Examining the surgical backlog due to COVID-19 in Latin America and the Caribbean: insights from a scoping review

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Summary

This scoping review assessed the surgical backlog in Latin America and the Caribbean (LAC) due to COVID-19 and identified mitigation strategies. We searched seven databases for citations from December 2019 to December 2022, focusing on LAC patients with cancelled or postponed procedures. We registered our protocol at Open Science Framework (https://osf.io/x2nd8) and adhered to PRISMA-ScR guidelines. We included 83 citations covering 23 LAC countries and 19 surgical specialities, with Brazil (67%, 56/83) and transplant surgery (24%, 20/83) being the most documented. Surgical backlogs were mainly reported at the hospital (44%, 37/83) and national levels (38%, 32/83). We identified 58 citations that reported a total of 42 strategies to mitigate the backlog, the most cited being establishing prioritisation criteria for surgical cases (41%, 24/58). Our findings highlight challenges across differing healthcare systems in LAC, including disparities in data availability, surgical capacity, and resource allocation. For instance, while countries like Brazil had extensive data on national surgical backlogs, others lacked comprehensive national-level data. Our review can help inform policymakers and healthcare stakeholders to implement targeted interventions to prepare LAC-based surgical systems for future health emergencies.

Keywords: COVID-19; Global burden of disease; Health equity; Health policy; Pandemic preparedness; Surgical procedures; Operative

Introduction

The COVID-19 pandemic disrupted health systems globally. Due to the growing demand for COVID-19-related services, reduced inpatient capacity, nationwide lockdowns, and decreased surgical workforce availability, hospitals postponed or cancelled operations to delay the virus's spread and preserve resources. Such measures led to an estimated backlog of 115 million surgical procedures worldwide.[7–9]

The surgical backlog provoked by COVID-19 caused unprecedented effects across specialities. For instance, a survey of 25 American hospital systems showed that patients scheduled for elective orthopaedic, plastic, and oropharyngeal operations were the most affected.[10] In Ontario, Canada, the number of elective ophthalmological surgeries decreased by 97% in May 2020 and 80% in May 2021, compared to the same month in 2019.[11] Critical and time-sensitive operations were also impacted. A study conducted in 61 countries found that 1 in 7 oncological patients in regions under lockdown did not undergo their planned surgery and experienced longer preoperative delays.[12] Moreover, a systematic review demonstrated that cancellation of surgeries to treat breast, lung, and colon cancer reduced patients' overall survival.[13]

Although COVID-19 generated consequences for surgical systems, few publications have comprehensively assessed the surgical backlog in low- and middle-income countries, including those in Latin America and the Caribbean (LAC).[14,15] Understanding the extent of the

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surgical backlog can help inform context-wise policy responses and implement recovery plans in the region.[16] In this scoping review, we primarily aimed to investigate the extent of the surgical backlog provoked by COVID-19 in LAC. Our secondary aim was to map short and long-term strategies to mitigate the surgical backlog following the WHO's health system building blocks.[17]

Methods

Study design

This study was registered at Open Science Framework (https://osf.io/x2nd8) and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR).[18,19]

Citation selection process

Results from the literature searches were exported to EndNote (Clarivate) to remove duplicates.[20] References were then imported into Covidence online software.[21] Two independent reviewers screened titles and abstracts, followed by full-text screening for eligible references. Reasons for excluding sources were recorded, and disagreements were resolved by additional reviewers at each screening stage.

Data extraction

Two independent reviewers collected data from each citation using an extraction form based on the Joanna Briggs Institute template.[22] A third reviewer solved disagreements. The following data items were collected: title; publication year; country of the study population; study design; type of source; included medical specialities; source's primary issue of interest; funding source; estimation of the surgical backlog; level of reported backlog (i.e., hospital/department, municipality, city, state, country regions, national, and LAC levels); and strategies to mitigate the effects of the surgical backlog.

Risk of bias and strength of evidence

We used the Mixed Methods Appraisal Tool (MMAT) to assess the risk of bias in included studies.[23] The primary reason for selecting this tool was its demonstrated effectiveness in studies with heterogeneous methodologies.[24,25] MMAT allows the assessment of qualitative research, randomised controlled trials, along with non-randomised, quantitative descriptive, and mixed methods studies.[23] Following the MMAT requirements, we conducted risk of bias assessment in studies deemed empirical research. Therefore, we decided to exclude letters to the editor, conference abstracts, and other studies lacking methodological details, considering those to have a higher risk of bias.

We used the content from the articles' methods to label each citation's study design. If the study design remained unclear, our team classified each citation according to the definitions provided by MMAT. Two independent reviewers assessed each citation to determine the risk of bias, with a third reviewer solving disagreements.

Data synthesis

We used frequencies and percentages to describe the characteristics of the included studies. A narrative summary of the findings from the selected studies was provided, along with tables and figures. A map illustrating countries from included citations was designed using QGIS (version 3.30.1 "s-Hertogenbosch").[26] We used the Risk-of-bias VISualization (robvis) to create plots representing the outputs of our quality assessment.[27]

Two reviewers categorised the strategies to mitigate the surgical backlog following WHO's health system building blocks: service delivery, health workforce, governance, infrastructure, financing, and information management.[17] Based on content, recommendations were condensed into major strategies within building blocks. Disagreements were solved through discussion.

Ethical aspects

This project was submitted to the Harvard Faculty of Medicine Institutional Review Board and considered non-human subjects research (protocol # IRB22-1239).

Results

Literature search

We retrieved 2113 records from searches conducted between November 28th and December 1st, 2022. Removal of duplicates in EndNote and Covidence resulted in 1346 citations for screening (Fig. 1). After screening 118 studies for full-text eligibility, we ultimately included 83 citations (Supplementary Table S2).

Characteristics of sources of evidence

Most citations were original articles (78%, 65/83) and conference abstracts (15%, 13/83). Out of 41 countries in LAC, we included citations from 23 (56%, 23/41) countries (Fig. 2). Brazil had the highest representation (67%, 56/83), followed by Argentina (15%, 13/83) and Chile (14%, 12/83). Following the World Bank classification, our citations encompassed 12 upper-middle-income countries, 5 high-income countries, and 5 lower-middle-income countries. When we conducted the analyses, Venezuela's income level was temporarily unclassified.[2]

The primary focus of 77 articles was to assess surgical capacity (e.g., delay and cancellation of surgeries). The most commonly reported specialities were transplant surgery (24%, 20/83), followed by surgical oncology (22%, 19/83), and general surgery (21%, 18/83). The majority of citations were cross-sectional studies (34%, 29/83), followed by retrospective cohort

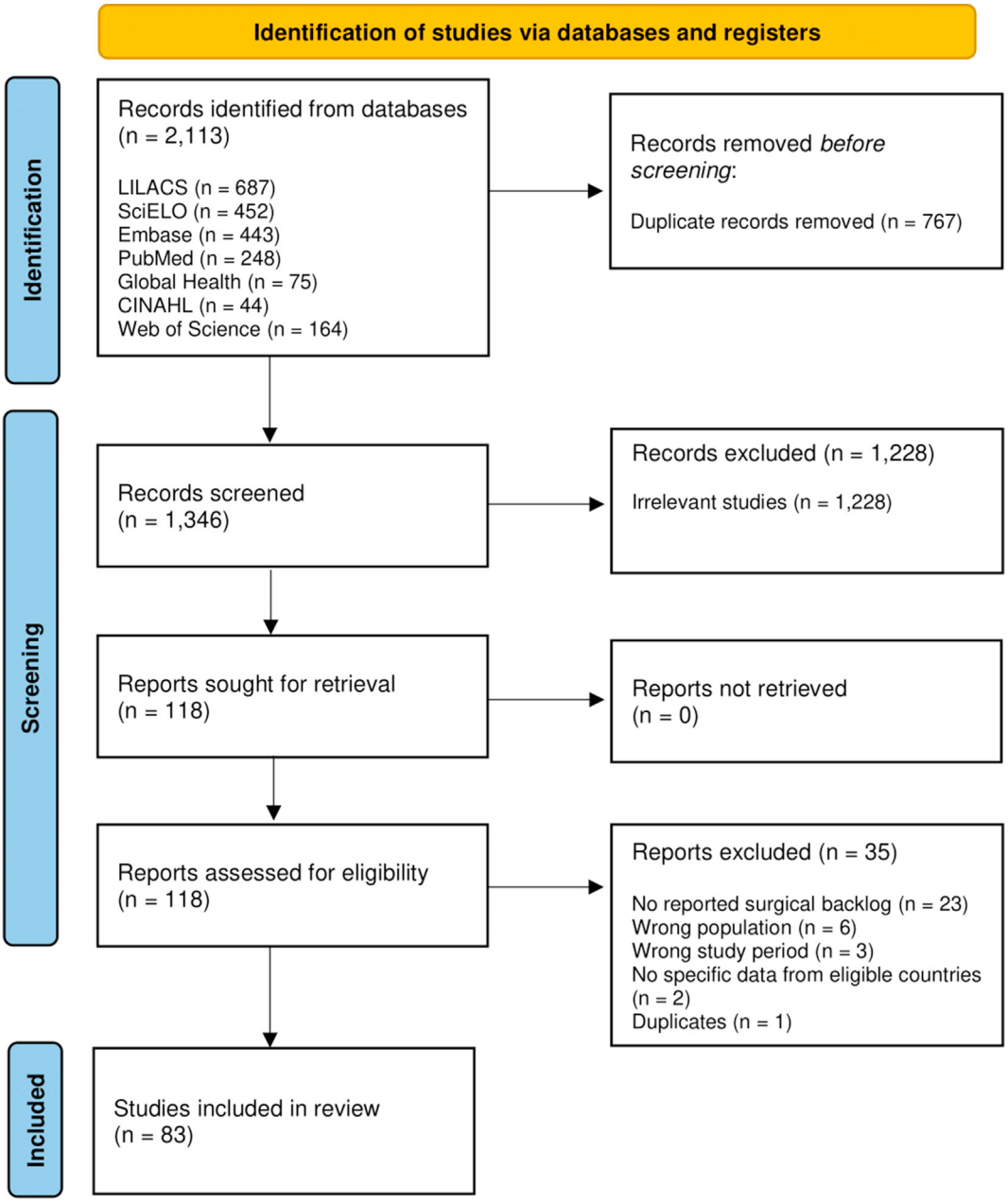

Fig. 1: **Flowchart of the review process.** The flowchart displays information about each phase of the review process and maps out the number of citations identified, included, excluded, and the reasons for exclusions.

studies (33%, 28/83), in some cases nested with ecological studies (2%, 2/83). A summary of the citations' characteristics is provided in Table 1. Characteristics of each citation are reported in Supplementary Table S3.

Risk of bias and strength of evidence

Following MMAT criteria, we included 66 citations in the risk of bias assessment which comprised 33 non-randomised quantitative studies, 32 quantitative descriptive studies, and 1 qualitative study. Among non-randomised studies, 93% (31/33) adequately represented the target population and had complete outcome data. However, 60% (20/33) did not account for confounding variable adjustments. In the case of descriptive studies, 96% (31/32) and 87% (28/32) employed adequate sampling strategies and statistical methods, respectively. Nonetheless, 11 studies exhibited a higher risk of non-response bias, while 6 had sample representativeness issues. Methodological aspects for

***Fig. 2:* Number of articles per Latin American and Caribbean Country.** This figure shows the frequency of citations per Latin American and Caribbean country included in our scoping review. Created on QGIS (version 3.30.1 "s-Hertogenbosch"), on April 28, 2023.

included qualitative studies were mostly unclear, hindering a comprehensive evaluation (Supplementary Figures S1–S3).

Estimations of surgical backlog

Most citations reported backlogs at the hospital or department level (44%, 37/83), followed by the national level (38%, 32/83). Citations utilised various measures to estimate the backlog, such as the number of patients, operations, admissions, and consults. Some citations indirectly estimated the accumulation of surgical cases by surveying residents, specialists, health facilities, and healthcare programs. We report the backlog findings for each included citation in Supplementary Table S4.

Backlog at the LAC level

Only some studies provided backlog data covering the entire LAC region. After assessing 20 LAC countries, Pages et al. specified that COVID-19 was associated with a 26% and 41% decrease in liver transplantation and

Characteristic	Number of citations (%)
Type of publication	
Original article	65 (78)
Conference abstract	13 (15)
Letter to the editor	2 (2)
Review	2 (2)
Bulletin	1 (1)
Study design	
Cross-sectional	29 (34)
Retrospective cohort	26 (31)
Ecological study	20 (24)
Before and after study	2 (2)
Retrospective cohort & Ecological study	2 (2)
Interrupted time-series	1 (1)
Narrative review	1 (1)
Speciality	
Transplant surgery	20 (24)
Surgical oncology	19 (22)
General surgery	18 (21)
Orthopaedics/Traumatology	13 (15)
Cardiothoracic surgery	11 (13)
Urology	10 (12)
Head and neck surgery	7 (8)
Obstetrics and Gynaecology	7 (8)
Paediatric surgery	7 (8)
Neurosurgery	6 (7)
Breast surgery	5 (6)
Otorhinolaryngology	4 (4)
Vascular surgery	4 (4)
Colorectal surgery	2 (2)
Hepatopancreatobiliary surgery	2 (2)
Ophthalmology	2 (2)
Plastic surgery	2 (2)
Oral and maxillofacial surgery	1 (1)
Surgery in emergentology	1 (1)
Not reported	4 (4)
Primary issue of interest	
Surgical capacity (e.g., delay/cancellation of surgeries)	77 (92)
Patient surgical/clinical outcomes (e.g., mortality, postoperative complications)	26 (31)
Education (e.g., residency training)	9 (10)
Challenges faced by providers to deliver care	2 (2)
Epidemiological transitions	2 (2)
Assess the effect of operational strategies in the conversion of services	1 (1)
Continuity of care delivery towards non-communicable chronic diseases	1 (1)
Level of reported backlog	
Hospital/Department	37 (44)
National (only one country)	32 (38)
State	11 (13)
Regional (various regions within a single country)	11 (13)
Latin America and the Caribbean (multiple countries from the region)	7 (8)
Municipality	1 (1)
City	1 (1)
Other	4 (4)

Caption: Studies could be counted more than once, depending on the assessed characteristic.

Table 1: **Summary of characteristics of the 83 included studies.**

living donor liver transplant rates, respectively. Salvalaggio et al. encountered that over 80% of assessed LAC centres did not perform living donor kidney transplants. Additionally, Villanueva et al. described that 43% of surveyed participants from more than 20 LAC countries reported decreased paediatric oncological surgeries up to October 2020.

Backlog at the national level

Of the 23 included LAC countries, only citations from Brazil provided evidence to calculate the overall national surgical backlog across specialities. While Truché et al. estimated that Brazil accumulated 1,119,433 surgical operations in 2020, Bigoni et al. reported a 59% reduction in low and medium-complexity surgeries, 27% in high-complexity surgeries, and 44% in transplants in the same year compared to national estimates from 2019. We observed that several LAC countries had national backlog estimates for specific specialities. These data were often extracted from studies conducted within a single country or across multiple countries, primarily evaluating surgical oncology and transplants. In contrast, there was a lack of national-level data for Trinidad and Tobago, Jamaica, and Puerto Rico.

Backlog for elective and emergency procedures

Overall, 28 studies provided details on elective procedures when estimating the surgical backlog. All 28 citations reported reductions in these surgeries, with a large portion presenting data from Brazil (64%, 18/28). Specifically, 7 citations (25%, 7/28) analysed data from multiple surgical specialities. The elective surgical backlog was most commonly estimated at the hospital or department level (39%, 11/28) and the national level (53%, 15/28).

A total of 21 citations described changes in the volume of emergency procedures. Most studies were conducted in Brazil (42%, 9/21). Among these citations, 12 provided data at the hospital or department level, and 7 at the national level. Additionally, 4 studies assessed

operations involving multiple specialities. Unlike the declining trend in elective surgeries, the studies reported mixed results for emergency operations. In particular, 4 references reported an increased volume of emergency operations, while the remaining 17 indicated a decreased volume. Truché et al. highlighted a slight reduction in these procedures (4%) compared to elective surgeries (40%) by evaluating national public healthcare data from Brazil. Table 2 outlines the estimations of the surgical backlog across analysed surgical specialities.

Mitigation strategies

Overall, 58 of the 83 included citations mentioned recommendations to mitigate the effects of the COVID-19 surgical backlog. We identified 148 recommendations and condensed them into 42 strategies. Following WHO's health system building blocks, we found that 28% (12/42) of the strategies focused on service delivery, 21% (9/42) on the health workforce, 19% (8/42) on governance, 14% (6/42) on infrastructure, 9% (4/42) on financing, and 4% (2/42) on information management. Table 3 displays the identified strategies per building block and their frequency.

Most reported strategies

The "service delivery" domain comprised the two most frequently reported strategies: establishing criteria to determine the prioritisation of surgical procedures (41%, 24/58) and adopting telemedicine (27%, 16/58). The third most cited strategy pertained to "infrastructure" and consisted of increasing the availability of personal protective equipment (PPE) and COVID-19 testing (18%, 11/58).

Regarding the "health workforce," adaptation and expansion of surgical training using online and remote educational resources was the most commonly reported strategy (8%, 5/58). In the "governance" domain, citations emphasised the promotion of timely production and release of clear guidelines and protocols for surgical practice (15%, 9/58).

Lastly, citations reporting "financing" strategies outlined the need to adjust the remuneration of surgical providers (3%, 2/58), along with generating and maintaining sustainable funding mechanisms for surgical care beyond periods of public health emergencies (3%, 2/58).

Discussion

We conducted a scoping review to gain insights into the surgical backlog resulting from COVID-19 in LAC. Our study revealed that nearly half of the countries in the region lacked sufficient data to assess the backlog's extent. Among the countries we studied, only Brazil had national-level data to estimate the overall surgical backlog across various specialities. A large proportion of included countries had data available for specific specialities, particularly in surgical oncology and transplant. Importantly, our scoping review compiled 42 strategies to mitigate the effects of surgical backlog using WHO's health system building blocks. These strategies will prove vital in strengthening surgical systems in LAC and preparing them for future health emergencies.

Our review exposed a lack of data in 18 (44%) of the 41 LAC countries, underscoring a critical gap in comprehending the total surgical backlog in the region. Modelling studies effectively address this gap by predicting surgery accumulation and quantifying the resulting burden. For example, the COVIDSurg Collaborative conducted a study projecting the volume of cancelled or postponed surgeries across 190 countries during the initial 12-week peak period of the pandemic. This study included 33 LAC countries and estimated a backlog of 5.6 million procedures for the region.[8] The application of predictive models offers an alternative for calculating the backlog in countries with limited data, enabling interventions to alleviate the surgical burden.

Our study revealed a concentration of references from Brazil, comprising 67% of included citations, followed by Argentina and Chile. This high rate for Brazil is expected, given its significant expenditures in health and research compared to most LAC countries. In 2021, Brazil was among the top three LAC countries with the highest health expenditure, investing 9.89% of its national gross domestic product (GDP) in health.[28] Additionally, data from 2020 indicated that Brazil allocated 1.14% of its GDP to public and business research and development, although this level of investment remains limited compared to other major economies.[29] According to a report released by Scopus and Web of Science, Brazilian researchers published over 72,000 scientific publications in 2021.[30] In this context, the presence and strength of government agencies dedicated to fostering science and technology in Brazil, Argentina, and Chile likely explain the higher number of citations from these countries.[31–35] These institutions shape the research culture by providing essential resources, funding, and frameworks that foster academic outputs, including publications.[36,37] Therefore, the higher concentration of references from these nations reflects the underlying heterogeneity among countries, particularly in their investments and support structures for health and research.

Furthermore, some countries likely had a higher prevalence of articles due to the availability of open healthcare databases administered by governments. In Brazil, the Unified Health System's Informatics Department (DATASUS) database reports on various surgical care indicators.[38] The current literature underscores the advantages of such clinical databases, emphasising their role in promoting research and evidence-driven policymaking.[39,40] Due to their extensive

Speciality	Main findings
Transplant surgery	LAC Backlog • Assessment of 20 LAC countries showed a decrease of 26% in liver transplantation rate and 41% in the living donor liver transplantation rate comparing volumes from 2019 to 2020 (Pages J, Zapata RL et al., 2021) Argentina National Backlog • Prospectively collected data from the National Report Agency (INCUCAI) revealed a reduction from 3120 transplants in 2019 to 1184 procedures in 2020 (Pages J, Piñero F et al., 2021b). Brazil National Backlog • Data from the Brazilian Transplantation Registry between January and September 2019 and 2020 showed a decrease of 23% in heart transplants (285 versus 215), 49% in lung transplants (72 versus 39), 10% in liver transplants (1620 versus 1506), 14% in pancreas transplants (12 versus 108), and 25% in kidney transplants (4617 versus 3486), respectively (Ribeiro Junior et al., 2021). Mexico National Backlog • Mexico's National Transplant Registry reported an 80% reduction in transplant volume between pre-COVID-19 and COVID-era periods, from 7136 to 1457 procedures (Servin-Rojas et al., 2021).
Surgical oncology	LAC Backlog • Of 704 oncology practitioners surveyed from 20 LAC countries, 61% and 20% had delayed and cancelled surgeries, respectively (Bernabe Ramirez et al., 2021). Brazil National Backlog • In 2020, the Unified Health System (SUS) Hospital Information System revealed a decrease of 25172 (15%) cancer surgeries in the public health system compared to 2019 (Ribeiro et al., 2022). • A time series analysis at SUS Hospital and Ambulatory Information Systems revealed a 9% reduction in oncological surgeries (Fonseca et al., 2021).
General surgery	Argentina National Backlog • A retrospective survey among medical directors of 31 private healthcare institutions observed a 73% reduction in the volume of general surgeries from 19,600 procedures in April 2019 to 5205 surgeries in April 2020 (Bozovich et al., 2020). • A survey distributed to 18 centres found a 53% decrease in general surgeries, from 9309 procedures in 2019 to 4421 in 2020 (Gondolesi et al., 2020). Brazil National Backlog • An interrupted time series study estimated that approximately 248,529 general surgery procedures were cancelled in 2020 (Frio et al., 2022).
Orthopaedics and Traumatology	Brazil National Backlog • Open data from the Department of Information and Informatics of the Unified Health System (DATASUS) revealed a 51% decrease in total knee arthroplasties between 2019 and 2020 (Pereira et al., 2022). • A study revealed a 28% and 34% reduction in spine surgeries performed at public hospitals in 2020 and 2021, compared to the mean of 18,571.67 surgeries during the pre-pandemic years from 2017 to 2019 (Oliveira et al., 2022). Chile National Backlog • Data from the Chilean Department of Statistics and Health Information showed a 22% decrease in orthopaedic surgeries from 128,735 in 2019 to 99,333 in 2020 (Barahona et al., 2021).
Cardiothoracic surgery	Argentina National Backlog • A retrospective survey of 31 private health institutions revealed a 59% decrease in coronary angioplasty, a 65% decrease in percutaneous interventions, and a 58% decrease in cardiac surgeries between April 2019 and April 2020 (Bozovich et al., 2020). Brazil National Backlog • A national survey revealed that eight paediatric and congenital heart surgery centres experienced a 23%–75% decrease in surgical volume (Miana et al., 2022).
Urology	Brazil National Backlog • A study showed a backlog in elective procedures for treating urolithiasis in Brazil, from 14,290 in 2017–2019 to 9720 procedures in 2020 (Korkes et al., 2022). • A 35% decrease in prostatectomies was estimated in Brazil's public health system, comparing data from April–September 2019 and 2020 (Lima et al., 2021). Colombia National Backlog • There was an 18% decrease in prostatectomies in the country's public health system, comparing data from April–September 2019 and 2020 (Lima et al., 2021).
Head and Neck Surgery	Brazil National Backlog • In a survey of 46 head and neck surgery residents, 22 participants reported having more than 75% of their surgical activities reduced (Leite et al., 2021). • Limitations for resuming elective procedures included restrictions imposed by surgical centres, the lack of available ICU units, and patients' fear of getting infected during hospitalisation (Imamura et al., 2021).
Obstetrics and Gynaecology	Brazil State Backlog • A study in São Paulo state found a 9% and 18% decrease in surgery rates in the public and private sectors and a 4-day increase between diagnosis and treatment for epithelial ovarian cancer during COVID-19 (Moterani et al., 2022).

(Table 2 continues on next page)

Speciality	Main findings
(Continued from previous page)	
Paediatric Surgery[a]	Analyses at the hospital level were conducted for Argentina (Rodríguez et al., 2021) and Brazil (Ballestero et al., 2020).
Neurosurgery	Brazil National Backlog • In the country's public health system, neurosurgical procedures experienced a 21% drop (28,858 cases), with elective cases being more impacted (42%) than emergency ones (5%) (de Macêdo Filho et al., 2021).
Breast Surgery	Brazil National Backlog • A 14% decrease in mastectomies was estimated in Brazil's public health system, comparing data from April–September 2019 and 2020 (Lima et al., 2021). Colombia National Backlog • A 9% decrease in mastectomies was estimated in Colombia's public health system, comparing data from April–September 2019 and 2020 (Lima et al., 2021).
Otorhinolaryngology	Chile National Backlog • A Chilean Society of Otorhinolaryngology survey revealed that 75% of respondents limited surgical practice or operated only oncological and emergency cases (Villarroel et al., 2021).
Vascular Surgery	Analyses at the hospital level were encountered for Brazil (Guarinello et al., 2022) and Uruguay (Martínez et al., 2022).
Coloproctological Surgery	Analyses at the hospital level were encountered for Jamaica (Brown et al., 2022).
Hepatopancreatobiliary Surgery	Argentina National Backlog • A survey of 18 centres with high transplant cases revealed a 49% reduction in hepatopancreatobiliary surgeries and a 31% reduction in hepatocellular carcinoma resections between 2019 and 2020 (Gondolesi et al., 2020).
Ophthalmology	Mexico National Backlog • A survey by the Mexican Ophthalmology Society revealed that 107 out of 363 ophthalmologists continued operations during COVID-19, with less experienced physicians being more likely to perform emergency procedures. (López-Ulloa et al., 2021).
Plastic Surgery[b]	Analyses at the hospital level were encountered in Brazil (Pagotto et al., 2020).
Oral and Maxillofacial Surgery	Analyses at the hospital level were encountered in Brazil (Santos et al., 2021).
Surgery in Emergentology	Argentina City Backlog • One study showed an indirect backlog estimation through reduced resident exposure to surgical cases (Palacios Huatuco et al., 2021).

Caption: This table summarises the most relevant findings per surgical speciality, following the speciality with the highest to lowest number of articles included. [a]Various studies across LAC examined the backlog of surgical procedures performed in paediatric patients; however, most of these have focused on other specialities and subspecialty areas. These findings are detailed in other speciality sections. [b]This section does account for studies on reconstructive or aesthetic breast surgeries.

Table 2: **Surgical backlog caused by COVID-19 per speciality.**

sample size, these databases may capture a more representative portion of the patient population.[39,40] In surgery, leveraging health databases facilitates the exploration of disease incidence, mortality rates, prevalence of surgical treatments, and correlation between healthcare disparities, socioeconomic factors, and policymaking.[40] The study by Truché et al. exemplifies these possibilities by correlating increased stringency in state-level policies with reduced delays in emergent surgical delivery but increased elective surgical backlogs in Brazil.[14] For instance, the availability of open data enables nuanced analyses and lays the groundwork for designing evidence-based strategies to address surgical backlogs.

Our review reaffirmed that COVID-19 predominantly affected elective procedures, while evidence regarding emergency procedures demonstrated variability. This result aligns with reports from diverse regions, affirming the global impact of the pandemic on reducing elective surgical care.[8,41] Most studies attributed the procedural decrease to resource reallocation, workforce distribution, lockdown measures, and patient hesitancy.[42,43] Similar to most of our included citations centred on emergency operations, other reviews noted a reduction in trauma and emergency procedures, although not as prominently as the decline in elective surgeries.[41,42,44] Potential explanations for the increase in emergency cases were explored. Korkes et al. reported on urological procedures at a hospital where urolithiasis cases prevailed.[45] The authors suggested that delaying elective procedures, such as those for treating urolithiasis, may have led to patient complications, thereby increasing the number of emergent surgeries.[45] Furthermore, López-Ulloa et al. attributed the surge in emergency and oncological procedures to the performance of procedures that would otherwise have been referred to other centers.[46]

Although our study primarily examines surgical systems, it is important to stress that the surgical backlog had implications beyond its immediate effects on surgical care, extending to various healthcare domains. Firstly, the diversion of resources, including personnel, equipment, and facilities, to manage the influx of COVID-19 cases compromised the capacity to effectively address non-COVID health issues. This resulted in delays and disruptions in routine healthcare

Building block	Strategy	Number of citations (%)
1. Service delivery	1.1 Establish criteria to prioritise which surgical cases should be operated (e.g., using artificial intelligence, unifying waiting lists)	24 (41)
	1.2 Encourage the adoption of telemedicine	16 (27)
	1.3 Create flowcharts and processes to separate, allocate, and manage patients with and without COVID-19 as admissions and referrals to surgical departments	7 (12)
	1.4 Adopt safety measures to early detect and prevent COVID-19 among patients to avoid contamination in surgical departments	6 (10)
	1.5 Improve the geographical distribution of health institutions and resources to continue the provision of non-COVID-related services	4 (6)
	1.6 Establish clinical and laboratory criteria to facilitate organ donation	4 (6)
	1.7 Improve accessibility of surgical services to vulnerable populations	4 (6)
	1.8 Promote control of COVID-19 cases in the community to prevent delays and cancellations of surgical procedures (e.g., vaccination)	4 (6)
	1.9 Reorganise the care network and availability of services to promote early detection of potential surgical conditions (e.g., cancer screening)	4 (6)
	1.10 Design early discharge and outpatient programs	3 (5)
	1.11 Promote the exchange of resources between health institutions to improve resource allocation	2 (3)
	1.12 Enhance the provision of surgical services by equipping existing health facilities	1 (1)
2. Health workforce	2.1 Adapt surgical training using online and remote educational resources	5 (8)
	2.2 Balance allocation of surgical providers between COVID-19 and non-COVID-19 health services	2 (3)
	2.3 Extend the duration of residency training	2 (3)
	2.4 Generate scientific evidence to tailor the management of surgical services and develop recovery plans	2 (3)
	2.5 Provide training for healthcare professionals to use personal protective equipment adequately	2 (3)
	2.6 Reorganize the workload, schedule, and complexity of procedures assigned to surgical providers	2 (3)
	2.7 Enhance recruitment of surgical providers	1 (1)
	2.8 Increase the density of surgical providers	1 (1)
	2.9 Plan strategies to lessen the psychological and financial burdens on surgical providers	1 (1)
3. Governance	3.1 Promote timely production of clear guidelines and protocols to guide surgical practice	9 (15)
	3.2 Improve communication between health authorities, the health workforce, and the population	6 (10)
	3.3 Optimise knowledge dissemination and implementation of guidelines	6 (10)
	3.4 Implement timely and stringent government policies at the onset of public health emergencies	4 (6)
	3.5 Promote social awareness through campaigns and other activities to motivate surgical practice	2 (3)
	3.6 Adopt a multi-sectoral and multi-stakeholder approach	1 (1)
	3.7 Ensure stakeholders' compliance with established pandemic-related recommendations and guidelines	1 (1)
	3.8 Coordinate responses according to socioeconomic factors	1 (1)
4. Infrastructure	4.1 Increase availability of personal protective equipment and COVID-19 testing to optimise the safety of surgical procedures	11 (18)
	4.2 Increase availability of surgical-related equipment, medications, and supplies	3 (5)
	4.3 Expand intensive and advanced care capacity	3 (5)
	4.4 Increase the number of surgical and hospital beds	3 (5)
	4.5 Adopt administrative, environmental, and engineering-related safety precautions for health facilities	1 (1)
	4.6 Optimise resource allocation to COVID-19 and non-COVID-19 services	1 (1)
5. Financing	5.1 Adjust remuneration of surgical providers (e.g., according to production)	2 (3)
	5.2 Generate and maintain sustainable financing mechanisms toward surgical care beyond periods of public health emergencies	2 (3)
	5.3 Improve fiscal austerity measures	1 (1)
	5.4 Provide financial support to patients and their families to assist with logistics needed for surgical procedures	1 (1)
6. Information management	6.1 Monitor the prevalence and incidence of emergency and urgent surgical cases (both operated and non-operated)	1 (1)
	6.2 Tailor pandemic response according to epidemiological data	1 (1)

Caption: This table reports the frequency for each identified strategy per health system building block, considering that 58 citations reported at least one mitigation strategy to tackle the surgical backlog due to COVID-19.

Table 3: **Mitigation strategies reported on 58 citations toward the COVID-19 surgical backlog per health system building block.**

services such as diagnostic procedures, chronic disease management, and preventive care.[47] Secondly, the postponement of elective surgeries exacerbated existing health disparities, as patients from vulnerable populations faced prolonged wait times and limited access to essential treatments.[48] Moreover, the financial burden

incurred by healthcare institutions to adapt to pandemic protocols and ensure patient safety further strained already stretched healthcare budgets.[49] Consequently, the effects of the surgical backlog illustrate the interconnectedness between healthcare services and the need for comprehensive strategies to mitigate the broader impacts of public health crises.

Our scoping review systematically compiled 42 strategies to manage the consequences of surgical backlogs, considering WHO's health system building blocks. Comparable findings emerge from studies conducted beyond the LAC region.[50,51] A systematic review found that most surgical societies established criteria for triage and prioritisation, especially on urgent and non-deferrable oncological cases.[50] Consistent with our review, published literature frequently mentioned other strategies we identified, such as selecting treatment approaches, ensuring proper use of PPE, and optimising departmental organisation.[51] However, the evidence supporting these recommendations is limited, relying heavily on expert opinions and categorised as grade C recommendations.[52,53] Agrawal et al. also noted a need for more specificity in the guidelines provided by surgical societies, particularly concerning the optimisation and conservation of PPE.[52] Moreover, protocols could be enhanced by discussing the provision of interim treatments while waiting lists remain critically high, as suggested in other fields.[54] As we advance our understanding of managing surgical volumes during pandemics, future studies should rigorously assess the effectiveness of these proposed strategies to inform high-quality and cost-effective interventions.

Besides addressing immediate backlog issues, the strategies identified in our reviewed articles can enhance surgical service preparedness for future crises. The pandemic has highlighted the fragmentation within LAC health systems, exacerbating surgical delays due to capacity constraints at secondary-level hospitals and overflows at tertiary centres.[55] Implementing a more integrated care network is essential to address these challenges effectively. Such a network would facilitate early detection of surgical conditions and promote resource sharing between institutions, improving overall healthcare delivery.[56–58] Additionally, adopting telemedicine and advanced data management workflows can enhance healthcare system preparedness by streamlining access to information across all care levels and reducing unnecessary tests and procedures.[59]

To further optimise the implementation of strategies in LAC, governmental collaboration with international organisations such as the Pan American Health Organization and WHO is critical. A partnership between these organisations could catalyse the development and endorsement of a standardised evaluation tool to facilitate consistent assessment across health centres and identify chronic gaps in surgical care provision. Subsequently, stakeholders should create and disseminate clear guidelines and protocols covering various aspects of surgical care delivery, including case prioritisation, referral processes, follow-up strategies for non-emergent patients with potential medium-term complications, and hospital transition management across crisis phases. Streamlining the dissemination and implementation of these protocols through government agencies, healthcare institutions, and professional associations can strengthen healthcare system resilience against future crises.

Addressing financial and workforce challenges requires adapting and expanding online surgical training resources, such as video and simulation-based learning. Initiatives like the GlobalSurgBox could benefit the LAC region by facilitating standardised, low-cost surgical training across diverse socioeconomic settings.[60] Additionally, ensuring continuous mental health support for healthcare providers is paramount, as studies have shown higher rates of perceived mental health impairment among surgical residents during the pandemic.[61] Strategies to alleviate the psychological issues of healthcare professionals can include reorganising workloads and schedules.[14,46] Finally, adjusting surgical provider remuneration to pandemic scenarios and establishing sustainable funding mechanisms necessitates innovative approaches tailored to the LAC socioeconomic context. Leveraging public-private partnerships, international aid, and community-based financing models can ensure adequate financial support for surgical care during public health emergencies and beyond.

Limitations

The varying levels of research output among the countries included in our study, coupled with the lack of published studies from over half of LAC countries, hinder a complete understanding of the surgical backlog in the entire region. Future research efforts should prioritise exploring these underrepresented areas by integrating additional grey literature, thereby diminishing publication bias. We observed that included studies had heterogeneity regarding targeted population groups and units of analysis. Hence, the included studies should be compared cautiously. We could not incorporate citations written in languages other than English, Spanish, Portuguese, and French, potentially leading to the exclusion of relevant articles. This review encompassed articles published until December 2022, excluding other research studies of equal importance published afterward. Additionally, we did not focus on evaluating the differences in surgical volume between the public and private sectors.

Despite its proven efficacy in evaluating studies with diverse methodologies, MMAT has limitations as the assessment may be affected by the subjectivity of the reviewers. Since MMAT evaluates heterogeneous studies, the tool may not examine all relevant methodological procedures in detail.[23] Therefore, the tool may

Search strategy and selection criteria

We included studies with patients requiring surgical procedures to treat any disease, illness, or injury for which surgical care can improve health outcomes.[1] We considered procedures from all surgical specialities, including gynaecology and obstetrics. Additionally, we used the World Bank classification to determine whether a country was from LAC.[2] Surgical backlog was defined as the number of individuals waiting for surgical interventions.[3,4] We focused on emergency and elective procedures cancelled or postponed due to the COVID-19 pandemic. We interpreted surgical backlog as a measure of unmet surgical needs.[4] Regarding study designs and eligible publication types, we included experimental and quasi-experimental studies, analytical and descriptive observational studies, qualitative studies, reviews, and letters to the editor. We also included conference abstracts and considered them grey literature as previously described.[5] We excluded case reports, commentaries, viewpoints, editorials, open eds, opinion papers, and non-human research.

All eligible original studies, reviews, letters, and conference abstracts were identified by searching seven databases. We described each database's search strategy in Supplementary Table S1. Controlled vocabulary terms (i.e., MeSH, Emtree, CINAHL Subject Headings, CAB Thesaurus) were included when available and appropriate. We limited the publication date to December 2019 onward to correspond to when the World Health Organization (WHO) received the first case reports of COVID-19 in China.[6] We adopted such a time range to account for temporal differences concerning the first reported cases of COVID-19 among LAC countries. We included citations published in English, French, Portuguese, and Spanish due to the geographic region covered and the language proficiency skills of the authors.

not comprehensively address all publication biases. To that extent, other methods for quality assessment, such as funnel plots and the trim-and-fill, could help address some of these concerns, with each additional method having its own limitations.[23,62,63] Nonetheless, although conducting a risk of bias assessment is not required for scoping reviews, we included this methodological step using the MMAT to strengthen our analysis.[24,25] In spite of these limitations, our study provides an overview of the impact of COVID-19 on accumulating surgical procedures in LAC. It encourages further research on mitigation strategies and their respective cost-effectiveness to strengthen and prioritise surgical systems' preparedness and response to public health emergencies.

Conclusion

We analysed 83 citations to assess the extent of the surgical backlog caused by COVID-19 in LAC. We found that 18 out of 41 countries in the region had no available data to evaluate the surgical backlog. Citations covered 19 specialities and most frequently documented volumes from transplant, surgical oncology, and general surgery. Most references provided backlog estimates at the hospital and national levels. Brazil was the country with the highest representation in our review and the only one to have statistics to estimate nationwide surgical backlog across specialities. Using WHO's health system building blocks, our scoping review identified 42 strategies to alleviate the effects of surgical backlog. This work can assist surgeons, policymakers, and stakeholders in LAC to address their surgical backlog and develop evidence-based policies to strengthen LAC surgical systems for future pandemics and other public health emergencies.

Contributors

LNC, MBA, SKH, SJ, and TUL conceived this study. LNC, MBA, AG, SKH, CC, MZ, SJ, JLF, and TUL defined the study design and methodology. LNC, MBA, AG, CC, and CM contributed to defining and conducting the search strategy. LNC, MBA, AG, and SKH conducted the screening of citations. LNC, MBA, AG, CC, and MZ collected data. LNC, AG, and SKH assessed the risk of bias in the studies. LNC, MBA, DDV, and JLF validated findings from the data extraction and risk of bias assessment. LNC cleaned the data. LNC, MBA, and AG analysed the data. LNC, MBA, AG, SKH, JFL, and TUL interpreted the data. LNC, MBA, and AG prepared figures and tables. LNC, MBA, AG, and CM wrote the first draft of the manuscript. All authors critically reviewed and edited the manuscript. All authors had full access to all the data and accepted the responsibility of submitting them for publication. All authors approved the final version.

Data sharing statement

This article and its supplementary information files include all data generated or analysed during this study.

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Declaration of interests

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.lana.2024.100908.

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