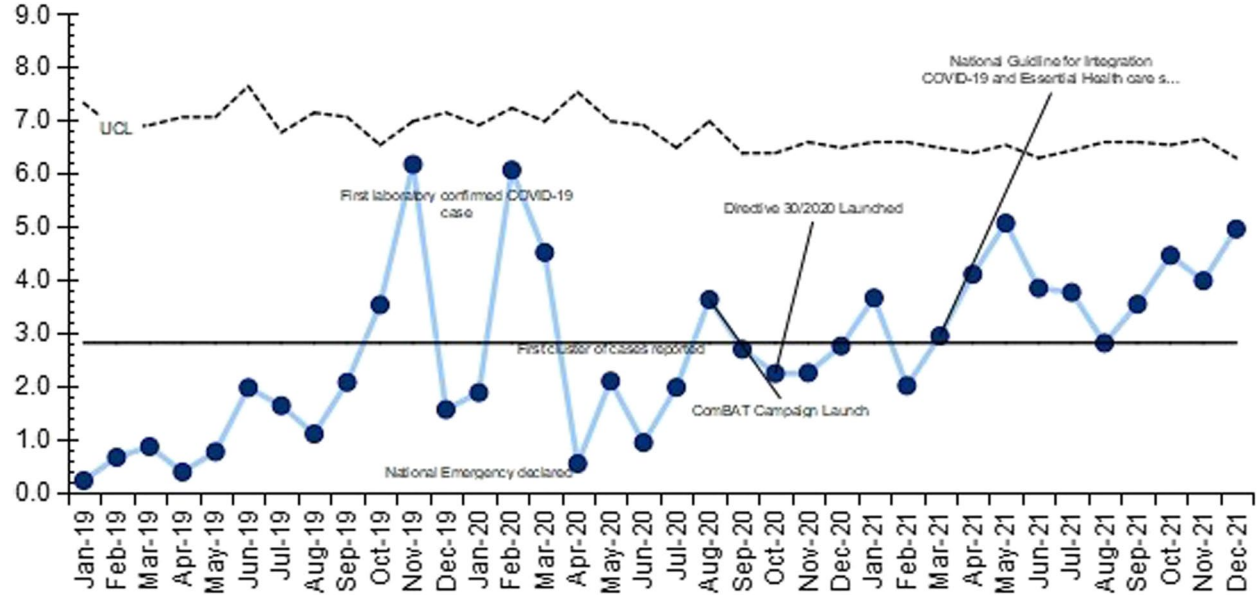

Fig. 6 Trend of Delay for elective surgical admission, primary hospitals, 2019–2021 months

Table 3 Caesarean section rate during pre-pandemic (phase 0), pandemic (phase 1) and post-pandemic (phase 2) periods

Indicator	Health Facility	Phase 0 versus Phase 1		Diff3erence	*p*-value	Phase 1 versus Phase 2		Difference	*p*-value
		Phase 0 Mean (± SD)	Phase 1 Mean (± SD)			Phase 1 Mean (± SD)	Phase 2 Mean (± SD)		
Caesarean section rate	Referral	29.54 (± 1.73)	31.66 (± 1.68)	2.12	0.011	31.66 (± 1.68)	33.68 (± 1.22)	2.02	0.003
	General	21.77 (± 0.08)	24.47 (± 1.41)	2.70	< 0.001	24.47 (± 1.41)	24.70 (± 0.99)	0.23	0.644
	Primary	12.57 (± 1.16)	14.36 (± 1.07)	1.79	0.004	14.36 (± 1.07)	14.60 (± 1.09)	0.24	0.591

SD Standard deviation

Ethiopia during the COVID-19 pandemic found a reduction in surgical case volume during and after the lockdown [17].

Compared to the pandemic year, statistically and clinically significant delays in surgical admission in referral, general, and primary hospitals have been seen during

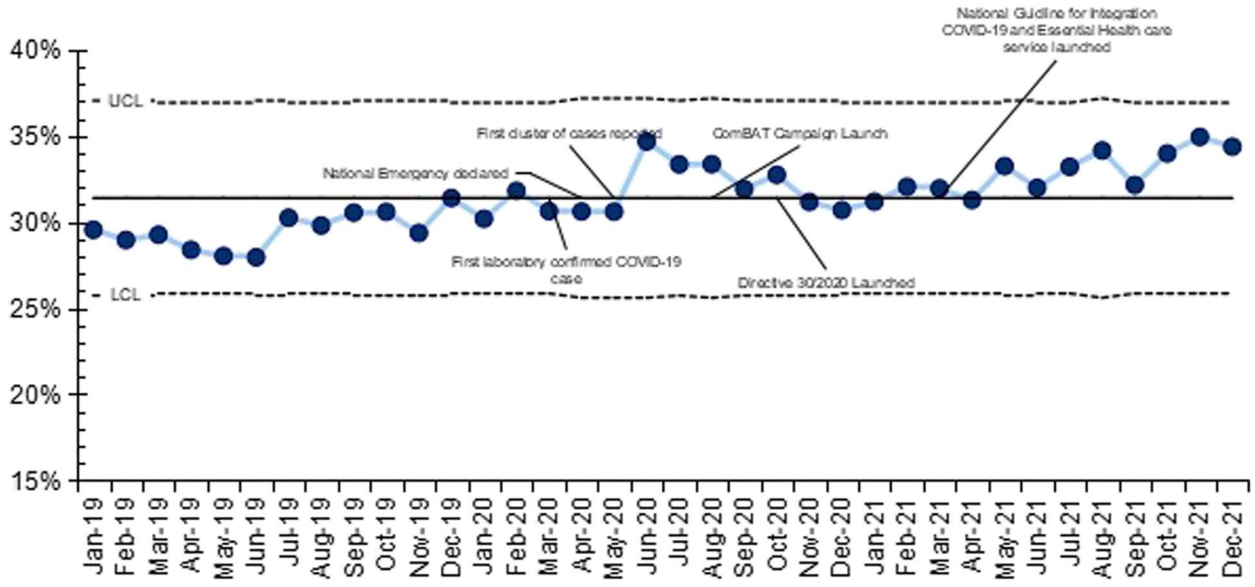

Fig. 7 Trends of CS rate, referral hospitals, 2019–2021 months

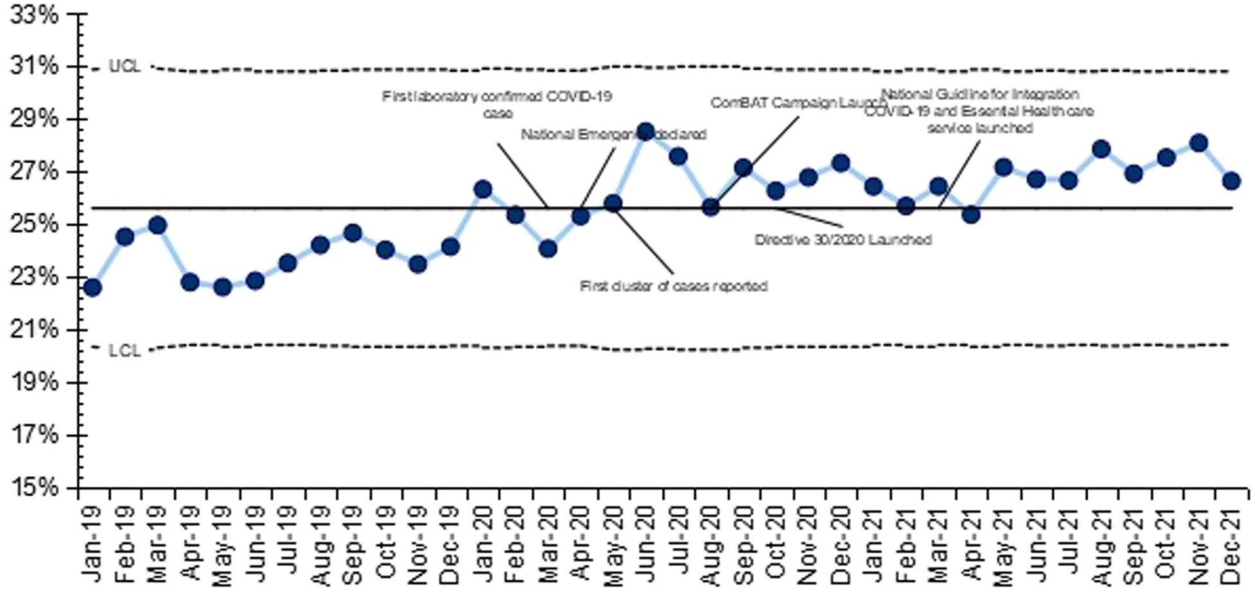

Fig. 8 Trend of CS rate, General hospitals, and 2019–2021 months

the post-pandemic year. The clinically significant delay of surgical admission in all types of hospitals is associated with launching the National Guideline for Integration of COVID-19 and Essential Health care services. Standardized approaches will assist in effectively and efficiently providing essential health services during this pandemic to address health service needs for diseases other than Covid 19. The guideline strongly recommends that all patients needing surgery be tested for SARS Corona II virus [18].

Although there was a shift of surgical service from referral hospitals, there was a decreased delay in the surgical admission rate in primary and general hospitals in the post-pandemic year in this study. This finding was directly related to guidelines recommendations to continue the service with 50 – 70% capacity due to a shortage of supply and decreased number of surgical beds after instituting appropriate distance between beds and also due to allocation of surgical beds for priority COVID-19 case management. It can also be concluded as a "mixed blessing" related to the high rate of asymptomatic cases and predominantly practiced COVID-19 testing in referral hospitals, resulting in case cancellation and postponement [19]. Considering the backlog of patients requiring

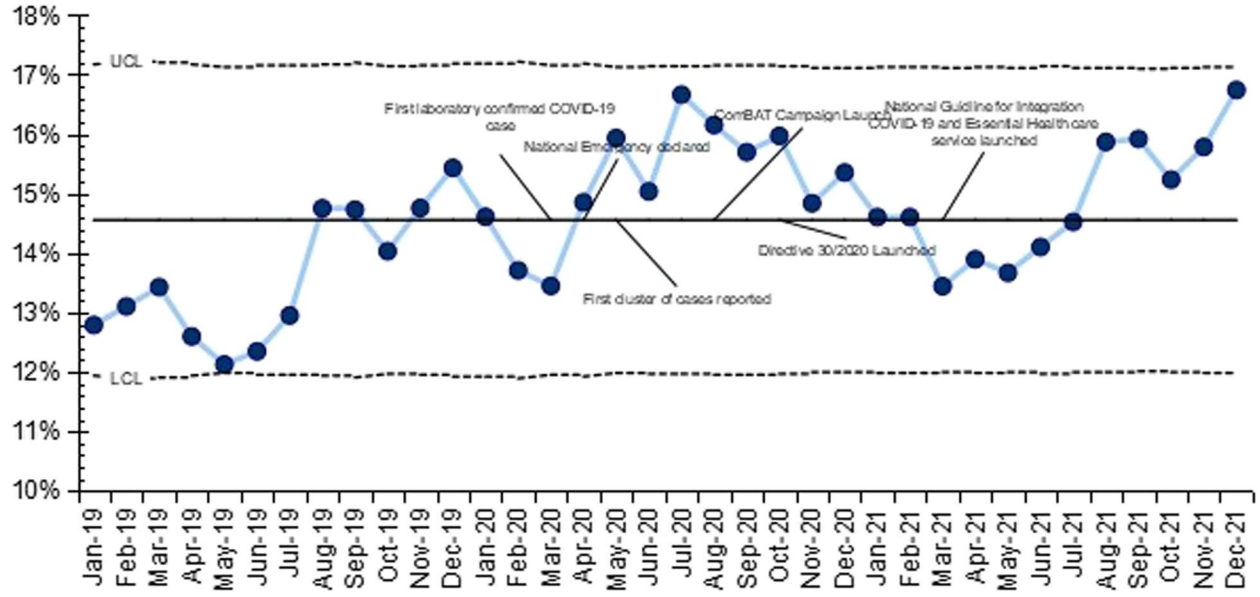

Fig. 9 Trend of CS rate, primary hospitals, and 2019–2021 months

Table 4 Surgical site infection rate during pre-pandemic (phase 0), pandemic (phase 1) and post-pandemic (phase 2) periods

Indicator	Health Facility	Phase 0 versus Phase 1		Diff3erence	*p*-value	Phase 1 versus Phase 2		Difference	*p*-value
		Phase 0 Mean (±SD)	Phase 1 Mean (±SD)			Phase 1 Mean (±SD)	Phase 2 Mean (±SD)		
Surgical site infection	Referral	8.77 (±15.19)	3.09 (±2.17)	−5.68	0.213	3.09 (±2.17)	1.51 (±0.42)	−1.57	0.02
	General	10.59 (±5.13)	2.08 (±1.31)	−8.51	0.112	2.08 (±1.31)	3.59 (±0.29)	1.51	0.49
	Primary	3.42 (±6.85)	1.76 (±1.91)	−1.67	0.426	1.76 (±1.91)	1.55 (±0.52)	−0.21	0.86

SD Standard Deviation

surgical intervention, prolonging appointments for a reasonable time depends on the patient's condition. General and primary hospitals played a major role in responding to the demand for surgical services in the community. Health facilities are also advised to revise their list and prioritize patients based on their case proportions and risk of malignant transformation. And this was transparently communicated to the community and regional health bureaus [20].

The mean caesarian section rate was significantly higher in the pandemic year than in the pre-pandemic year in all types of hospitals. This finding was in line with a study done in Iran [21].The possible reason might be that healthcare providers perceived that opting for a cesarean section might be associated with decreased waiting time in the hospital, reducing viral transmission during the pandemic wave [22].

This study has found dramatically and substantially reduced SSI rates in referral hospitals. One of the study's limitations was its inability to determine if the stringent infection control measures put in place due to COVID-19 had any direct or indirect effects on the rate of SSI. However, a single-center observational cohort study in Riyadh hypothesized that stricter infection control measures were implemented during the COVID-19 pandemic to reduce the likelihood of transmission. Strict hand hygiene regulations, as well as contact and droplet isolation, were applied. The surgical site infection rate decreased due to the above actions and restrictions on visitors in the surgical wards [23].

Strengths and limitations of the study

This study used data retrieved from DHIS-2, which was not directly collected in real-time. By establishing inclusion and exclusion criteria, data quality has been enhanced. Health facilities without complete monthly surgical care data are excluded. The study's dates did not align with the country's COVID-19 epidemic waves. This was done to maintain control over confounding variables resulting from variations in surgical indicators caused by the erratic pre-COVID-19, the first and second year of the COVID-19 pandemic wave. The analysis and discussion of surgical care data over three years allowed for the inclusion of an adequate number of patients in the study. Future qualitative investigations on strategic initiatives, their implementation perspectives, and outcomes at the level of health facilities are recommended.

Conclusion and recommendation

Compared to the pre-pandemic period, COVID-19 significantly impacted the Ethiopian surgical care continuum, indicated by decreased surgical volume and increased surgical admission delays. Additionally, cesarean section rate was increased during the pandemic. However, during the pandemic, there was a decrease in the rate of surgical site infarction. After the pandemic, surgical volume was observed to have increased compared to the previous year.

According to this national survey, surgical services should be cascaded to primary healthcare facilities, including primary hospitals and health centers with surgical services. The COVID-19 pandemic was successfully managed while preserving surgical and anesthetic services attributable to the health service recovery measures taken during the outbreak, such as the early inclusion of COVID-19 case management in the essential service package.

To build a more resilient health system and meet community surgical service demand during public health emergencies, strengthening surgical service at primary health care units, such as primary hospitals and health centers with operation theatre blocks, should be given the utmost priority.

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Authors' contributions
AHG, BRM and HMB: Took part in conceptualization, methodology, formal analysis, investigation, resources, data curation, writing - original manuscript draft, writing– review & editing, visualization,. DBT, FD and MKS: Took part in methodology, formal analysis, investigation, writing review & editing, visualization. ASE and FTK: Manuscript writing, paper revision, editing, methodology. All authors approved the final draft of manuscript.

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Data availability
The data generated during and analyzed during this study are available from the corresponding request upon a reasonable request.

Declarations

Ethics approval and consent to participate
This study, which included an informed consent waiver, was approved by the institutional review board (IRB) of Saint Paul Hospital Millennium Medical College, Addis Ababa, Ethiopia (Reference number: Pm23/143). All methods were carried out in accordance with relevant guidelines and regulations in accordance with the Declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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