



Rethinking referral systems in rural chiapas: A mixed methods study

Valeria Macias^a, Zulema Garcia^a, William Pavlis^{b,*}, Sarah Hill^c, Zachary Fowler^{c,d},
Diana D. del Valle^c, Tarsicio Uribe-Leitz^{c,e,f}, Hannah Gilbert^g, Lina Roa^{c,h},
Mary-Jo DelVecchio Good^g

^a *Compañeros en Salud, Ángel Albino Corzo, Mexico*

^b *Department of Orthopaedics, University of Miami, Miami, FL, USA*

^c *Program in Global Surgery and Social Change, Harvard Medical School, Boston, USA*

^d *Department of Surgery, Zucker School of Medicine at Hofstra/Northwell, New Hyde Park, NY, USA*

^e *Center for Surgery and Public Health, Brigham and Women's Hospital, Boston, USA*

^f *Epidemiology, Department for Sport and Health Sciences, Technical University of Munich, Munich, Germany*

^g *Department of Global Health and Social Medicine, Harvard Medical School, Boston, USA*

^h *University of Alberta, Edmonton, Canada*

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ABSTRACT

Background: Despite the assurance of universal health coverage, large disparities exist in access to surgery in the state of Chiapas. The purpose of this study was to determine the effectiveness of the surgical referral system at hospitals operated by the Ministry of Health in Chiapas.

Methods: 13 variables were extracted from surgical referrals data from three public hospitals in Chiapas over a three-year period. Interviews were performed of health care workers involved in the referral system and surgical patients. The quantitative and qualitative data was analyzed convergently and reported using a narrative approach.

Findings: In total, only 47.4% of referred patients requiring surgery received an operation. Requiring an elective, gynecological, or orthopedic surgery and each additional surgery cancellation were significantly associated with lower rates of receiving surgery. The impact of gender and surgical specialty, economic fragility of farmers, dependence upon economic resources to access care, pain leading people to seek care, and fertility leading patients to abandon the public system were identified as main themes from the mixed methods analysis.

Interpretation: Surgical referral patients in Chiapas struggle to navigate an inefficient and expensive system, leading to delayed care and forcing many patients to turn to the private health system. These mixed methods findings provide a detailed view of often overlooked limitations to universal health coverage in Chiapas. Moving forward, this knowledge must be applied to improve referral system coordination and provide hospitals with the necessary workforce, equipment, and protocols to ensure access to guaranteed care.

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Introduction

Surgical conditions account for one-third of mortality worldwide, yet an estimated five billion people lack access to safe, affordable surgery and anesthesia care [1]. This burden is concentrated in low- and middle-income countries, where an additional 143 million surgical procedures are required annually to meet the current need [1]. Factors such as poverty, geography, and structural violence create dramatic inequities

in surgical access within countries [2–4]. These realities underlie the fact that surgical services are cross-cutting and essential in the pursuit of universal healthcare [5,6].

Mexico is an upper-middle income country with marked income inequality [7,8]. At the time of this study, Mexico had a health care system with three main components: a public social security system for those with formal employment, a public social protection system for those without formal employment, and a private system. Until 2020, the

* Corresponding author at: 1600 NW 10th Ave #1140, Miami, FL 33136, USA
E-mail address: wwp7@med.miami.edu (W. Pavlis).

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insurance-based component of the social protection system, called *Seguro Popular*, guaranteed the roughly 50 million Mexicans without social security access to a set of 260 essential health interventions and 18 high-cost interventions [9,10]. In January 2020, *Seguro Popular* was replaced by INSABI (Instituto de Salud para el Bienestar), but this change focused primarily on funding mechanisms, and the majority of the systems described in this study remain unchanged [11]. Despite universal health coverage, large disparities exist in healthcare access and quality in the southern state of Chiapas, where roughly 30% of the population lives in extreme poverty [12,13]. In recent studies, the public surgical system in Chiapas was found to have significant capacity limitations in areas such as infrastructure, diagnostic capabilities, and workforce [14–16].

However, little research is available detailing patient and physician perceptions of specific barriers to surgical care in rural Mexico and other low- and middle-income countries (LMICs) with universal health coverage. To address barriers to surgical care, a locally based understanding of the referral process is essential. Analysis of the qualities associated with successful surgery and patient experiences in the process will allow policy makers in Chiapas and other similar, rural, low-resource settings to determine key areas for improvement. Only when these hurdles have been identified and procedural gaps addressed will Mexico be able to ensure effective and universal access to health care. The purpose of this study was to determine the effectiveness of the surgical referral system and evaluate what barriers exist for surgery patients in the referral system at hospitals run by the Ministry of Health (MOH) in a rural region of Chiapas.

Methods

This is a mixed-methods study evaluating the barriers and facilitators to successful referral of surgical patients with *Seguro Popular* to hospitals with surgical capabilities in the *Fraylesca* Region of Chiapas, Mexico. A convergent mixed methods analysis, integrating a narrative reporting approach, allowed greater understanding of the severity and qualities of barriers to surgical care [17]. This research was conducted in collaboration with the MOH in Chiapas and a local organization, *Compañeros en Salud México* (CES), as part of an academic thesis of the primary author (VM) [18]. This study has been reported in line with the Consolidated criteria for Reporting Qualitative Research (COREQ) criteria. This study received ethics approval from the Chiapas Ministry of Health (*Secretaría de Salud*) ethics review board, Harvard Medical School IRB, and the *Instituto Tecnológico y Estudios Superiores de Monterrey* (ITESM) ethics committee.

Setting

The MOH in Chiapas contains ten health districts. The focus of this study, District IV in the *Fraylesca* region, includes five municipalities and nearly 300,000 people dispersed within 60 medical units [19]. The study was conducted in three hospitals that belong to the district: Ángel Albino Corzo (AAC), Revolución, and Villaflores. These hospitals were selected as they were the only facilities in the study setting with an operating room and at least one surgeon. AAC and Revolución are basic community hospitals while Villaflores is a second level general hospital. In this setting, written referrals via official referral sheets are common practice. Telephone or online coordination of referrals is a frequent practice, but no formal electronic referral system is utilized.

The *Fraylesca* is a remote region, making transportation challenging and communication difficult due to a scarcity of phone signal and internet. The study population belongs to the informal sector of the economy that receives care through *Seguro Popular*. Most of the population in these communities faces poverty or extreme poverty, high rates of illiteracy, and marginalization [20].

Subjects

The quantitative portion of the study consisted of a retrospective analysis of all written referral records from the year 2012 to 2014. Inclusion criteria encompassed patients ≥ 18 years receiving referrals to Hospital AAC, Revolución, or Villaflores for elective or emergency general, gynecologic, or orthopedic surgery at first or second level hospitals between January 1, 2012 and December 31, 2014. Surgeries included in the study were covered by *Seguro Popular* and available at primary and secondary hospitals (Appendix) [21]. Patients who were under the age of 18, referred to a tertiary facility, non-surgical candidates, in need of an obstetric surgery, or pregnant were excluded from the study. Surgical providers at the receiving hospitals included in this study determined if referred patients were indeed surgical candidates.

Qualitative participant recruitment and interviews were performed by two female authors and Mexican physicians (VM and ZG). We used a snowball sampling technique to recruit patients with *Seguro Popular* who needed surgery or who had received surgery. A person of trust within the community, such as a community health worker, identified the first patient that met the predefined inclusion criteria. After the initial interviews, the participants were asked if they were aware of other community members with experience with the referral system. The researchers used purposive sampling to select health care worker (HCW) participants from rural hospitals and clinics they had become acquainted with during their time in the region. The methods utilized for the qualitative portion of this study are described in further detail in a previously published article [22].

Data Collection

Patients were identified from written referral booklets at each hospital and paper patient files were used to extract a total of 12 categorical and continuous variables for quantitative analysis (Appendix). The continuous predictor variables included age, absenteeism by surgical personnel, patient no shows, number of pre-surgical consultations, number of times surgery was scheduled, and number of visits for diagnostic tests. Categorical variables included hospital (AAC, Revolución, Villaflores), diagnosis (Appendix), sex (male, female), marital status (single, married), specialty (general surgery, gynecology, or orthopedic surgery), urgency of procedure (emergency, elective), and education level (illiterate, completed pre-school, completed primary school, completed middle school, completed high school, higher education). The outcome variable was whether the patient received surgery. Data were recorded using the electronic application *Commcare*.

The researchers obtained verbal consent from patient participants prior to interviews. Interviews took place in private settings within the patient participants' homes. HCW participants chose a comfortable setting for interviews, most frequently their private office in the hospital. Researchers obtained written consent from each HCW participant. Researchers conducted in-depth interviews with participants using semi-structured interview guides (Appendix). Both interview guides were pilot tested prior to use. The interviews took place and were transcribed in Spanish. Only results were translated to English. Interviews took from one to two hours. Interviewers took notes and audio recordings with permission from participants. Transcripts were not shared with patients and no interviews were repeated. In total, 18 HCWs and 19 patients were interviewed for this study. One HCW refused to participate in the study. All patients agreed to participate. No participants dropped out of the study.

Data Analysis

The descriptive analysis of continuous and categorical variables used medians and interquartile ranges and frequencies and percentages, respectively. We reported outcomes as numbers and proportions with corresponding 95% confidence intervals. We identified potential risk

factors for not receiving surgery using univariate logistic regression models for all predictor variables. Statistical significance was measured as $\alpha = 0.05$. Variables that were significant were then considered for the multivariable logistic regression model developed using forward stepwise addition. Using this model, we conducted a subgroup analysis with logistic regression for sex, specialty, and elective surgery. STATA software version 14.2 was used.

Qualitative data analysis was performed using an inductive, conventional content analysis approach [23]. After completion of data collection, each interview was transcribed in Spanish and analyzed together with interview notes to generate themes. One author generated a draft code book (VM). The coded data were then inductively analyzed with a second author (HG) through an iterative approach to define categories and then further refined to a final set of descriptive themes. Data were collected until it was determined that thematic data saturation had been reached. MAXQDA Analytics Pro 12 software was used to code interview transcripts.

In this convergent study, integration occurred through the merging of the two data sets after numerical and thematic analysis of the quantitative and qualitative data sets, respectively. Quantitative and qualitative data collection and analysis occurred simultaneously. After merging, we integrated the interpretations through a narrative, weaving approach, reporting findings on a theme-by-theme basis.

Role of the Funding Source

Funding sources had no role in the study design, data collection, data analysis, writing of the manuscript, or the decision to submit it for publication. All authors had full access to all the data in the study and accept responsibility for its submission for publication.

Results

The results have been organized into themes representing barriers to surgical care drawn from the quantitative data, qualitative data, or both sources. Relevant characteristics of the three hospitals where data was collected are summarized in Table 1. Characteristics of qualitative participants can be found in Table 2

Referral data from a total of 1184 patient charts were collected from records at hospital Bicentenario (678), AAC (301), and Revolución (205). Descriptive statistics of the quantitative sample are summarized in Table 3. 734 (62.0%) referrals were placed to General Surgery, 319 (26.94%) to Gynecology, and 131 (11.1%) to Orthopedics. 252 (31.2%) referrals were defined as emergencies. On average, medical absenteeism occurred 19.4% of the time, and patient no-shows occurred in only 3.3% of referrals. Patients visited a laboratory a median of two times prior to surgery. More than 57% of patients needed to travel to have laboratory studies repeated. Consultations for elective surgery were performed a median of one time, and surgery was scheduled a median of one time. In total, only 47.4% of patients referred for surgery received an operation.

Table 4 summarizes the statistically significant predictors of receiving surgery from a univariate logistic regression analysis. We

Table 1
Hospital characteristics that participated in quantitative part of the study.

	Hospital General Regional Bicentenario	Hospital Básico Comunitario Ángel Albino Corzo	Hospital Básico Comunitario Revolución
Hospital Beds	61	27	23
Anesthesiologists	9	0*	2
Gynecologists	9	1	0
General Surgeons	8	1	2
Orthopedic Surgeons	3	0	0

* Anesthesiologist was available on a non-full time basis as part of surgical brigades.

Table 2
Characteristics of qualitative participants.

Patients	Male (%)	Female (%)	Total
Patients who did not receive surgery	1 (10)	9 (90)	10
Patients who received surgery at a MOH hospital	3 (43)	4 (57)	7
Patients who received surgery from private provider	1 (50)	1 (50)	2
Total	5 (26)	14 (74)	19

Healthcare providers	Male	Female	Total
Social Service Physicians	2 (67)	1 (33)	3
General Practitioners	1 (50)	1 (50)	2
Specialists	4 (100)	0 (0)	4
Social Worker	0 (0)	5 (100)	5
Community Coordinator	1 (100)	0 (0)	1
Ambulance Driver	1 (100)	0 (0)	1
Referrals Companion	1 (50)	1 (50)	2
Total	10 (56)	8 (44)	18

observe that patients requiring a general surgery operation or emergency surgery are significantly more likely to receive surgery. Requiring gynecological or orthopedic surgery, requiring elective surgery, or having your surgery postponed significantly reduced the odds of receiving a surgery. For every additional trip made for diagnostic tests, there was a 9% increase in the odds of receiving surgery.

A logistic regression analysis was performed to better examine predictors of receiving surgery by subgroup. The results of the analysis are presented in Table 5. Patients requiring an elective gynecological surgery were least likely to receive surgery (OR: 0.12, 95% CI: 0.04-0.36). Patients requiring a general surgery at Hospital Revolución were within the subgroup most likely to receive surgery.

Surgical Specialty and Gender

Quantitative results showed a significant difference in the likelihood of receiving surgery based on gender and surgical specialty. Compared to general surgery patients, patients were significantly less likely to receive surgery for a gynecologic condition (OR 0.45, 95% CI: 0.34-0.60) or an orthopedic condition (OR 0.46, 95% CI: 0.32-0.68). Male patients were also more likely to receive surgery (OR 1.06, 95% CI: 0.83-1.36), though this did not reach statistical significance in the unadjusted model. However, logistic regression performed by specialty showed that men were significantly more likely than women to receive surgery for a general surgery diagnosis (OR: 1.72, 95% CI: 1.13, 2.60).

Economic Fragility of Farmers

In qualitative interviews, participants described a relentless work life, waking up before sunrise to begin work in the house or in the fields as a farmer. They explain that with just one coffee harvest per year, the seasonal economy leaves them in a situation of economic fragility where any changes in the crop directly affect their ability to provide for their family's daily needs. Day laborers without farms of their own are among the most vulnerable and described being paid 70 pesos (\$3.50 USD) per day on the days they are hired. Participants explained how this makes upward economic mobility nearly impossible and exposes them to larger economic, sociopolitical, and environmental changes. For example, one participant described how a recent coffee plague, *la roya*, has decimated the local crop and, consequently, worker's economic security.

...one stops eating bread for a whole week or even a month so that [your child] has his own economic means where he is sitting, where he is studying.

-Male patient, farmer, 66 years old

Table 3
Descriptive statistics of quantitative participants organized by hospital.

	Hospital General Regional Bicentenario	H.B.C. Ángel Albino Corzo	H.B.C. Revolución	Total
Sample Size (%)	678 (57.2%)	301 (25.4%)	205 (17.3%)	1184 (100%)
Age, median (IQR)	39 (29-51)	37 (28-54)	41 (32-53)	39.5 (29-52)
Female Sex (%)	489 (72.1%)	180 (59.8%)	156 (76.1%)	825 (69.7%)
Specialty:				
General Surgery	389 (57.4%)	186 (61.8%)	159 (77.6%)	734 (62.0%)
Gynecology	217 (32.0%)	56 (18.6%)	46 (22.4%)	319 (26.9%)
Orthopedics	72 (10.6%)	59 (19.6%)	0 (0%)	131 (11.1%)
Emergency Surgery (%) (n = 808)	218 (37.9%)	15 (20.0%)	19 (12.0%)	252 (31.2%)
Single (%) (n = 964)	152 (22.6%)	20 (22.2%)	40 (19.8%)	212 (22.0%)
% of Patients that Experienced Medical Absenteeism (min, max) (n = 576)	20.0%	23.5%	13.5%	19.4% (0,4)
% of Patients that Missed Appointments (min, max) (n = 576)	3.9%	0.0%	1.4%	3.3% (0,1)
Education Level (%) (n = 578)				
Illiterate	82 (16.7%)	7 (24.1%)	12 (21.1%)	101 (17.5%)
Preschool	50 (10.2%)	8 (27.6%)	8 (14.0%)	66 (11.4%)
Elementary	140 (28.5%)	10 (34.5%)	18 (31.6%)	168 (29.1%)
Middle School	114 (23.2%)	1 (3.5%)	5 (8.8%)	120 (20.8%)
High School	63 (12.8%)	2 (6.9%)	6 (10.5%)	71 (12.3%)
College or Higher	43 (8.7%)	1 (3.5%)	8 (14.0%)	52 (9.0%)
Median times surgery was scheduled (IQR) (n = 613)	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
Median Visits to Laboratory (IQR) (n = 848)	2 (1-3)	1 (1-2)	2 (2-3)	2 (1-3)
Median Consultations for Elective Surgery (IQR) (n = 607)	1 (1-1)	1 (1-1)	1 (1-1)	1 (1-1)
Received Surgery (%)	340 (50.2%)	64 (21.3%)	157 (76.6%)	561 (47.4%)

Table 4
Odds ratio for end point of receiving surgery.

Variable	Odds Ratio of Receiving Surgery (CI)
Sex (n = 1184)	Female (reference) – Male 1.06 (0.83, 1.36)
Specialty (n = 1184)	General Surgery (Reference) – Gynecology 0.45* (0.34, 0.60) Orthopedic Surgery 0.46* (0.32, 0.68)
Urgency (n = 808)	Emergency (reference) – Elective 0.64* (0.45, 0.89)
Cancellations (n = 613)	Each additional postponement 0.54* (0.38, 0.76)
Testing (n=848)	Each additional trip to do diagnostic tests 1.09* (1.01, 1.17)

*p < 0.05.

Table 5
Logistic regression by subgroup.

	By sex: female	By specialty: general surgery	By specialty: gynecology	Urgency: elective
Sex: Male	–	1.72* (1.13, 2.60)	–	1.72* (1.06, 2.77)
Age	0.99 (0.98, 1.00)	0.99 (0.98, 1.00)	0.98 (0.96, 1.00)	0.98* (0.97, 1.00)
Hospital: AAC	0.22* (0.11, 0.44)	0.61 (0.32, 1.13)	–	0.49* (0.27, 0.89)
Hospital: Revolución	2.99* (1.87, 4.79)	3.78* (2.18, 6.53)	1.58 (0.76, 3.30)	3.19* (2.02, 5.04)
Urgency: Elective	0.61* (0.39, 0.96)	1.09 (0.71, 1.71)	0.12* (0.04, 0.36)	–
Specialty: Trauma	1.51 (0.67, 3.40)	–	–	1.00 (0.42, 2.03)

*p < 0.05.

[La roya] has affected us a lot because there are not many places to work. Sometimes, very rarely my husband finds a job, for example as a construction helper or helping other farmers that pay him to go and spray and plant corn or beans, or clean also. But they pay them seventy or eighty pesos a day. When we had coffee in addition, we could afford to buy coffee, sugar, salt, clothes or we had extra to go and buy some other things we wanted.

-Female patient, community health worker, 40 years old

Accessing Care Requires Continued Access to Economic Resources

Participants linked this lack of economic resources and emergency savings to key delays in accessing health care when patients become sick. They felt seeing a doctor was a luxury that farmers often cannot afford. Instead, patients explained they endure pain and turn to home remedies when they cannot afford health care. Health care at a hospital often required them to travel long distances and miss several days of work. Transportation options are unreliable and limited, so patients often pay inflated prices for private taxis in addition to the costs for food and housing. Moreover, despite being covered by *Seguro Popular*, participants describe being required to pay medical expenses for IV lines, medications, diagnostic tests, surgical materials, and more. Quantitative analysis found that 57.1% of patients required more than one visit to the laboratory. Money is required to attend each appointment, making these repeat trips burdensome. It was often necessary for participants to borrow money to continue to access care. As a result, patients delay their care because they have no money to return and cannot manage the extra debt.

My husband was very worried. He said, 'What's wrong? Why are you feeling this way? The pain suddenly started. ... We left the fields [where we were working] to come back home as soon as the sun came up. When we were [home] they gave me home remedies. I did not go to the doctor because we had no money to go to Jaltenango.

-Female patient, community health worker, 40 years old

I mean you cannot assure that there will be transportation. Many times, you have to be looking for a car or they prefer to go down one or two days before the date of the appointment and that implies big expenditure for the family.

- Female physician, general practitioner

It was expensive because everyday they would do it. The bilirubin, the amylase and lipase, and since they did not have them in the hospital, they were from a private provider. 400 pesos every day, and

he had to look for a way to pay for it. My father-in-law went to look for borrowed money so that he could send it to us.

-Female patient, homemaker, 22 years old

Pain Leads People to Seek Care

Participants explained that the pain associated with their conditions is the predominant factor that creates a sense of urgency to seek care. However, when patients arrive at hospitals, they believe practitioners do not see their conditions as surgical emergencies. After being referred to higher level facilities, they described only being provided pain medications and sent home. They felt this didn't adequately address their problem, but rather perpetuates a cycle where pain medications provide short-term relief as conditions worsen, expenses rise, and elective conditions can become emergencies. This reality was reflected in the quantitative analysis; patients were significantly less likely to receive an elective compared to emergency surgery (OR: 0.64, CI:0.45, 0.89). Eventually, some participant's pain led them to turn to the more expensive private system for definitive treatment.

They were going to operate on me [at the MOH hospital] ... But it was going to be in February, and in November the pain got stronger, that is why they took me to a private physician and I did not wait until February for the surgery. Because the pain was stronger. My stomach was swollen, I felt much punished. I could not eat, I could not sleep, I could not walk, nothing. My body was so punished; they would rather take me to a private physician so that it would be faster.

-Female patient, homemaker, 36 years old

I went to the hospital; they gave me medications when I had a lot of pain...I was like that for four months. In June I started with pain again, but it was stronger, stronger and with vomiting. Hospitalizations were more and more frequent.

-Female patient, homemaker, 22 years old

Futility Leads Patients to Avoid the System

The process of seeking care was described as bureaucratic and overly complex. Patients feel they are "vuelteando," or flying around, from provider to provider, seeking care from multiple public hospitals without success. Resource gaps at every step of the process give the impression providers are wasting patients' time. At hospitals, participants would wait all day to see a physician, only to be told there are no surgical appointments, the needed tests or supplies are missing, or they need to travel to the next hospital. Patient data demonstrates how an inefficient system affects outcomes. Despite the financial and physical efforts made by patients to arrive at appointments, medical absenteeism caused nearly 20% of them to be cancelled. Patients were significantly less likely to receive surgery after each cancellation (OR: 0.54, CI: 0.38, 0.76). Meanwhile, patients were slightly more likely to receive surgery with every additional diagnostic test received (OR: 1.09, CI: 1.01, 1.17).

Qualitative participants express their understanding that is important to receive timely surgery to avoid complications. However, the quantitative data demonstrates that only 47.38% of patients received the surgery they required. For this reason, patients routinely discuss avoiding the public system and seeking care with private providers. Patients reflect on how they are treated much better at private hospitals and can receive surgery in a timely manner, often the same day.

I believe that all [referred patients] except for the children, have always been a problem. What I am trying to say is that none of them have followed a straight line from their consultation, then their pre-surgical evaluation, their blood donations, and finally their surgery, not one patient. There is always something. Either there is no

material, or there is no surgery ward, or there is no bed, or there are no blood donations or...there is always something.

-Female physician, referrals administrator

If you go to Jaltenango from here it is 40 pesos in total, plus the medication. Sometimes in the hospital they do not receive you, they find excuses saying we do not have this, go to consultation.

- Male, 72, farmer

I do not even want to get surgery anymore, I would rather stay with the pain. This is taking too long. I would rather continue with the pain.

-Male physician, general practitioner, discussing his female patient

Discussion

This mixed methods study is the first to assess the effectiveness of the surgical referral system in Chiapas, Mexico. It revealed that only 47.4% of referred patients requiring surgery ended up receiving it. Gynecological or orthopedic patients, those requiring elective procedures, females, and those who had their surgery postponed were found to be at significantly higher risk of not receiving surgery compared to controls. The mixed methods approach to this study allowed the examination of patient and health care worker experiences to support quantitative information. The convergent analysis further demonstrated the impact of themes such as economic fragility of this population, the economic resources required to access care in Mexico's universal health coverage system, emergent pain as a primary motivator to seek care, and patient's experience of futility in the public system that leads them to abandon it. These integrated findings add a more nuanced understanding of the barriers to effective surgery referrals in Chiapas, as well as similar rural settings with universal health coverage throughout Latin America.

This study identified inefficiencies and poor coordination in the work up of surgical cases as a main barrier to an effective referral system. The extensive process encompassing laboratory testing and preoperative consultations is often complicated by issues such as medical absenteeism, economic fragility, and rescheduling of operations. Patients are taxed with medical and non-medical costs for each visit, making efficient completion of the referral process cost prohibitive. Repeated delays due to these costs may cause testing to expire and for patients to repeat various steps in the process, creating further, occasionally critical delays in care. This is reflected by our finding that a patient's likelihood of receiving surgery was significantly reduced with each surgical postponement (OR 0.54, 95% CI: 0.38-0.76). This reduction emphasizes a need for streamlining pre-surgical planning, including initial consultation, preoperative labs and imaging, and surgical scheduling. This process causes patients to feel stuck in a cycle of pain and futility. The resulting frustration contributes to patients' decision to carry on despite painful surgical conditions or wait to seek care until their conditions become emergent. These ongoing delays in the referral process can negatively impact outcomes [24,25].

These findings are supported by the existing literature on referral systems in LMICs around the world and in Latin America. A systematic review of surgery referrals in LMICs identified little empirical evidence on the field of surgical referrals in these environments, but identified a lack of resources, comprehensive referral protocols, and efficient patient pathways as common obstacles [26]. A 2017 study examining health referral systems among six Latin American countries found limited coordination and communication among all countries, with particularly severe problems in Mexico due to pervasive mistrust between providers [27]. Furthermore, a 2017 qualitative study in rural Ecuador similarly found that patient inconvenience, cost, and mistrust of hospitals were the three most cited barriers to surgical care [28]. As in our study, poor system-level coordination and a lack of patient-centric protocols exacerbate shortages in the referral system.

Additionally, this study identified key inequities in accessing surgical care related to economic resources, gender, and type of surgery. Due to frustration or the perceived acuity of their condition, some patients elect to circumvent the public system's scheduling delays entirely. However, seeking care from the private sector has its own accompanying fees, making expendable resources key to accessing care. A 2020 study found surgery in the private sector significantly more likely to cause catastrophic expenditure [14]. These costs put patients at risk of joining the over 81 million people who experience catastrophic expenditure from surgical costs annually, often leading to generational poverty through the selling of essential property [29].

Further, most patients pursuing a surgical referral were female (69.7%), and 26.94% of cases evaluated were gynecologic. However, neither of the basic community hospitals included in this study employed both a full-time gynecologist and anesthesiologist. It then follows that the odds of having gynecologic surgery were much lower (OR: 0.45, 95% CI: 0.34-0.60) when compared to General Surgery. Moreover, males requiring a general surgery were significantly more likely than females to receive one (OR: 1.72, 95% CI: 1.13-2.60). Female sex has been associated with decreased access to surgery and increased postoperative complication rates in a variety of low-resource settings [30–32]. In Chiapas, this finding points to gender disparities that need to be addressed.

Similarly, no full-time orthopedic surgeons were employed at either basic community hospital and as a result orthopedic operations had significantly lower odds of completion (0.46, 95% CI: 0.32-0.68) compared to general surgery. This disparity reflects the ongoing need for greater distribution of surgical specialists to rural areas in Mexico and around the world [33,34]. While Chiapas has among the lowest density of surgical providers in Mexico, issues such as a concentration in urban areas and employment in private clinics may further exacerbate problems such as medical absenteeism and a lack of available specialists [35].

These findings provide key implications for Mexico's achievement of universal health coverage. Despite Mexico being lauded for its achievement of universal health coverage in 2012 [36], this study demonstrates the key ways the referral system does not protect patients from the financial burden of medical and surgical care, nor does it guarantee timely surgical treatment. These shortcomings are reflected nationally as a 2023 study on access to surgery found only 81.7% of the population had timely access to essential surgery within two hours [35]. Among the areas with particularly low access is Chiapas, where more than 20% of the population lacked timely access to surgery and only 532 surgical procedures were performed annually per 100,000 citizens, both below the Lancet Commission on Global Surgery's target levels [1]. This rate of surgical procedures puts Chiapas on par with low-income countries such as Rwanda, Liberia, and Zambia, rather than other upper-middle income countries. Moreover, the 47.4% of successful referrals found in our study suggests the true rate of access to surgery may be well below what is reported in this national modelling study. This mixed methods study provides significant, on the ground insight into the system-based and interpersonal mechanisms limiting access to essential surgery care that are often missed in larger modelling studies.

To address these gaps, policymakers should focus on improving coordination in the system, reducing inefficiencies, and reducing disparities. Interventions should target gaps at both the sending and receiving end of referrals. At the pre-hospital level, community health workers have been shown to effectively identify patients in need of care, initiate referral processes, and coordinate transport to hospitals [37]. These programs should focus on assisting particularly at-risk groups, such as women in need of gynecological care, to overcome their specific barriers to care. Community hospitals should then be better equipped with the specialists and resources needed to perform basic emergency and elective surgeries, reducing the need for referrals, patient delays and extra costs [26,38]. Increased opportunities for continuing professional development and better supervision have been shown to improve

surgical specialist morale and retention in rural areas and should be considered [1,39,40]. In this study setting, a health professional education program with a focus on training in global health and social medicine has increased recruitment of primary care *pasantes*, or social service year physicians [41]. A similar model for surgical specialists could improve recruitment and understanding of the barriers to care faced by patients. A surgical mission model has been employed by the Ministry of Health in rural Chiapas and, while not a full-time solution, could be an alternative path towards increasing access to surgery. Finally, referral protocols must be better implemented to ensure a successful transition of care. To achieve this, studied methods include the creation of protocols for increased communication between facilities, greater staffing focused on referrals, and new training centered on transfer criteria and current services available at other facilities [1,42]. In the study area, a Right to Health Care Program providing coverage of direct and indirect costs for secondary and tertiary health services as well as patient accompaniment was shown to improve outcomes in a cost-effective manner [43]. While there remains a need for more research on surgical referral systems, these recommendations highlight key avenues to improvement in Chiapas.

Several limitations of this study must be acknowledged. First, only patients who were able to reach the referral hospitals could be included, as patients who did not reach the receiving surgical facilities would have no records available. This could have in fact led to an overestimation of the percentage of successful referrals. Secondly, the hospitals in our study participated in surgical mission trips, and these missions allowed patients to bypass the normal process and access care with additional support. However, in the author's experience, surgical mission trips are commonplace in Mexico and reflect the reality of care delivery. Third, many of the medical records reviewed had missing data. Bicentenario had the most complete data, with the two smaller hospitals more frequently providing incomplete records. The most incomplete data were seen with pre-surgical consultations and consisted of diagnostic tests, medical absenteeism, surgical cancellations, and patients lost to follow up. Missing data many contribute to underreporting of many of these variables, and issues such as medical absenteeism may be more frequent than demonstrated in this paper. Fourthly, quantitative analysis was made at the surgical specialty level rather than the diagnosis level, limiting this study's ability to infer about disparities and overall access to care at the diagnosis level. Finally, this study reports data on patients enrolled in *Seguro Popular*, which was replaced by *INSABI* in January 2020. However, the changes are primarily related to funding mechanisms and organization at the level of the central government [11].

This study's mixed method approach adds a patient-focused understanding of the barriers associated with receiving surgical care in rural Mexico that is atypical of referral systems research. The barriers identified stem from several domains within the health system, including healthcare delivery, management, infrastructure, and economics and finance. A large amount of work has been done in recent years to assess these challenges and deficits within surgical systems in Mexico and globally. This study provides on the ground perspective on the realities of accessing surgical care that aren't included in larger modelling studies. Furthermore, there remains a need to apply this knowledge in clinical and public health settings. The transition from descriptive studies to implementation science will require that data are used in a coordinated and targeted manner [44]. Further research should focus on interventions to improve referral system effectiveness and efficiency in rural, low-resource settings in Mexico and abroad. To achieve real system changes, input will be needed from many non-clinical disciplines, including public health, policy, epidemiology, education, and economics.

Conclusion

Despite the assurance of universal health coverage, patients in

Chiapas face a multitude of challenges in receiving timely surgical care. In this mixed methods analysis, it was found that less than half of all referred patients receive their required surgery in the public system, with significant disparities in access along gender and type of surgery needed. The integration of qualitative data detailed how with limited economic resources, patients are unable to overcome costs or navigate an inefficient system. This leads to delayed care, prolonged suffering, and often requires patients to turn to an expensive private system. Moving forward, this knowledge must be applied to implement innovative solutions in improving referral system coordination and providing hospitals with the necessary workforce, equipment, and protocols to ensure efficient care.

CRedit authorship contribution statement

Valeria Macias: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Visualization, Writing – original draft. **Zulema Garcia:** Conceptualization, Investigation, Data curation, Writing – review & editing. **William Pavlis:** Visualization, Project administration, Writing – original draft, Writing – review & editing. **Sarah Hill:** Project administration, Formal analysis, Writing – review & editing. **Zachary Fowler:** Conceptualization, Data curation, Investigation, Project administration, Visualization, Writing – original draft, Writing – review & editing. **Diana D. del Valle:** Project administration, Writing – review & editing. **Tarsicio Uribe-Leitz:** Conceptualization, Supervision, Writing – review & editing, Validation. **Hannah Gilbert:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Lina Roa:** Conceptualization, Validation, Writing – review & editing. **Mary-Jo DelVecchio Good:** Conceptualization, Formal analysis, Methodology, Supervision.

Declaration of Competing Interest

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Data Availability

Data from this study, including individual participant data, the data dictionary, and related documents, will be made available upon personal request on a case-by-case basis.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.dialog.2023.100156>.

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