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# BMJ Open

## Diagnosis and management of surgical disease at Ethiopian Health Centers: an assessment of resources and barriers to care

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**Title Page:**

**Title:** Diagnosis and management of surgical disease at Ethiopian Health Centers: an assessment of resources and barriers to care

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## Abstract

### Objectives:

The aim of this study was to characterize the resources and challenges at health centers in South Wollo Zone, Ethiopia.

### Setting:

Eight primary health centers in South Wollo Zone, Ethiopia.

### Participants:

Health officers and nurses staffing health centers completed a survey.

### Primary and Secondary Outcome measures:

Survey assessed human and material resources, diagnostic capabilities and challenges. Data on patients with surgical diagnoses was collected over a 30-day period including diagnosis, referral status and patient-reported barriers to care.

### Results:

Health centers had an average of 18 providers each, the majority of which were nurses (62.2%) and health officers (20.7%). None had any form of imaging and only one could provide blood transfusion. Providers rated the most difficult diagnoses as gallstone disease, intraabdominal tumors, perforated ulcer and kidney stones, most often due to lack of diagnostic imaging. A total of 168 surgical patients were seen at the 8 health centers; 58% were referred for surgery. Most common diagnoses were trauma/burns (42%) and need for Cesarean section (9%). Of those who did not receive surgery, thirty-two patients reported specific barriers to obtaining (91.4%). The most common specific barriers encountered were the patient not being decision maker to have surgery, lack of family or social support, and inability to afford hospital fees.

### Conclusions:

Health centers in South Wollo Zone, Ethiopia, are well-staffed with nurses and health officers, however face a number of diagnostic challenges due to lack of imaging equipment and training. A substantial number of patients requiring surgery receive initial diagnosis and care at health centers; sociocultural and financial factors commonly prohibit these patients from receiving surgery. Equipping health centers with imaging devices and exploring community and family perceptions of surgery may enable more streamlined access to surgical care.

Article Summary: Strengths and Limitations of this study

In Ethiopia, health centers serve as an important gateway for triaging and referring patients needing surgery to higher-level care. This study of health centers conducted in South Wollo Zone, Ethiopia, explores the resources available, provider capabilities and surgical patient characteristics, as well as barriers patients expressed to obtaining surgery.

Health centers were staffed according to Ministry of Health guidelines, and most centers had supplies such as suture materials, antibiotics, and pain medications, but few had consistent access to clean water and none had imaging or blood transfusion capabilities. Health Center providers reported difficulty making common surgical diagnoses like perforated ulcer, tumors and gallstone disease, most often due to lack of imaging equipment.

Sociocultural factors, such as patient decision-making ability in the family, and lack of social support, and lacking an accompanying family member were the most common reasons cited for not seeking surgery, in addition to financial concerns.

This is an important study of rural populations that may often present with surgical complaints but fail to reach a hospital with surgical capacity due to sociocultural or financial reasons. Further study on strategies to improve diagnosis of surgical patients such as expansion of imaging capabilities like ultrasound, is needed to understand the impact on this population. Additionally the sociocultural barriers such as patient autonomy, family and social support should be further explored to better understand healthcare seeking behavior of rural Ethiopian populations.

## Introduction

Global health priorities have evolved over the past several decades with a greater focus placed on surgery as part of a package of essential health care. Estimates indicate that 11% of the global burden of disease could be treated with surgical interventions (1). However, there is great inequity in the distribution of surgical care worldwide, with 73.6% of surgical procedures performed on 30% of the global population, and the poorest third receiving only 3.5% of surgeries (2). Many studies have aimed to quantify the burden of surgical disease and describe existing resources and infrastructure related to surgical care worldwide, in an effort to best direct interventions and improve access. It is clear there is a shortage of trained personnel and equipment at the district hospital level to provide adequate surgical services in low and middle-income countries (LMICs) (3).

Ethiopia is particularly affected by these shortages. A survey of surgical services in 2012 found only 106 general surgeons in 116 federal hospitals serving a population of 82.8 million (4). Although the surgical workforce has increased in recent years with the expansion of residency training programs and task-shifting to Integrated Emergency Surgical Officers (IESOs) - clinicians with additional emergency surgical training - there is still a shortage of surgical and anesthesia care providers.

Out of 56 WHO member states investigated in a study focused on documented rates of surgery, Ethiopia had the lowest surgical volume rate at 148 per 100,000 (5). Part of this phenomenon may be explained by the limited resources available for surgical interventions in Ethiopia. Hospitals often lack reliable access to running water, medications, electricity, oxygen, and blood banking. The average hospital had a maximum of two operating rooms for the vast population served (4).

The number of surgeons and other health workers within local hospitals or clinics is limited as well. A retrospective survey study conducted to outline surgical activity in rural Ethiopia found 76 health workers able to provide surgical services to the 12.9 million people that made up the sample population (6).

Beyond the lack of hospital equipment and personnel, however, other factors impede the ability of patients to access surgical services. Community assessments have revealed that cultural, financial, and structural barriers impact the ability of patients to seek and access care (7). Many patient factors are barriers to obtaining care, such as fear of surgery, lack of time or monetary resources, lack of transportation, cultural beliefs surrounding surgery, health illiteracy and lack of social support systems. Structural barriers such as poor roads, distance to hospitals, lack of communication and difficulty navigating the healthcare and referral system also impede the ability of patients to access surgical care. Medical services and loss of wages may be prohibitively expensive for most patients. These populations also tend to be spread across rural areas in Ethiopia, and have difficulty reaching hospitals in larger cities (8).

Mid-level and rural healthcare providers have the unique position as both the gatekeeper and facilitator between patients and facilities capable of providing surgical care. Few studies, however, have examined the barriers perceived by providers in the process of obtaining surgical care (9).

For the majority of Ethiopians, the nearest health care facility would be a town or city health center. Patients needing urgent medical attention may seek initial care at these health centers, after which they may be referred for appropriate higher level of care. According to the 2012

Ethiopian Standard Health Center Requirements (11), recommended practitioners at each health center include a minimum of two health officers, three midwives, five nurses and laboratory and pharmacy technicians. The guidelines also state each health center should have capacity to perform minor operations such as circumcision, lipoma excision and abscess drainage, and external immobilization of fractures.

The aim of this study was to describe material and human resources available at health centers in the South Wollo Zone, Ethiopia, and assess barriers experienced by mid-level providers and patients at health centers in obtaining surgical care.

Methods

Study Setting

Ethiopia is a low-income country in Eastern Sub-Saharan Africa with a rapidly growing population. With a population of 102 million in 2016, life expectancy was estimated at 65.5 years (10). Maternal mortality is moderate at 353/100,000 live births, and under-5 mortality rate is rapidly falling, estimated at 61/100,000 in 2015. Surgical diseases, however, are now a major source of mortality, with non-communicable diseases now making up a majority of causes of death, particularly cardiovascular disease, malignant neoplasms and digestive diseases. It was reported that only 55% of healthcare facilities could provide basic obstetric care and 52% could provide basic surgical care in 2015.

The ratio of healthcare providers and facilities per population is among the lowest in the world, with 149 total hospitals in country, 1343 health centers, and 3305 health posts in 2008. The Amhara region was estimated to have 17.2 million inhabitants in 2007 with 7406 total health care providers, 2152 physicians (2.7/100,000 population). In response to the low numbers of healthcare providers, the Health Sector Development Programme called for the training and deployment of 30,000 new health extension workers by 2009 and to increase the annual medical school enrollment 4-fold from 250 to 1000. In 2007 an estimated 140 surgeons were practicing in the country, with estimates for 820 by 2015.

Study Design & Study Population

This study was a cross-sectional survey of eight woreda (district) level health centers in the South Wollo Zone of Ethiopia. Survey was designed by the study personnel using review of prior similar studies on barriers to accessing surgery and health center assessment tools. Surveys were distributed to all health centers in the South Wollo Zone for completion.

Patient and Public Involvement statement

Patients and the public were not involved in the study design or survey tool design; however local health care providers gave input on survey questions during study design. Findings from this study will be made available at the referral hospital for public viewing and dissemination.

Participants

Surveys were distributed at a regional health bureau meeting. Study participants who completed the survey were nurses or health officers employed at the respective health centers. Orientation



and training on survey completion were provided by an Ethiopian nurse who was engaged in the project. This trainer and the Principal Investigator were available to answer questions for participants throughout the study period by phone regarding survey completion. The survey was distributed to health center nurses or health officers at all 21 woredas in South Wollo. Participation was voluntary and participants received a small monetary compensation when the survey was returned at the end of the study period.

### *Variables*

Study participants completed survey questions regarding health center staffing, diagnostic and treatment resources available at their health center, as well as provider comfort level making common surgical diagnoses in their setting. They also recorded data on all patients presenting to their respective health centers with surgical diagnoses as stipulated by the study definitions over a 30-day period. Information about these patients including age, gender, diagnosis, whether or not a referral was made at the clinic visit, and barriers expressed or perceived that prevented patients from receiving surgical care were recorded.

### *Data Collection*

Participants collected patient data over a 30-day period between November 2014 and January 2015; health centers varied in the specific dates of their data collection. Surveys were returned to the study PI in person or via post and compensation was provided upon return of completed survey. All participating health centers were in a geographic network making surgical referrals to a single referral hospital in Dessie, Ethiopia. In an effort to avoid selection bias surveys were distributed to all health centers in the Zone and orientation to the survey was conducted with staff from all health centers. Study size included all health centers in South Wollo Zone that were expected to make referrals to a single hospital in the Zonal capital.

### *Quantitative Variables*

Quantitative data such as health center catchment population, staffing, patient age and referral status were analyzed with frequencies and standard deviations. Descriptive statistics were used for all variables and no multivariate analysis or associations were calculated.

### *Data Analysis & Management*

Data were returned via paper forms and entered into RedCap by study personnel. Data were extracted to Microsoft Excel and kept confidential on encrypted computer by study personnel. Descriptive statistics were used to analyze health center providers, resources, diagnostic challenges, patient diagnoses and barriers to care. Data analysis was conducted using Excel and Stata/SE Version 15.1.

### *Data Sharing*

No additional data available.

### *Ethical Considerations*

IRB approval was obtained from Boston University (Boston, MA, USA) and Wollo University (Dessie, Ethiopia) prior to survey distribution.



**Results:**

Eight health centers in South Wollo Zone were surveyed, representing 38% of the total zonal health centers (n=21). Health centers were distributed geographically throughout the zone with a mean distance of 93.9km ± 59.3km (58.3mi ± 36.8mi) from the Dessie Referral Hospital. Each health center served a population of approximately 36,000 in their catchment area.

*Providers:*

An average of 18 (±4) clinical service providers were employed at each health center and saw an average of 1212 (range 278 - 4118) patients at each facility in the 30-day study period (Table 1). On average 25 (2.1%) of these patients had a surgical complaint. Only one health center was staffed by physicians and none had anesthesia providers. The majority of providers were health officers (20.7%), nurses (62.2%), and midwives (13.7%). Half of the health centers had lab and pharmacy technicians.

*Resources:*

All health centers had access to electricity, pain medications, antibiotics, and antipyretics (Figure 1). All but one center had minor suturing materials. Half of centers reported they always had access to NG or rectal tubes. Only two centers always had clean water, while the other 6 reported they sometimes had clean water. Only one reported access to blood for transfusion, and no health centers had access to any form of imaging (ultrasound, radiograph or CT Scan) or paracentesis kits.

*Diagnostic Capabilities:*

Providers reported the difficulty of diagnosing common illnesses with their available resources (Figure 2). According to health center provider ratings, the most difficult diagnoses were cholecystitis and other gallstone disease, intraabdominal tumors, perforated ulcer and kidney stones. Most often lack of diagnostic aids was cited as the reason for difficulty. The conditions most easily diagnosed were traumatic injury, appendicitis, a need for cesarean section, hernia, skin/soft tissue tumors, and peptic ulcer disease (Table 2). Even for the diagnoses that were rated as “not difficult at all”, however, lack of diagnostic aids and lack of training were still cited as reasons for difficulty.

*Surgical Patients:*

A total of 168 patients were seen with surgical complaints over the 30-day study period at the eight health centers (Table 3). Patient average age was 34, ranging 1 – 80 years and 63.6% were male. Ninety-seven patients (58%) were referred to the hospital for surgery; of the 71 patients (42%) not referred for surgery the majority of them (87%) could be treated in clinic. The other 9 (12.6%) refused referral. Most surgical patients seen in health centers had traumatic injuries or burns (42%) (Figure 3). Other common diagnoses seen in the health centers were need for cesarean section (9%), appendicitis (5%), benign prostatic hyperplasia (4%), peptic ulcer disease (6%) and bowel obstruction (5%). Less common diagnoses were kidney stones, soft tissue infections, goiters, hemorrhoids, requests for circumcision, and soft tissue tumors.

*Barriers to Receiving Surgery:*

Of those who received a referral for surgery (97), 35 did not receive surgery, and of those thirty-two patients reported specific barriers to obtaining surgery to health center providers (33%) (Table 4). The most common specific barriers encountered were the patient not being decision maker to have surgery (7), lack of family or social support (6), and inability to afford hospital

fees (5). Less commonly the patient expressed fear of surgery (4), had no one to accompany them to the hospital (4) or lacked information about surgery (2). Rarely reported was lack of time, fear of lost wages, poor roads to hospital or lack of understanding disease severity. Most patients traveled by ambulance (46.4%) or car (39.2%) to the hospital. Few were transported by animal (4.1%).

### Discussion:

It is well established that surgical care throughout Ethiopia is critically limited. However, specific barriers to care and provider and facility needs have not been determined, and the surgical disease burden has not been assessed. This research represents an attempt to further elucidate the barriers to surgical care faced by Ethiopian patients.

The majority of patients requiring surgical care in Ethiopia, particularly in rural settings, can access surgical services by first seeking care at a nearby health center. Many of the patients seen at health centers in our study were perceived to require surgery by the clinical judgement of the health center providers, but ultimately not referred to a surgeon for their diagnoses. While at times minor injuries could be treated in the health center, about half of patients referred to the zonal hospital for surgery did not ultimately go to the hospital to pursue surgical care.

The two most common reasons cited for not being referred was that the patient was not the primary decision maker or lacked family support. This underscores the importance of the family in medical decision-making that must be considered when designing interventions to improve health care access. What is lacking from these data is an understanding of why a family might withhold support for seeking surgical care. The next most commonly cited reason for refusing a referral was inability to afford the surgery. Whether a lack of familial support for surgery also stems from financial concerns, or if there are other factors weighing in on a family's decision needs to be investigated further. Of note, male patients were far more likely to arrive at the health centers than were female patients (92 male patients, 54 female), however men were more likely to be injured as well.

Importantly, the data collected suggest severe limitations with performing even minor procedures at the health centers. While all centers reported they always had access to electricity, pain medication, antibiotics, and antipyretics, only some had consistent access to clean water, nasogastric tubes, rectal tubes, and none had available imaging equipment. Only one center reported having access to blood. With inconsistent availability of clean water and suturing kits, patients who are able to reach the health center still may not receive needed care. For many patients, the only way to receive even minor surgery or emergency procedures may be to have the means and ability to travel to a hospital for care.

Most or all centers reported difficulty diagnosing intraabdominal tumors, gallstones, cholecystitis, and renal stones, all of which are diagnoses typically confirmed through the very imaging modalities these centers lack. Unsurprisingly, health care workers identified a lack of diagnostic aids as the number one barrier to making definitive diagnoses in their centers. None of the eight centers ever had access to ultrasound, CT, or X-ray. The general pattern of resource availability demonstrates that health centers are better equipped for managing infectious and communicable diseases than they are for making diagnoses that require imaging equipment.

Studies have demonstrated that while CT and MR scanners draw too much electricity to be universally useful in many developing countries, ultrasound can be effectively introduced into

such setting with success (12). This presents a possible mode of intervention to improve diagnosis and patient care in South Wollo health centers. Of note, however, introducing ultrasound equipment to health care centers will require more than the purchase of ultrasound machines. Dedicated intensive ultrasound training will likely need to take place for this intervention to be successful in improving health center diagnostics.

Ethiopia is currently implementing the SaLTS program, a national surgical plan to improve access to and quality of surgery nationwide. This plan, which encompasses human resource and infrastructure development, data quality, service quality, and monitoring and evaluation will be crucial for closing gaps in access to surgical care (13).

**Limitations**

This study had several limitations; data collection time periods varied across sites, and different farming or weather patterns may have affected the number of patients presenting to health centers throughout the year as well as their presenting diagnoses, such as work-related injuries or road traffic accidents. The survey completion rate was low, with 40% of health centers in the zone completing surveys, therefore the data may not be representative of the entire South Wollo zone. Also, small numbers of patients reported which barriers were affecting their decision or ability to be referred for surgery and, while descriptive, were not reported in large enough numbers to draw larger conclusions about the population.

Additionally, there are wide variations in culture and economic prosperity between regions in Ethiopia, which may affect healthcare seeking behavior and perceived barriers to care. This study was conducted in the South Wollo Zone of Amhara region, Ethiopia, and therefore findings may not necessarily be applicable to other regions in Ethiopia.

**Conclusion**

This study represents an important contribution to the literature as the only survey of health center resources and diagnostic capabilities in Ethiopia. As investment in surgical services is expanding in Ethiopia, it is important to understand the material and human capabilities of the health centers which are often responsible for the diagnosis and referral of surgical conditions.

Additionally, with the possible expansion of surgical services to more rural and primary healthcare facilities in Ethiopia, it is important to understand the current available human and material resources, as well as patient mix presenting to those facilities.

One future area for research is further elucidating the reasons behind the lack of family support for patients citing this barrier as a reason for not seeking surgical care. Should this stem from monetary reasons, financial interventions may be additionally required. Future research should also focus on the effects of the SaLTS program on enabling surgical patients to receive appropriate care, and on the barrier variability across different areas in Ethiopia.

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**Contributors**

NS conceived and designed the study and survey tool with input from GK and MW. NS, SC, AS, RC and MW participated in data collection and interpretation of data. NS, SC and MC conducted data analysis. NS and SC drafted the manuscript. SC, AS, MC, GK and MW critically revised the manuscript and approved final version of the paper.

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**Table 1: Baseline Characteristics of Health Centers (N=8)**

Baseline Characteristics	N (%)
Distance from Referral Hospital km (mean $\pm$ SD)	93.9 km $\pm$ 59.3 km
Woreda (Administrative Zone) Population (mean $\pm$ SD)	36,300 $\pm$ 19859
Total patients seen in 30-days (mean $\pm$ SD)	1212 $\pm$ 1345
Surgical patients seen in 30-days (mean $\pm$ SD)	25 $\pm$ 7.5
Number of healthcare providers (mean $\pm$ SD)	18 $\pm$ 4
<b>Frequency of providers at all health centers</b>	
Physicians	
None	6
1-5	0
5-10	1
>10	0
Health officers	
1-5	6
5-10	1
>10	1
Nurses & Nursing Assistants	
1-5	---
5-10	5
>10	3
Anesthetists	
None	8
Midwives	
1-5	8
Lab Technician	
None	4
1-5	4
Pharmacy Technician	
None	4
1-5	4



**Table 2: Reasons provided by Health Center Staff for difficulty in making Diagnoses (N=8)**

Diagnosis	Reason for difficulty		
	Lack of Diagnostic Aids	Lack of Training	Atypical Presentation
Traumatic injury	4	----	----
Incarcerated hernia	2	1	1
Appendicitis	2	----	1
Gallbladder Disease	6	----	----
Bowel Obstruction	4	1	----
Indication for cesarean section	1	2	----
Perforated ulcer	5	----	----
Ruptured ectopic pregnancy	5	----	----
Hernia	2	----	2
Renal Stones	4	1	
Intraabdominal tumors	----	----	----
Peptic Ulcer Disease	4	----	----
Skin/soft tissue tumors	----	3	----

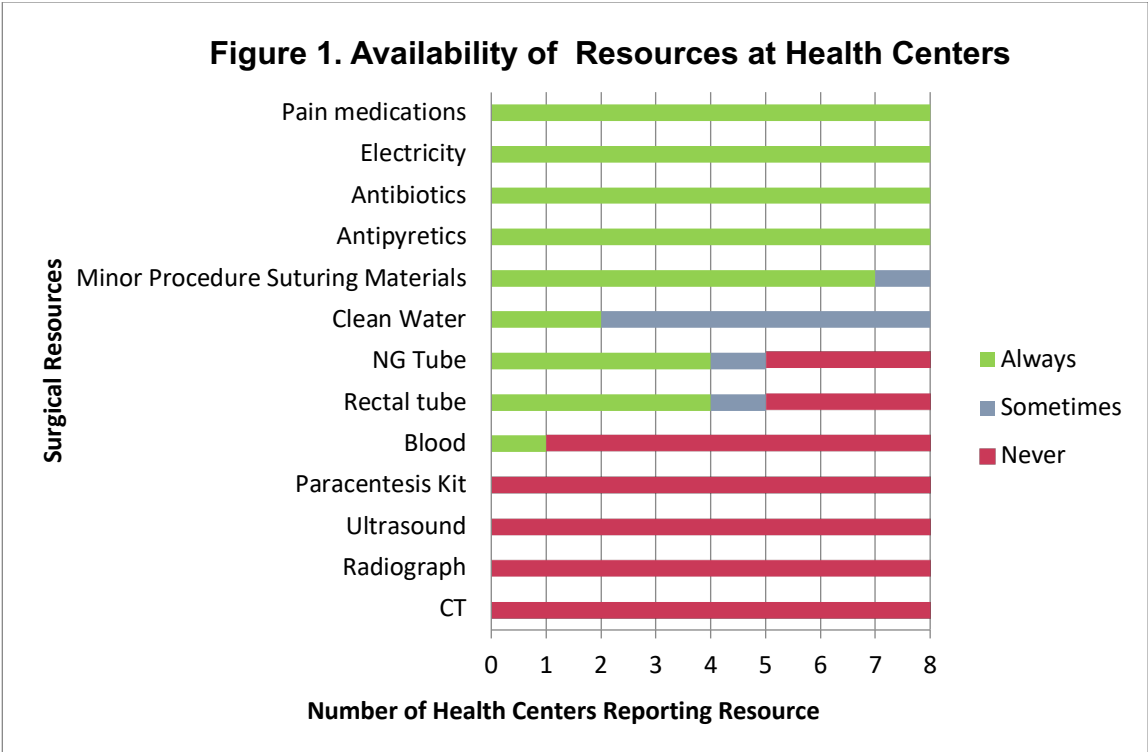
**Table 3: Baseline Characteristics of Surgical Patients at district health centers (N= 168)**

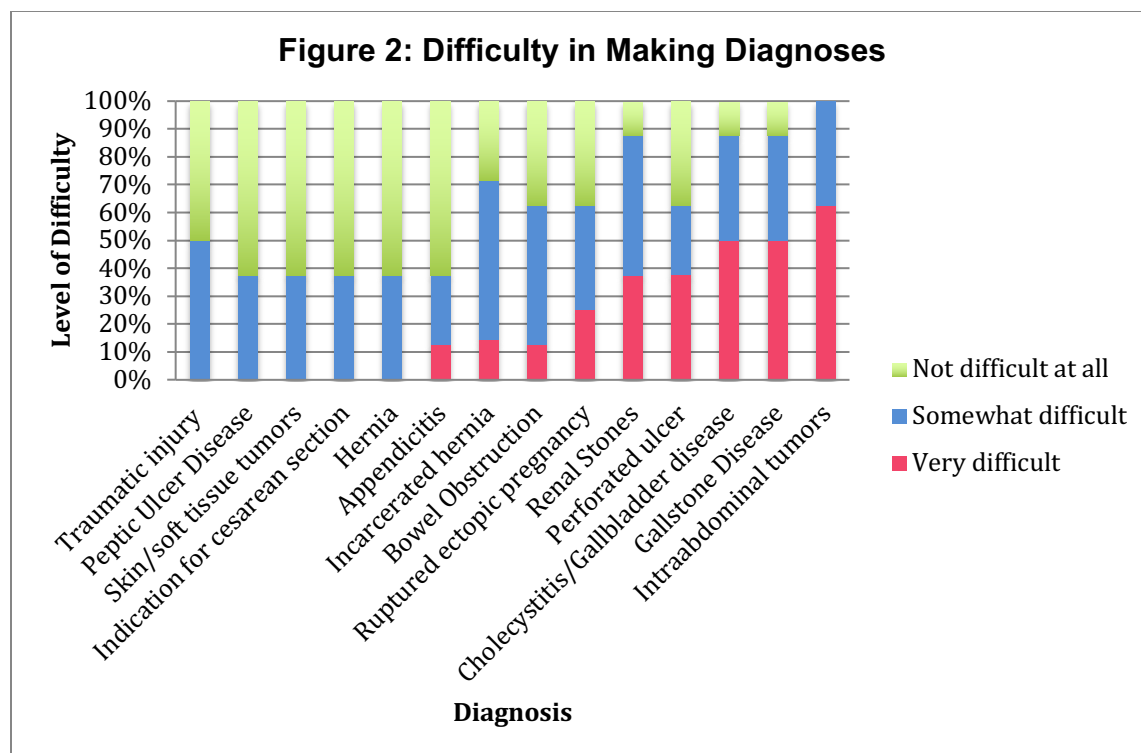
Baseline Characteristics	N (%)
Age (mean ± SD)	34.2 ± 16.8
Sex	
Male	107 (63.6%)
Female	61 (36.3%)
Referral for Surgery	
Yes	97 (57.7%)
No	71 (42.2%)
Reason for lack of referral (n=71)	
Minor injury treated in clinic	62 (87.3%)
Refused referral	9 (12.7%)
Referred patients receiving surgery (N=97)	
Yes	49 (50.5%)
No	35 (36.1%)
Unknown	13 (13.4%)
Transportation to Hospital	
Ambulance	45 (46.4%)
Car	38 (39.2%)
Animal	4 (4.1%)
Not Reported	10 (10.3%)



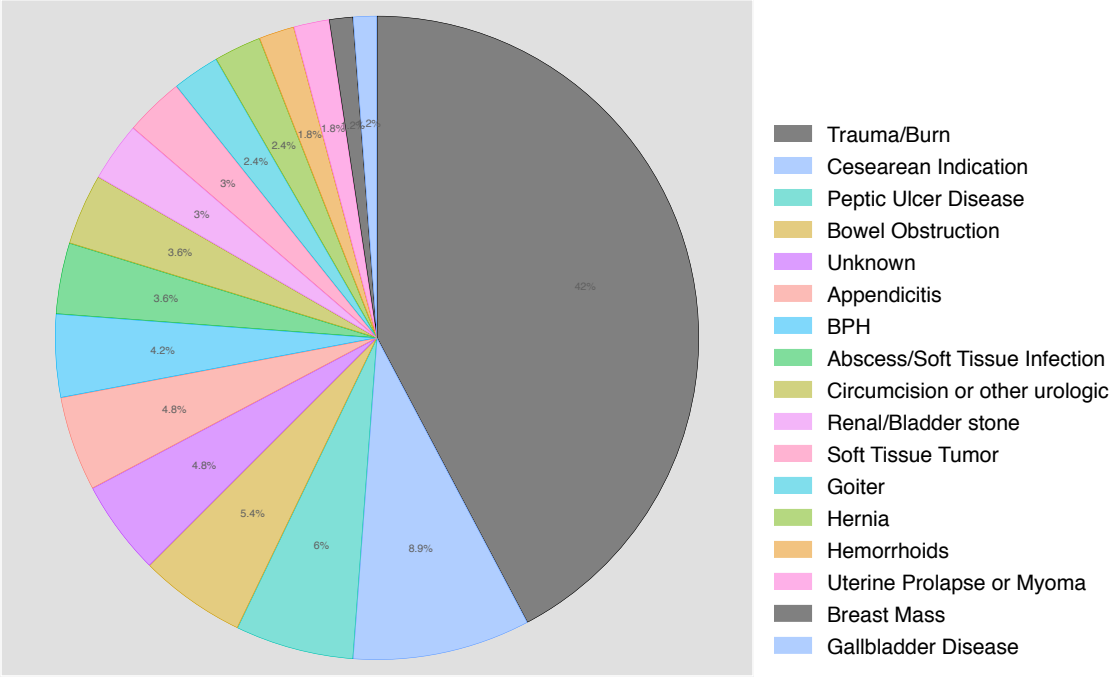
**Table 4: Barriers to receiving surgery (N= 35)**

<b>Patient factors</b>			
Patient is not the decision maker to have surgery	7	20.0%	
Lack of family or social support	6	17.1%	
No one to accompany patient to surgery	4	11.4%	
Fear of surgery, anesthesia or bad outcomes	4	11.4%	
Lack of information about disease, process of surgery, or post-op care	2	5.7%	
Lack of time	1	2.9%	
Patient does not understand severity of condition	1	2.9%	
<b>Financial Factors</b>			
Patient cannot afford- hospital fees, transport,	5	14.3%	
Patient cannot afford- to lose wages during surgery/recovery	1	2.9%	
<b>Structural Factors</b>			
Poor roads	1	2.9%	
None Reported	3	8.6%	





South Wollo Zone Health Centers: Surgical Patient Diagnoses  
(n=168)



review only

STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

Page	Item No	Recommendation
1,2 Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
<b>4 Introduction</b>		
4 Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
5 Objectives	3	State specific objectives, including any prespecified hypotheses
<b>Methods</b>		
5 Study design	4	Present key elements of study design early in the paper
5 Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
5 Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (b) For matched studies, give matching criteria and number of exposed and unexposed
6 Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
6 Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
6 Bias	9	Describe any efforts to address potential sources of bias
6 Study size	10	Explain how the study size was arrived at
6 Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
6 Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) If applicable, explain how loss to follow-up was addressed (e) Describe any sensitivity analyses
<b>Results</b>		
7 Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
7 Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Summarise follow-up time (eg, average and total amount)
7 Outcome data	15*	Report numbers of outcome events or summary measures over time
N/A Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period

N/A Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
<b>Discussion</b>		
8 Key results	18	Summarise key results with reference to study objectives
9 Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
9 Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
9 Generalisability	21	Discuss the generalisability (external validity) of the study results
<b>Other information</b>		
10 Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.

# BMJ Open

## Diagnosis and management of surgical disease at Ethiopian Health Centers: Cross-sectional survey of resources and barriers to care

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**Title Page:**

**Title:** Diagnosis and management of surgical disease at Ethiopian Health Centers: Cross-sectional survey of resources and barriers to care

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## Abstract

### Objectives:

The aim of this study was to characterize the resources and challenges for surgical care and referrals at health centers in South Wollo Zone, Ethiopia.

### Setting:

Eight primary health centers (HCs) in South Wollo Zone, Ethiopia.

### Participants:

Health officers and nurses staffing health centers completed a survey.

### Primary and Secondary Outcome measures:

Survey assessed human and material resources, diagnostic capabilities and challenges. Data on patients with surgical diagnoses was collected over a 30-day period including diagnosis, referral status and patient-reported barriers to care.

### Results:

Eight HCs had an average of 18 providers each, the majority of which were nurses (62.2%) and health officers (20.7%). HCs had intermittent availability of clean water, nasogastric tubes, rectal tubes and suturing materials, none had any form of imaging and only one could provide blood transfusion. Providers rated the most difficult diagnoses as gallstone disease, perforated ulcer and kidney stones, most often attributed to lack of diagnostic imaging. A total of 168 surgical patients were seen at the 8 HCs; 58% were referred for surgery. Most common diagnoses were trauma/burns (42%) and need for Cesarean section (9%). Of those who did not receive surgery, thirty-two patients reported specific barriers to obtaining care (91.4%). The most common specific barriers were patient not being decision maker to have surgery, lack of family/social support, and inability to afford hospital fees.

### Conclusions:

Health centers in South Wollo Zone, Ethiopia, are well-staffed with nurses and health officers, however face a number of diagnostic and treatment challenges due to lack of material resources and training in surgical diagnoses. A substantial number of patients requiring surgery receive initial diagnosis and care at HCs; sociocultural and financial factors commonly prohibit these patients from receiving surgery. Improving material resources including basic imaging at HCs, and exploring community and family perceptions of surgery may enable more streamlined access to surgical care and prevent delays.

Article Summary: Strengths and Limitations of this study

- In Ethiopia, health centers serve as an important gateway for triaging and referring patients needing essential surgery (Bellwether procedures) to higher-level care.
- This study of HCs conducted in South Wollo Zone, Ethiopia, explores the resources available, provider capabilities and surgical patient characteristics, as well as barriers patients expressed to obtaining surgery.
- HCs were staffed according to Ministry of Health guidelines, and most centers had supplies such as suture materials, antibiotics, and pain medications, but few had consistent access to clean water and none had imaging or blood transfusion capabilities.
- Sociocultural factors, such as patient decision-making ability in the family, and lack of social support, and lacking an accompanying family member were the most common reasons cited for not seeking surgery, in addition to financial concerns.
- This is an important study of rural populations that may often present with surgical complaints but fail to reach a hospital with surgical capacity due to sociocultural or financial reasons.

## Introduction

Global health priorities have evolved over the past several decades with a greater focus placed on surgery as part of a package of essential health care. Estimates indicate that up to 30-35% of the global burden of disease could be treated with surgical interventions (1)(2)(3). However, there is great inequity in the distribution of surgical care worldwide, with 73.6% of surgical procedures performed on 30% of the global population, and the poorest third receiving only 3.5% of surgeries (4). Many studies have aimed to quantify the burden of surgical disease and describe existing resources and infrastructure related to surgical care worldwide, in an effort to best direct interventions and improve access. It is clear there is a shortage of trained personnel and equipment at the district hospital level to provide adequate surgical services in low and middle-income countries (LMICs) (5).

Ethiopia is particularly affected by these shortages. A survey of surgical services in 2012 found only 106 general surgeons in 116 federal hospitals serving a population of 82.8 million (6). Although the surgical workforce has increased in recent years with the expansion of residency training programs and task-shifting to Integrated Emergency Surgical Officers (IESOs) - clinicians with additional emergency surgical training - there is still a shortage of surgical and anesthesia care providers. Additionally hospitals are not well resourced with limited capacity to provide blood transfusions, supplemental oxygen and adequate patient monitoring at all facilities(7).

Access to the “Bellwether procedures”, debridement of open fracture, emergency laparotomy, and Cesarean section within two hours for 80% of the population is a target established by the Lancet Commission on Global Surgery, with target procedure volumes of 5,000/100,000 population (5). Out of 56 WHO member states investigated in a study focused on documented rates of surgery, Ethiopia had the lowest surgical volume rate at 148 per 100,000 (8). Part of this phenomenon may be explained by the limited resources available for surgical interventions in Ethiopia. Hospitals often lack reliable access to running water, medications, electricity, oxygen, and blood banking. The average hospital had a maximum of two operating rooms for the vast population served (6).

The number of surgeons and other health workers within local hospitals or clinics is limited as well. A retrospective survey study conducted to outline surgical activity in rural Ethiopia found 76 health workers able to provide surgical services to the 12.9 million people that made up the sample population (9).

Beyond the lack of hospital equipment and personnel, however, other factors impede the ability of patients to access surgical services. Community assessments have revealed that cultural, financial, and structural barriers impact the ability of patients to seek and access care (10). Many patient factors are barriers to obtaining care, such as fear of surgery, lack of time or monetary resources, lack of transportation, cultural beliefs surrounding surgery, health illiteracy and lack of social support systems. Structural barriers such as poor roads, distance to hospitals, lack of communication and difficulty navigating the healthcare and referral system also impede the ability of patients to access surgical care. Medical services and loss of wages may be prohibitively expensive for most patients. These populations also tend to be spread across rural areas in Ethiopia, and have difficulty reaching hospitals in larger cities (11).

Mid-level and rural healthcare providers have the unique position as both the gatekeeper and facilitator between patients and facilities capable of providing surgical care. Few studies, however, have examined the barriers perceived by providers in the process of obtaining surgical

care (12).

For the majority of Ethiopians, the nearest health care facility would be a town or city health center. Patients needing urgent medical attention may seek initial care at these health centers, after which they may be referred for appropriate higher level of care. According to the 2012 Ethiopian Standard Health Center Requirements (13), recommended practitioners at each health center include a minimum of two health officers, three midwives, five nurses and laboratory and pharmacy technicians. The guidelines also state each health center should have capacity to perform minor operations such as circumcision, lipoma excision and abscess drainage, and external immobilization of fractures.

Contemporaneously with this study, the Ethiopian Federal Ministry of Health and international partner organizations began the “Saving Lives through Safer Surgery” (SaLTS) Initiative, and multi-pronged national surgical plan to improve access to and quality of surgical care throughout Ethiopia (14). This initiative not only better characterized resources and surgical volume at hospitals, but developed a nationwide plan to improve surgical leadership, infrastructure, data quality, human and materials resources. The SaLTS initiative does not specifically outline a plan for HCs in the surgical referral network, however SaLTS does prioritize access, quality and surgical volume as targets for the program (14).

The “three delays” model of accessing care has often been used to described delays in care contributing to maternal mortality at several timepoints, the first being decision to seek healthcare, the second reaching the appropriate medical facility, and the third receiving timely, appropriate intervention after reaching the right facility (15). This model is also applicable to emergency surgical and trauma care, when timely access to higher-level care is often critical for patient survival (16). Barriers faced by patients can contribute to care-seeking behaviors in the first delay; lack of resources or training at intermediate facilities such as HCs can lead to second and third delays in care.

The aim of this study was to describe material and human resources available at health centers in the South Wollo Zone, Ethiopia, and assess barriers experienced by mid-level providers and patients at health centers in obtaining surgical care.

Methods

Study Setting

Ethiopia is a low-income country in Eastern Sub-Saharan Africa with a rapidly growing population. With a population of 102 million in 2016, life expectancy was estimated at 65.5 years (17). Maternal mortality is moderate at 353/100,000 live births, and under-5 mortality rate is rapidly falling, estimated at 61/100,000 in 2015. Surgical diseases, however, are now a major source of mortality, with non-communicable diseases now making up a majority of causes of death, particularly cardiovascular disease, malignant neoplasms and digestive diseases. It was reported that only 55% of healthcare facilities could provide basic obstetric care and 52% could provide basic surgical care in 2015.

The ratio of healthcare providers and facilities per population is among the lowest in the world, with 149 total hospitals in country, 1343 health centers, and 3305 health posts in 2008. This study was conducted in the Amhara region, which was estimated to have 17.2 million

inhabitants in 2007 with 7406 total health care providers, 2152 physicians (2.7/100,000 population). In 2007 an estimated 140 surgeons were practicing in the country, with estimates for 820 by 2015 (17).

Dessie Referral Hospital is the only referral hospital in South Wollo Zone within the Amhara Region (Figure 1) and serves an estimated catchment area of 7 million, with general surgeons, orthopedic surgeons, and obstetricians on staff. While intensive/critical care is limited, and subspecialties such as oncologic care are not available, all Bellwether procedures can be performed at this hospital.

### *Study Design & Study Population*

This study was a cross-sectional survey of eight woreda (district) level HCs in the South Wollo Zone of Ethiopia. Survey was designed by the study personnel using review of prior similar studies on barriers to accessing surgery and HC assessment tools (10)(18)(19)(20)(21). Surveys were distributed to all HCs in the South Wollo Zone for completion. The survey was reviewed by local colleagues at the main study site at Dessie Referral Hospital in South Wollo Zone and feedback incorporated into the final tool. The survey tool was piloted with one health center in Dessie town with a surgeon and HC nurse and all questions were determined to be understandable and possible to answer by the local study personnel. Although Dessie Hospital is considered a “referral hospital” by the Ethiopian healthcare network, according to international standards it meets criteria as a primary hospital, with inpatient and general surgical services available, but lacking subspecialty or ICU services (22).

### *Patient and Public Involvement statement*

Patients and the public were not involved in the study design or survey tool design; however local health care providers gave input on survey questions during study design. Findings from this study will be made available at the referral hospital for public viewing and dissemination.

### *Participants*

Surveys were distributed at a regional health bureau meeting. Study participants who completed the survey were nurses or health officers (diploma nurses with additional training) employed at the respective HCs. Orientation and training on survey completion were provided by an Ethiopian nurse who was engaged in the project. This trainer and the Principal Investigator were available to answer questions for participants throughout the study period by phone regarding survey completion. The survey was distributed to HC nurses or health officers at all 21 woredas in South Wollo. Participation was voluntary and participants received a small monetary compensation when the survey was returned at the end of the study period.

### *Variables*

Study participants completed survey questions regarding health center staffing, diagnostic and treatment resources available at their health center, as well as provider comfort level making common surgical diagnoses in their setting. They also recorded data on all patients presenting to their respective health centers with surgical diagnoses as stipulated by the study definitions over a 30-day period. Information about these patients including age, gender, diagnosis, whether or not a referral was made at the clinic visit, and barriers expressed or perceived that prevented patients from receiving surgical care were recorded.



*Data Collection*

Participants collected patient data over a 30-day period between November 2014 and January 2015; health centers varied in the specific dates of their data collection. Surveys were returned to the study PI in person or via post and compensation was provided upon return of completed survey. All participating HCs were in a geographic network making surgical referrals to a single referral hospital in Dessie, Ethiopia. In an effort to avoid selection bias surveys were distributed to all HCs in the Zone and orientation to the survey was conducted with staff from all HCs. Study population included all HCs in South Wollo Zone that were expected to make referrals to a single hospital in the Zonal capital.

*Quantitative Variables*

Quantitative data such as HC catchment population, staffing, patient age and referral status were analyzed with frequencies and standard deviations. Descriptive statistics were used for all variables and no multivariate analysis or associations were calculated.

*Data Analysis & Management*

Data were returned via paper forms and entered into RedCap by study personnel. Data were extracted to Microsoft Excel and kept confidential on encrypted computer by study personnel. Descriptive statistics were used to analyze HC providers, resources, diagnostic challenges, patient diagnoses and barriers to care. Data analysis was conducted using Excel and Stata/SE Version 15.1.

*Data Sharing*

No additional data available.

*Ethical Considerations*

IRB approval was obtained from Boston University (Boston, MA, USA) and Wollo University (Dessie, Ethiopia) prior to survey distribution.

**Results:**

Eight HCs in South Wollo Zone returned surveys, representing 38% of the total zonal HCs (n=21). Health centers were distributed geographically throughout the zone with a mean distance of 93.9km ± 59.3km (58.3mi ± 36.8mi) from the Dessie Referral Hospital (Figure 1). Each HC served a population of approximately 36,000 in their catchment area. Given road quality and typical transport speeds it would take an estimate of 2-4 hours to reach the Referral Hospital from the average participating HC.

*Providers:*

An average of 18 (±4) clinical service providers (physicians, health officers, or nurses) were employed at each health center and saw an average of 1212 (range 278 - 4118) patients at each facility in the 30-day study period (Table 1). On average 25 (2.1%) of these patients had a surgical complaint. Only one HC was staffed by physicians and none had anesthesia providers.



The majority of providers were health officers (20.7%), nurses (62.2%), and midwives (13.7%). Half of the health centers had lab and pharmacy technicians.

#### *Resources:*

All HCs had access to electricity, pain medications, antibiotics, and antipyretics (Figure 2). All but one center had minor suturing materials. Half of centers reported they always had access to NG or rectal tubes. Only two centers always had clean water, while the other 6 reported they sometimes had clean water. Only one reported access to blood for transfusion, and no health centers had access to any form of imaging (ultrasound, radiograph or CT Scan) or paracentesis kits.

#### *Diagnostic Capabilities:*

Providers reported the difficulty of diagnosing common illnesses with their available resources (Figure 3). According to HC provider ratings, the most difficult diagnoses were cholecystitis and other gallstone disease, intraabdominal tumors, perforated ulcer and kidney stones. Most often lack of diagnostic aids was cited as the reason for difficulty. The conditions most easily diagnosed were traumatic injury, appendicitis, a need for cesarean section, hernia, skin/soft tissue tumors, and peptic ulcer disease (Table 2). Even for the diagnoses that were rated as “not difficult at all”, however, lack of diagnostic aids and lack of training were still cited as reasons for difficulty.

#### *Surgical Patients:*

A total of 168 patients were seen with surgical complaints over the 30-day study period at the eight HCs (Table 3). Patient average age was 34, ranging 1 – 80 years and 63.6% were male. Ninety-seven patients (58%) were referred to the hospital for surgery; of the 71 patients (42%) not referred for surgery the majority of them (87%) could be treated in clinic. The other 9 (12.6%) refused referral. Most surgical patients seen in HCs had traumatic injuries or burns (42%) (Figure 4). Other common diagnoses seen in the HCs were need for cesarean section (9%), appendicitis (5%), benign prostatic hyperplasia (4%), peptic ulcer disease (6%) and bowel obstruction (5%). Less common diagnoses were kidney stones, soft tissue infections, goiters, hemorrhoids, requests for circumcision, and soft tissue tumors.

#### *Barriers to Receiving Surgery:*

Of those who received a referral for surgery (97), 35 did not receive surgery, and of those thirty-two patients reported specific barriers to obtaining surgery to HC providers (33%) (Table 4). The most common specific barriers encountered were the patient not being decision maker to have surgery (7), lack of family or social support (6), and inability to afford hospital fees (5). Less commonly the patient expressed fear of surgery (4), had no one to accompany them to the hospital (4) or lacked information about surgery (2). Rarely reported was lack of time, fear of lost wages, poor roads to hospital or lack of understanding disease severity. Most patients traveled by ambulance (46.4%) or car (39.2%) to the hospital. Few were transported by animal (4.1%).

#### **Discussion:**

It is well established that surgical care throughout Ethiopia is critically limited. However, specific barriers to care and provider and facility needs have not been determined, and the surgical disease burden has not been assessed. This research represents an attempt to further elucidate the barriers to surgical care faced by Ethiopian patients.

In Ethiopia, health centers serve as an important gateway for triaging and referring patients needing essential surgery to higher-level care. The majority of patients requiring surgical care in

Ethiopia, particularly in rural settings, can access surgical services by first seeking care at a nearby health center. However, a number of factors related to patients, healthcare providers, and material resources at HCs can contribute to the “three delays” of accessing appropriate surgical care.

*The first delay – patient barriers to care*

Barriers experienced by patients can contribute to the first delay; in our study this delay was overcome as all patients presented to HCs, but patient barriers related to decision-making capability and financial resources may still contribute to the “first delay” in the decision to seek definitive surgical care at the referral hospital.

Many of the patients seen at health centers in our study were perceived to require surgery by the clinical judgement of the HC providers, but ultimately not referred to a surgeon for their diagnoses. While at times minor injuries could be treated in the HC, about half of patients referred to the zonal hospital for surgery did not ultimately go to the hospital to pursue surgical care. In order to meet Ethiopian MOH and WHO targets for essential surgical care, patients should be triaged, appropriately diagnosed, and able to reach Dessie Referral Hospital within two hours to receive Bellwether or other emergency and essential surgical procedures (23). Limitations in diagnostic capabilities, provider training, and patient barriers can all contribute to delays in receiving appropriate care (16)(15), which in South Wollo Zone would require transport to the referral hospital for most surgical disease.

The two most common reasons cited for not being referred was that the patient was not the primary decision maker or lacked family support. This underscores the importance of the family in medical decision-making that must be considered when designing interventions to improve health care access. What is lacking from these data is an understanding of why a family might withhold support for seeking surgical care. The next most commonly cited reason for refusing a referral was inability to afford the surgery. Whether a lack of familial support for surgery also stems from financial concerns, or if there are other factors weighing in on a family's decision needs to be investigated further. Of note, male patients were far more likely to arrive at the health centers than were female patients (92 male patients, 54 female), however men were more likely to be injured as well. These barriers of inadequate social or family support (24), and financial concerns are echoed in the worldwide literature (25). However the barrier of being considered the “decision-maker” for surgery was unique to this context and may be important to explore community and family dynamics to further understand.

*The second and third delays – reaching appropriate facility and accessing care*

Importantly, the data collected suggest severe limitations with performing even minor procedures at the health centers. While all centers reported they always had access to electricity, pain medication, antibiotics, and antipyretics, only some had consistent access to clean water, nasogastric tubes, rectal tubes, and none had available imaging equipment. Only one center reported having access to blood. According to international standards, these facilities aim to provide “Health Center” level care, with access to minor surgery, basic medical care, family planning and safe childbirth services (22). With inconsistent availability of clean water, rectal tubes, nasogastric tubes and suturing kits, patients who are able to reach the health center still may not receive needed care.

For many patients, the only way to receive even minor surgery or emergency procedures may be to have the means and ability to travel to a hospital for care. Some studies have supported the decentralization of surgical care to rural areas by task-shifting to non-physician surgical providers or surgical “camps” to provide intermittent services (26). However given the resource

limitations at primary hospitals in Ethiopia (27), this solution may not be reasonable in this setting. Additionally, the Ethiopian MOH has continued to build new hospitals and train non-physician surgical providers (IESOs) in the interim, therefore some of these delays may be expected to improve, although these mid-level providers staff hospitals and usually not HCs.

Most or all centers reported difficulty diagnosing perforated ulcer, gallstones, cholecystitis, and renal stones, all of which are diagnoses typically confirmed through the very imaging modalities these centers lack. Unsurprisingly, health care workers identified a lack of diagnostic aids as the number one barrier to making definitive diagnoses in their centers. None of the eight centers ever had access to radiographs, ultrasound, or CT. The general pattern of resource availability demonstrates that health centers are better equipped for managing infectious and communicable diseases than they are for making diagnoses that require imaging equipment. Difficulties in diagnoses contribute to the “second” and “third” delays in care, that is a delay in reaching the appropriate facility and delay in accessing appropriate care (15)(16).

Studies have demonstrated that while CT and MR scanners draw too much electricity to be universally useful in many developing countries, ultrasound can be effectively introduced into such setting with success (28). This presents a possible mode of intervention to improve diagnosis and referral decisions in South Wollo health centers. Basic ultrasonography can potentially aid in diagnosis and management of soft tissue infections, intraabdominal pathologies, bleeding in trauma and obstetric complications. While definitive management for such conditions would not be expected at the health center level, ultrasound may be a helpful aid in increasing efficiency of diagnosis and triage of patients who need hospital-level care. Of note, however, introducing ultrasound equipment to health care centers will require more than the purchase of ultrasound machines. Dedicated intensive ultrasound training would likely need to take place for this intervention to be successful in improving health center diagnostics.

#### *Framing the study within the context of SaLTS*

Ethiopia is currently implementing the SaLTS program, a national surgical plan to improve access to and quality of surgery nationwide. This plan, which encompasses human resource and infrastructure development, data quality, service quality, and monitoring and evaluation will be crucial for closing gaps in access to surgical care (14). As part of the SaLTS initiative, an evaluation of surgical hospitals in two regions, one of which encompasses this study's health centers, revealed that access to surgical care may be limited by difficult roads and delays in transport, as well as limitations all five basic domains of surgical care (service delivery, infrastructure, workforce, information management, financing) (27).

Suboptimal road conditions and hospital resource limitations may be time-consuming and costly to address, however the patient barriers, healthcare provider resource and training constraints may also contribute to delays and offer important context to the ongoing implementation of the SaLTS program, particularly as it relates to Health Centers.

#### **Limitations**

This study had several limitations; data collection time periods varied across sites, and different farming or weather patterns may have affected the number of patients presenting to health centers throughout the year as well as their presenting diagnoses, such as work-related injuries or road traffic accidents. The survey completion rate was low, with 40% of health centers in the zone completing surveys, therefore the data may not be representative of the entire South Wollo zone. Also, small numbers of patients reported which barriers were affecting their decision or

ability to be referred for surgery and, while descriptive, were not reported in large enough numbers to draw larger conclusions about the population.

Additionally, there are wide variations in culture and economic prosperity between regions in Ethiopia, which may affect healthcare seeking behavior and perceived barriers to care. This study was conducted in the South Wollo Zone of Amhara region, Ethiopia, and therefore findings may not necessarily be applicable to other regions in Ethiopia.

**Conclusion**

This study represents an important contribution to the literature as the only survey of health center resources and diagnostic capabilities in Ethiopia, and of rural populations that may often present with surgical complaints but fail to reach a hospital with surgical capacity due to sociocultural or financial reasons.

As investment in surgical services is expanding in Ethiopia, it is important to understand the material and human capabilities of the health centers which are often responsible for the diagnosis and referral of surgical conditions. Additionally, with the possible expansion of surgical services to more rural and primary healthcare facilities in Ethiopia, it is important to understand the current available human and material resources, as well as patient mix presenting to those facilities.

Further study on strategies to improve diagnosis of surgical patients such as expansion of imaging capabilities like ultrasound, is needed to understand the impact on this population. Additionally, the sociocultural barriers such as patient autonomy, family and social support should be further explored to better understand healthcare seeking behavior of rural Ethiopian populations.

One future area for research is further elucidating the reasons behind the lack of family support for patients citing this barrier as a reason for not seeking surgical care. Should this stem from monetary reasons, financial interventions may be additionally required. Future research should also focus on the effects of the SaLTS program on enabling surgical patients to receive appropriate care, and on the barrier variability across different areas in Ethiopia.

This study must be taken in context with the ongoing Ethiopian National Surgical Plan, which clearly sets the stage for any evaluation and change in terms of surgical services in Ethiopia. The SaLTS program does not specifically address Health Centers as part of the SaLTS priorities and plans, although specifically stated goals of improved access and quality, and increasing surgical volume clearly are related to the referral networks of health centers.

As part of the SaLTS initiative to increase access to timely, safe, and affordable surgical care when needed in Ethiopia, health centers are an important piece in the referral network that can serve the role of decreasing burden on hospitals by managing minor conditions and efficiently referring patients to hospital when surgery is needed. However, in order to play a role in increasing surgical access and safety in Ethiopia, health centers must be consistently equipped with necessary material and human resources, and must have the training to confidently diagnose, triage and at times manage surgical conditions. This may require additional investment in training and capital expenditures, with basic training in ultrasonography as one suggested possibility. Patient and community barriers must also be mitigated as much as possible to ensure surgery is acceptable and affordable when needed.

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## Contributors

NS conceived and designed the study and survey tool with input from GK and MW. NS, SC, AS, RC and MW participated in data collection and interpretation of data. NS, SC and MC conducted data analysis. NS and SC drafted the manuscript. SC, AS, MC, GK and MW critically revised the manuscript and approved final version of the paper.

## Competing Interest Statement

None of the authors have any competing interests to declare.

Figure 1: Amhara Region and South Wollo Zone Map with Study Site Locations

Figure 2. Availability of Resources at Health Centers

Figure 3: Difficulty in Making Diagnoses

Figure 4: South Wollo Zone Health Centers: Surgical Patient Diagnoses



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**Table 1: Baseline Characteristics of Health Centers (N=8)**

<b>Baseline Characteristics</b>	<b>N (%)</b>
Distance from Referral Hospital km (mean $\pm$ SD)	93.9 km $\pm$ 59.3 km
Woreda (Administrative Zone) Population (mean $\pm$ SD)	36,300 $\pm$ 19859
Total patients seen in 30-days (mean $\pm$ SD)	1212 $\pm$ 1345
Surgical patients seen in 30-days (mean $\pm$ SD)	25 $\pm$ 7.5
Number of healthcare providers (mean $\pm$ SD)	18 $\pm$ 4
<b>Frequency of providers at all health centers</b>	
Physicians	
None	6
1-5	0
5-10	1
>10	0
Health officers	
1-5	6
5-10	1
>10	1
Nurses & Nursing Assistants	
1-5	---
5-10	5
>10	3
Anesthetists	
None	8
Midwives	
1-5	8
Lab Technician	
None	4
1-5	4
Pharmacy Technician	
None	4
1-5	4

**Table 2: Reasons provided by Health Center Staff for difficulty in making Diagnoses (N=8)**

Diagnosis	Reason for difficulty		
	Lack of Diagnostic Aids	Lack of Training	Atypical Presentation
Traumatic injury	4	----	----
Incarcerated hernia	2	1	1
Appendicitis	2	----	1
Gallbladder Disease	6	----	----
Bowel Obstruction	4	1	----
Indication for cesarean section	1	2	----
Perforated ulcer	5	----	----
Ruptured ectopic pregnancy	5	----	----
Hernia	2	----	2
Renal Stones	4	1	
Intraabdominal tumors	----	----	----
Peptic Ulcer Disease	4	----	----
Skin/soft tissue tumors	----	3	----

**Table 3: Baseline Characteristics of Surgical Patients at district health centers (N= 168)**

Baseline Characteristics	N (%)
Age (mean ± SD)	34.2 ± 16.8
Sex	
Male	107 (63.6%)
Female	61 (36.3%)
Referral for Surgery	
Yes	97 (57.7%)
No	71 (42.2%)
Reason for lack of referral (n=71)	
Minor injury treated in clinic	62 (87.3%)
Refused referral	9 (12.7%)
Referred patients receiving surgery (N=97)	
Yes	49 (50.5%)
No	35 (36.1%)
Unknown	13 (13.4%)
Transportation to Hospital	
Ambulance	45 (46.4%)
Car	38 (39.2%)
Animal	4 (4.1%)
Not Reported	10 (10.3%)

**Table 4: Barriers to receiving surgery (N= 35)**

<b>Patient factors</b>			
Patient is not the decision maker to have surgery	7	20.0%	
Lack of family or social support	6	17.1%	
No one to accompany patient to surgery	4	11.4%	
Fear of surgery, anesthesia or bad outcomes	4	11.4%	
Lack of information about disease, process of surgery, or post-op care	2	5.7%	
Lack of time	1	2.9%	
Patient does not understand severity of condition	1	2.9%	
<b>Financial Factors</b>			
Patient cannot afford- hospital fees, transport,	5	14.3%	
Patient cannot afford- to lose wages during surgery/recovery	1	2.9%	
<b>Structural Factors</b>			
Poor roads	1	2.9%	
None Reported	3	8.6%	

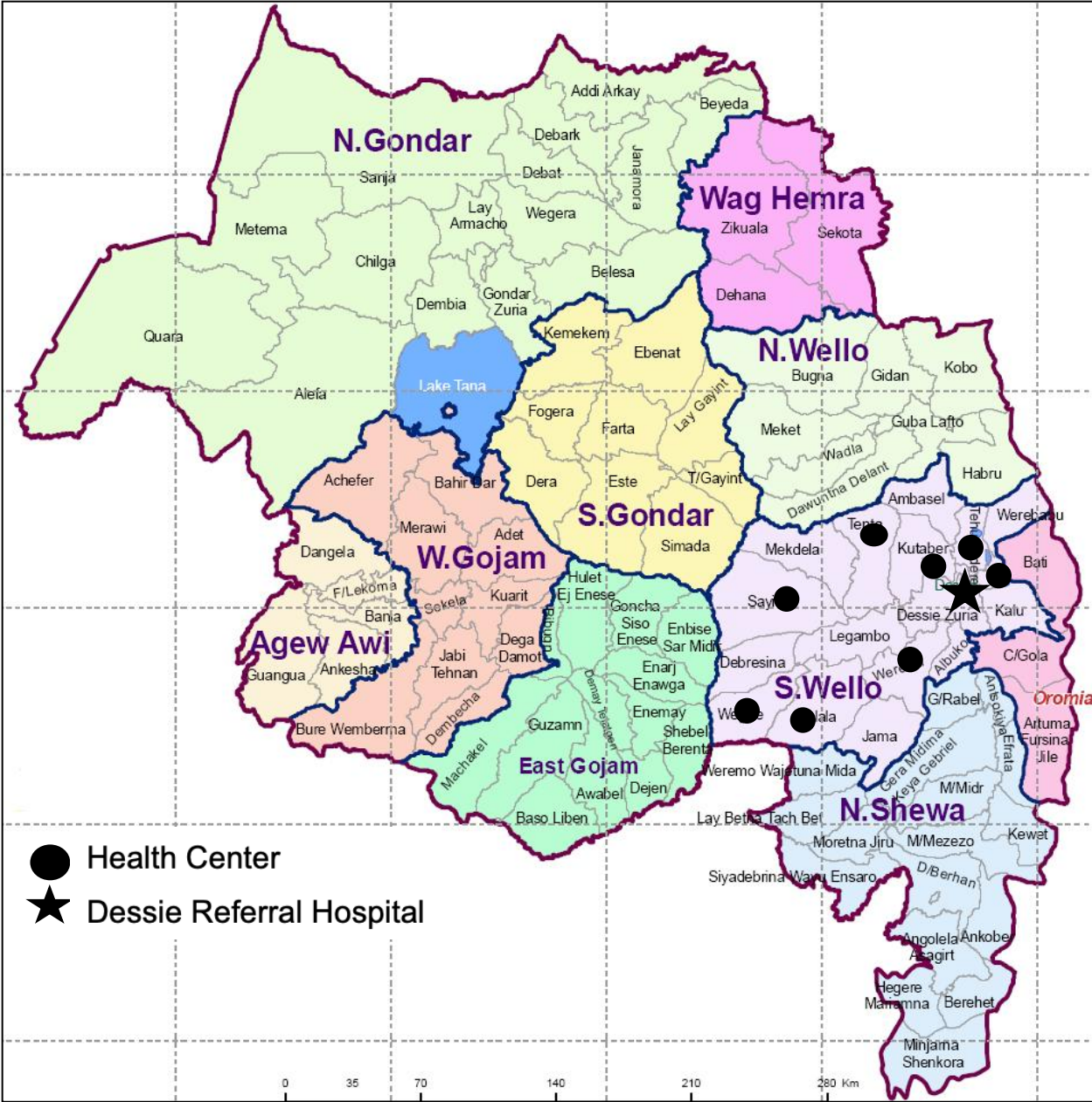
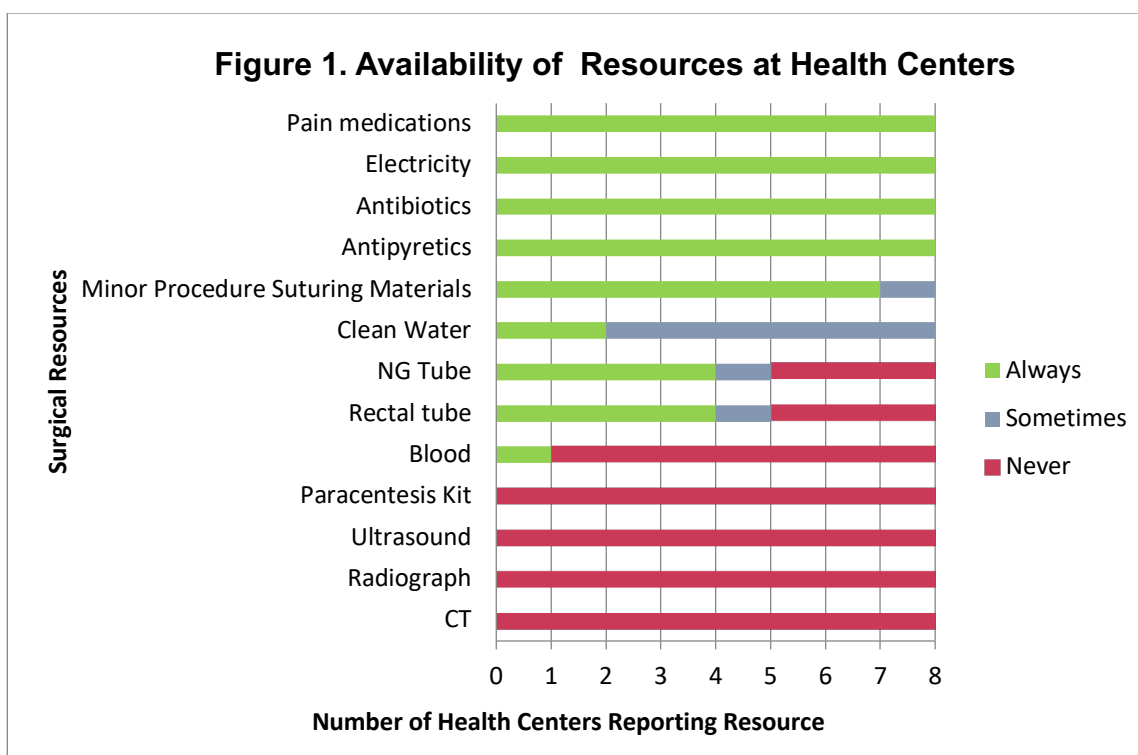
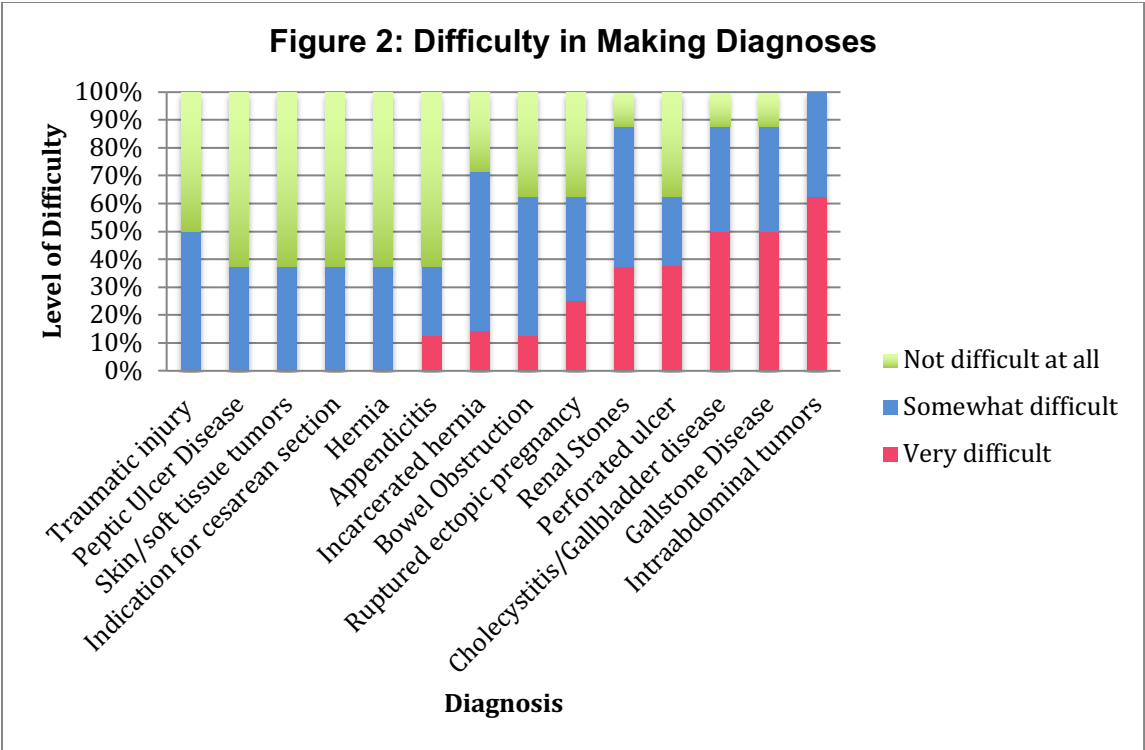


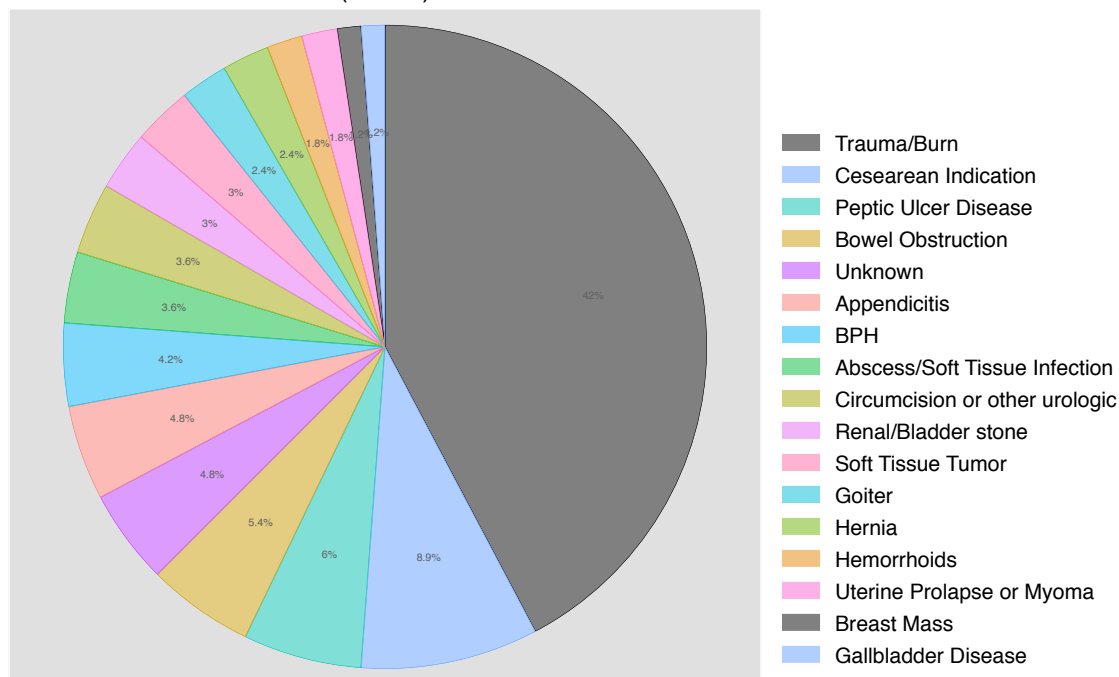
Figure 4: Amhara Region and South Wollo Zone Map with Study Site Locations







South Wollo Zone Health Centers: Surgical Patient Diagnoses  
(n=168)



Health Center Survey

1. Health Center name \_\_\_\_\_
2. Location: \_\_\_\_\_
3. Distance to nearest hospital where surgery is possible (km): \_\_\_\_\_
4. Approximate population served by the health center (catchment area): \_\_\_\_\_
5. Number of providers: \_\_\_\_\_
6. Total number of patients seen in the 30 day survey period: \_\_\_\_\_ How many are surgical? \_\_\_\_\_
7. Level of training of each provider (Fill in number for all):

Physician (MD)		Nurse Anesthetist	
Health Officer		Midwife	
Nurse		Other (List)	
Nursing Assistant		Other (List)	

8. Resources present at health center (always, sometimes, never):

Resource	Always	Sometimes	Never
Electricity			
Water (clean water)			
Ultrasound			
Radiograph			
CT			
Pain medications			
Antibiotics			
Antipyretics			
NG Tube			
Blood			
Paracentesis kit			
Rectal Tube			
Minor Procedure Suturing Materials			

## 9. How difficult is it for you to make the following diagnoses?

Diagnosis	Very difficult	Somewhat difficult	Not difficult at all	Why? Please write the reason below from the list.
Traumatic injury				
Incarcerated hernia				
Appendicitis				
Cholecystitis/Gallbladder disease				
Bowel Obstruction				
Indication for cesarean section				
Perforated ulcer				
Ruptured ectopic pregnancy				
Hernia				
Gallstone Disease				
Renal Stones				
Intraabdominal tumors				
Peptic Ulcer Disease				
Skin/soft tissue tumors				
Others (List)				

**Code- Reasons for difficulty in diagnosis:**

- 1= Lack of training
- 2= Lack of diagnostic aids (laboratory, imaging)
- 3= Atypical presentation
- 4= Difficult communication with consultants
- 5= Language barrier with patients
- 6= Other (please write the reason)

10. Please complete for each surgical patient seen in the **30 days** after you receive this survey:

No.	Age	Sex	Diagnosis	Referral (Yes/No)	If not referred, why? (See codes below)	If referred, did the patient receive surgery? (Yes/No)	If not, why? Barriers (List all codes)	Transportation to hospital (see transportation codes)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								

No.	Age	Sex	Diagnosis	Referral (Yes/No)	If not referred, why? (See codes below)	If referred, did the patient receive surgery? (Yes/No)	If not, why? Barriers (List all codes)	Transportation to hospital (see transportation codes)
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								
51								
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53								
54								
55								
56								
57								
58								
59								
60								
61								
62								
63								

**Referral Codes: Reasons patients were not referred:**

1= Patient can be treated in clinic, 2= Patient refused referral, 3= Patient prefers treatment in private health setting ,  
4= Patient prefers treatment by traditional healers, 5= Other (list)

**Barrier Codes: Reasons why pts requiring surgery not referred or did not obtain surgery:**

Category	Code	Barrier
Patient factors	A1	Fear of surgery, anesthesia or bad outcomes
	A2	Lack of family or social support
	A3	Lack of time
	A4	No one to accompany patient to surgery
	A5	Patient is not the decision maker to have surgery
	A6	Social role (i.e. beggar) is deterrent for surgery
	A7	Too old
	A8	Patient does not perceive need for surgery
	A9	Patient does not understand severity of condition
	A10	Cultural beliefs or use of traditional healers
	A11	Lack of information about disease, process of surgery, or post-op care
Financial factors	B1	Patient cannot afford- hospital fees, transport, food/clothing, hotel costs for caregiver, emergency care, informal payments for services
	B2	Patient cannot afford- to lose wages during surgery/recovery
Structural factors	C1	Delayed diagnosis or delayed decision to refer patient
	C2	Distance too far to travel or poor quality of service locally
	C3	Lack of infrastructure- equipment, blood, drugs, lab or imaging equipment
	C4	Lack of staff training or knowledge
	C5	Poor roads
	C6	Poor communication between health center and hospital

**Transportation Codes- Mode of transport taken by patients:** 1= ambulance, 2=car, 3=bus, 4=bajaj, 5=animal (horse, donkey), 6=bicycle, 7=foot

STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

Page	Item No	Recommendation
1,2 Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
<b>4 Introduction</b>		
4 Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
5 Objectives	3	State specific objectives, including any prespecified hypotheses
<b>Methods</b>		
5 Study design	4	Present key elements of study design early in the paper
5 Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
5 Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (b) For matched studies, give matching criteria and number of exposed and unexposed
6 Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
6 Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
6 Bias	9	Describe any efforts to address potential sources of bias
6 Study size	10	Explain how the study size was arrived at
6 Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
6 Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) If applicable, explain how loss to follow-up was addressed (e) Describe any sensitivity analyses
<b>Results</b>		
7 Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
7 Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Summarise follow-up time (eg, average and total amount)
7 Outcome data	15*	Report numbers of outcome events or summary measures over time
N/A Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period



N/A Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
<b>Discussion</b>		
8 Key results	18	Summarise key results with reference to study objectives
9 Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
9 Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
9 Generalisability	21	Discuss the generalisability (external validity) of the study results
<b>Other information</b>		
10 Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.

# BMJ Open

## Diagnosis and management of surgical disease at Ethiopian Health Centers: Cross-sectional survey of resources and barriers to care

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Keywords:	SURGERY, Ethiopia, Health policy < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Patient Access, Barriers

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**Title Page:**

**Title:** Diagnosis and management of surgical disease at Ethiopian Health Centers: Cross-sectional survey of resources and barriers to care

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## Abstract

### Objectives:

The aim of this study was to characterize the resources and challenges for surgical care and referrals at health centers in South Wollo Zone, Ethiopia.

### Setting:

Eight primary health centers (HCs) in South Wollo Zone, Ethiopia.

### Participants:

Eight health officers and nurses staffing eight health centers completed a survey.

### Design:

The study was a survey-based, cross-sectional assessment of health centers in South Wollo Zone, Ethiopia and data collected over a 30-day period from November 2014 – January 2015.

### Primary and Secondary Outcome measures:

Survey assessed human and material resources, diagnostic capabilities and challenges, and patient-reported barriers to care.

### Results:

Eight HCs had an average of 18 providers each, the majority of which were nurses (62.2%) and health officers (20.7%). HCs had intermittent availability of clean water, nasogastric tubes, rectal tubes and suturing materials, none had any form of imaging. A total of 168 surgical patients were seen at the 8 HCs; 58% were referred for surgery. Most common diagnoses were trauma/burns (42%) and need for Cesarean section (9%). Of those who did not receive surgery, thirty-two patients reported specific barriers to obtaining care (91.4%). The most common specific barriers were patient not being decision maker to have surgery, lack of family/social support, and inability to afford hospital fees.

### Conclusions:

Health centers in South Wollo Zone, Ethiopia, are well-staffed with nurses and health officers, however face a number of diagnostic and treatment challenges due to lack of material resources. Many patients requiring surgery receive initial diagnosis and care at HCs; sociocultural and financial factors commonly prohibit these patients from receiving surgery. Further study is needed to determine how such delays may impact patient outcomes. Improving material resources at HCs, and exploring community and family perceptions of surgery may enable more streamlined access to surgical care and prevent delays.

Article Summary: Strengths and Limitations of this study

- This study is the first of its kind to address limitations at the Health Center level in Ethiopia that may present barriers to surgical access.
- Our survey was conducted with healthcare providers in the South Wollo Zone of Ethiopia, who reported their perspectives on training and diagnostic abilities, as well as facility level material resources, patient mix and volume.
- In the context of the ongoing SaLTS (Saving Lives Through Safer Surgery) National Surgical Plan of Ethiopia, this study highlights important patient and provider related challenges that can be considered in the strengthening of Ethiopian surgical referral system.
- This survey incorporates both training and resource limitations, as well as patient reported barriers to surgical access, that capture the complex nature of the surgical referral ecosystem, particularly in rural areas.
- As the sample size was low, results may not be generalizable to other parts of the region or country in Ethiopia, but represent important perspectives that can inform future study.

## Introduction

Global health priorities have evolved over the past several decades with a greater focus placed on surgery as part of a package of essential health care. Estimates indicate that up to 30-35% of the global burden of disease could be treated with surgical interventions (1)(2)(3). However, there is great inequity in the distribution of surgical care worldwide, with 73.6% of surgical procedures performed on 30% of the global population, and the poorest third receiving only 3.5% of surgeries (4). Many studies have aimed to quantify the burden of surgical disease and describe existing resources and infrastructure related to surgical care worldwide, in an effort to best direct interventions and improve access. It is clear there is a shortage of trained personnel and equipment at the district hospital level to provide adequate surgical services in low and middle-income countries (LMICs) (5).

Ethiopia is particularly affected by these shortages. A survey of surgical services in 2012 found only 106 general surgeons in 116 federal hospitals serving a population of 82.8 million (6). Although the surgical workforce has increased in recent years with the expansion of residency training programs and task-shifting to Integrated Emergency Surgical Officers (IESOs) - clinicians with additional emergency surgical training - there is still a shortage of surgical and anesthesia care providers. Additionally hospitals are not well resourced with limited capacity to provide blood transfusions, supplemental oxygen and adequate patient monitoring at all facilities(7).

Access to the “Bellwether procedures”, debridement of open fracture, emergency laparotomy, and Cesarean section within two hours for 80% of the population is a target established by the Lancet Commission on Global Surgery, with target procedure volumes of 5,000/100,000 population (5). Out of 56 WHO member states investigated in a study focused on documented rates of surgery, Ethiopia had the lowest surgical volume rate at 148 per 100,000 (8). Part of this phenomenon may be explained by the limited resources available for surgical interventions in Ethiopia. Hospitals often lack reliable access to running water, medications, electricity, oxygen, and blood banking. The average hospital had a maximum of two operating rooms for the vast population served (6).

The number of surgeons and other health workers within local hospitals or clinics is limited as well. A retrospective survey study conducted to outline surgical activity in rural Ethiopia found 76 health workers able to provide surgical services to the 12.9 million people that made up the sample population (9).

Beyond the lack of hospital equipment and personnel, however, other factors impede the ability of patients to access surgical services. Community assessments have revealed that cultural, financial, and structural barriers impact the ability of patients to seek and access care (10). Many patient factors are barriers to obtaining care, such as fear of surgery, lack of time or monetary resources, lack of transportation, cultural beliefs surrounding surgery, health illiteracy and lack of social support systems. Structural barriers such as poor roads, distance to hospitals, lack of communication and difficulty navigating the healthcare and referral system also impede the ability of patients to access surgical care. Medical services and loss of wages may be prohibitively expensive for most patients. These populations also tend to be spread across rural areas in Ethiopia, and have difficulty reaching hospitals in larger cities (11).

Mid-level and rural healthcare providers have the unique position as both the gatekeeper and facilitator between patients and facilities capable of providing surgical care. Few studies, however, have examined the barriers perceived by providers in the process of obtaining surgical

care (12).

For the majority of Ethiopians, the nearest health care facility would be a town or city health center. Patients needing urgent medical attention may seek initial care at these health centers, after which they may be referred for appropriate higher level of care. According to the 2012 Ethiopian Standard Health Center Requirements (13), recommended practitioners at each health center include a minimum of two health officers, three midwives, five nurses and laboratory and pharmacy technicians. The guidelines also state each health center should have capacity to perform minor operations such as circumcision, lipoma excision and abscess drainage, and external immobilization of fractures.

*The SaLTS Program*

Contemporaneously with this study, the Ethiopian Federal Ministry of Health and international partner organizations began the “Saving Lives through Safer Surgery” (SaLTS) Initiative, and multi-pronged national surgical plan to improve access to and quality of surgical care throughout Ethiopia (14). This initiative not only better characterized resources and surgical volume at hospitals, but developed a nationwide plan to improve surgical leadership, infrastructure, data quality, human and materials resources. The SaLTS initiative does not specifically outline a plan for HCs in the surgical referral network, however SaLTS does prioritize access, quality and surgical volume as targets for the program (14).

As part of the SaLTS initiative to increase access to timely, safe, and affordable surgical care when needed in Ethiopia, health centers are an important piece in the referral network that can serve the role of decreasing burden on hospitals by managing minor conditions and efficiently referring patients to hospital when surgery is needed. However, in order to play a role in increasing surgical access and safety in Ethiopia, health centers must be consistently equipped with necessary material and human resources, and must have the training to confidently diagnose, triage and at times manage surgical conditions.

As investment in surgical services is expanding in Ethiopia, it is important to understand the material and human capabilities of the health centers which are often responsible for the diagnosis and referral of surgical conditions. Additionally, with the possible expansion of surgical services to more rural and primary healthcare facilities in Ethiopia, it is important to understand the current available human and material resources, as well as patient mix presenting to those facilities.

The “three delays” model of accessing care has often been used to described delays in care contributing to maternal mortality at several timepoints, the first being decision to seek healthcare, the second reaching the appropriate medical facility, and the third receiving timely, appropriate intervention after reaching the right facility (15). This model is also applicable to emergency surgical and trauma care, when timely access to higher-level care is often critical for patient survival (16). Barriers faced by patients and their families can contribute to care-seeking behaviors in the first delay; lack of resources or training at intermediate facilities such as HCs can lead to “third delays” in care.

The aim of this study was to describe material and human resources available at health centers in the South Wollo Zone, Ethiopia, and assess barriers experienced by mid-level providers and patients at health centers in obtaining surgical care.



## Methods

### *Study Setting*

Ethiopia is a low-income country in Eastern Sub-Saharan Africa with a rapidly growing population. With a population of 102 million in 2016, life expectancy was estimated at 65.5 years (17). Maternal mortality is moderate at 353/100,000 live births, and under-5 mortality rate is rapidly falling, estimated at 61/100,000 in 2015. Surgical diseases, however, are now a major source of mortality, with non-communicable diseases now making up a majority of causes of death, particularly cardiovascular disease, malignant neoplasms and digestive diseases. It was reported that only 55% of healthcare facilities could provide basic obstetric care and 52% could provide basic surgical care in 2015.

The ratio of healthcare providers and facilities per population is among the lowest in the world, with 149 total hospitals in country, 1343 health centers, and 3305 health posts in 2008. This study was conducted in the Amhara region, which, at last regional census, was estimated to have 17.2 million inhabitants in 2007 with 7406 total health care providers, 2152 physicians (2.7/100,000 population). In the most recent available provider densities in 2007, an estimated 140 surgeons were practicing in the country, with estimates for 820 by 2015 (17).

Dessie Referral Hospital is the only referral hospital in South Wollo Zone within the Amhara Region (Figure 1) and serves an estimated catchment area of 7 million, with general surgeons, orthopedic surgeons, and obstetricians on staff. While intensive/critical care is limited, and subspecialties such as oncologic care are not available, all Bellwether procedures can be performed at this hospital.

### *Study Design & Study Population*

This study was a cross-sectional survey of eight woreda (district) level HCs in the South Wollo Zone of Ethiopia. Survey was designed by the study personnel using review of prior similar studies on barriers to accessing surgery and HC assessment tools (10)(18)(19)(20)(21). Surveys were distributed to all HCs in the South Wollo Zone for completion. The survey was reviewed by local colleagues at the main study site at Dessie Referral Hospital in South Wollo Zone and feedback incorporated into the final tool. The survey tool was piloted with one health center in Dessie town with a surgeon and HC nurse and all questions were determined to be understandable and possible to answer by the local study personnel. Although Dessie Hospital is considered a "referral hospital" by the Ethiopian healthcare network, according to international standards it meets criteria as a primary hospital, with inpatient and general surgical services available, but lacking subspecialty or ICU services (22).

### *Patient and Public Involvement statement*

Patients and the public were not involved in the study design or survey tool design; however local health care providers gave input on survey questions during study design. Findings from this study will be made available at the referral hospital for public viewing and dissemination.

### *Participants*

Surveys were distributed at a regional health bureau meeting. Study participants who completed the survey were nurses or health officers (diploma nurses with additional training) employed at the respective HCs. Orientation and training on survey completion were provided by an

Ethiopian nurse who was engaged in the project. This trainer and the Principal Investigator were available to answer questions for participants throughout the study period by phone regarding survey completion. The survey was distributed to HC nurses or health officers at all 21 woredas in South Wollo. Participation was voluntary and participants received a small monetary compensation when the survey was returned at the end of the study period.

*Variables*

Study participants completed survey questions regarding health center staffing, diagnostic and treatment resources available at their health center, as well as provider comfort level making common surgical diagnoses in their setting. They also recorded data on all patients presenting to their respective health centers with surgical diagnoses as stipulated by the study definitions over a 30-day period. Information about these patients including age, gender, diagnosis, whether or not a referral was made at the clinic visit, and barriers expressed or perceived that prevented patients from receiving surgical care were recorded.

*Data Collection*

Participants collected patient data over a 30-day period between November 2014 and January 2015; health centers varied in the specific dates of their data collection. Surveys were returned to the study PI in person or via post and compensation was provided upon return of completed survey. All participating HCs were in a geographic network making surgical referrals to a single referral hospital in Dessie, Ethiopia. In an effort to avoid selection bias surveys were distributed to all HCs in the Zone and orientation to the survey was conducted with staff from all HCs. Study population included all HCs in South Wollo Zone that were expected to make referrals to a single hospital in the Zonal capital.

*Quantitative Variables*

Quantitative data such as HC catchment population, staffing, patient age and referral status were analyzed with frequencies and standard deviations. Descriptive statistics were used for all variables and no multivariate analysis or associations were calculated.

*Data Analysis & Management*

Data were returned via paper forms and entered into RedCap by study personnel. Data were extracted to Microsoft Excel and kept confidential on encrypted computer by study personnel. Descriptive statistics were used to analyze HC providers, resources, diagnostic challenges, patient diagnoses and barriers to care. Data analysis was conducted using Excel and Stata/SE Version 15.1.

*Data Sharing*

No additional data available.

*Ethical Considerations*

IRB approval was obtained from Boston University (Boston, MA, USA) and Wollo University (Dessie, Ethiopia) prior to survey distribution.

## Results:

Eight HCs in South Wollo Zone returned surveys, representing 38% of the total zonal HCs (n=21). Health centers were distributed geographically throughout the zone with a mean distance of 93.9km  $\pm$  59.3km (58.3mi  $\pm$  36.8mi) from the Dessie Referral Hospital (Figure 1). Each HC served a population of approximately 36,000 in their catchment area. Given road quality and typical transport speeds it would take an estimate of 2-4 hours to reach the Referral Hospital from the average participating HC.

### *Providers:*

An average of 18 ( $\pm$ 4) clinical service providers (physicians, health officers, or nurses) were employed at each health center and saw an average of 1212 (range 278 - 4118) patients at each facility in the 30-day study period (Table 1). On average 25 (2.1%) of these patients had a surgical complaint. Only one HC was staffed by physicians and none had anesthesia providers. The majority of providers were health officers (20.7%), nurses (62.2%), and midwives (13.7%). Half of the health centers had lab and pharmacy technicians.

### *Resources:*

All HCs had access to electricity, pain medications, antibiotics, and antipyretics (Figure 2). All but one center had minor suturing materials. Half of centers reported they always had access to NG or rectal tubes. Only two centers always had clean water, while the other 6 reported they sometimes had clean water. Only one reported access to blood for transfusion, and no health centers had access to any form of imaging (ultrasound, radiograph or CT Scan) or paracentesis kits.

### *Diagnostic Capabilities:*

Providers reported the difficulty of diagnosing common illnesses with their available resources (Figure 3). According to HC provider ratings, the most difficult diagnoses were cholecystitis and other gallstone disease, intraabdominal tumors, perforated ulcer and kidney stones. Most often lack of diagnostic aids was cited as the reason for difficulty. The conditions most easily diagnosed were traumatic injury, appendicitis, a need for cesarean section, hernia, skin/soft tissue tumors, and peptic ulcer disease (Table 2). Even for the diagnoses that were rated as "not difficult at all", however, lack of diagnostic aids and lack of training were still cited as reasons for difficulty.

### *Surgical Patients:*

A total of 168 patients were seen with surgical complaints over the 30-day study period at the eight HCs (Table 3). Patient average age was 34, ranging 1 – 80 years and 63.6% were male. Ninety-seven patients (58%) were referred to the hospital for surgery; of the 71 patients (42%) not referred for surgery the majority of them (87%) could be treated in clinic. The other 9 (12.6%) refused referral. Most surgical patients seen in HCs had traumatic injuries or burns (42%) (Figure 4). Other common diagnoses seen in the HCs were need for cesarean section (9%), appendicitis (5%), benign prostatic hyperplasia (4%), peptic ulcer disease (6%) and bowel obstruction (5%). Less common diagnoses were kidney stones, soft tissue infections, goiters, hemorrhoids, requests for circumcision, and soft tissue tumors.

### *Barriers to Receiving Surgery:*

Of those who received a referral for surgery (97), 35 did not receive surgery, and of those thirty-two patients reported specific barriers to obtaining surgery to HC providers (33%), representing a third delay in accessing surgical care (Table 4). The most common specific barriers encountered were the patient not being decision maker to have surgery (7), lack of family or

social support (6), and inability to afford hospital fees (5). Less commonly the patient expressed fear of surgery (4), had no one to accompany them to the hospital (4) or lacked information about surgery (2). Rarely reported was lack of time, fear of lost wages, poor roads to hospital or lack of understanding disease severity. Most patients traveled by ambulance (46.4%) or car (39.2%) to the hospital. Few were transported by animal (4.1%).

**Discussion:**

It is well established that surgical care throughout Ethiopia is critically limited. However, specific barriers to care and provider and facility needs have not been determined, and the surgical disease burden has not been assessed. This research represents an attempt to further elucidate the barriers to surgical care faced by Ethiopian patients.

In Ethiopia, health centers serve as an important gateway for triaging and referring patients needing essential surgery to higher-level care. The majority of patients requiring surgical care in Ethiopia, particularly in rural settings, can access surgical services by first seeking care at a nearby health center. However, a number of factors related to patients, healthcare providers, and material resources at HCs can contribute to the “three delays” of accessing appropriate surgical care.

*The first delay – patient barriers to care*

Barriers experienced by patients can contribute to the first delay; in our study this delay was overcome as all patients presented to HCs, but patient barriers related to decision-making capability and financial resources may still contribute to the “first delay” in the decision to seek definitive surgical care at the referral hospital.

Many of the patients seen at health centers in our study were perceived to require surgery by the clinical judgement of the HC providers, but ultimately not referred to a surgeon for their diagnoses. While at times minor injuries could be treated in the HC, about half of patients referred to the zonal hospital for surgery did not ultimately go to the hospital to pursue surgical care. In order to meet Ethiopian MOH and WHO targets for essential surgical care, patients should be triaged, appropriately diagnosed, and able to reach Dessie Referral Hospital within two hours to receive Bellwether or other emergency and essential surgical procedures (23). Limitations in diagnostic capabilities, provider training, and patient barriers can all contribute to delays in receiving appropriate care (16)(15), which in South Wollo Zone would require transport to the referral hospital for most surgical disease.

The two most common reasons cited for not being referred was that the patient was not the primary decision maker or lacked family support. This underscores the importance of the family in medical decision-making that must be considered when designing interventions to improve health care access. What is lacking from these data is an understanding of why a family might withhold support for seeking surgical care. The next most commonly cited reason for refusing a referral was inability to afford the surgery. Whether a lack of familial support for surgery also stems from financial concerns, or if there are other factors weighing in on a family’s decision needs to be investigated further. Of note, male patients were far more likely to arrive at the health centers than were female patients (92 male patients, 54 female), however men were more likely to be injured as well. These barriers of inadequate social or family support (24), and financial concerns are echoed in the worldwide literature (25). However the barrier of being considered the “decision-maker” for surgery was unique to this context and may be important to explore community and family dynamics to further understand.



One future area for research is further elucidating the reasons behind the lack of family support for patients citing this barrier as a reason for not seeking surgical care. Should this stem from monetary reasons, financial interventions may be additionally required. Future research should also focus on the effects of the SaLTS program on enabling surgical patients to receive appropriate care, and on the barrier variability across different areas in Ethiopia. Additionally, the sociocultural barriers such as patient autonomy, family and social support should be further explored to better understand healthcare seeking behavior of rural Ethiopian populations.

### *The “third delay” – accessing appropriate surgical care*

Importantly, the data collected suggest severe limitations with performing even minor procedures at the health centers. While all centers reported they always had access to electricity, pain medication, antibiotics, and antipyretics, only some had consistent access to clean water, nasogastric tubes, rectal tubes, and none had available imaging equipment. Only one center reported having access to blood. According to international standards, these facilities aim to provide “Health Center” level care, with access to minor surgery, basic medical care, family planning and safe childbirth services (22). With inconsistent availability of clean water, rectal tubes, nasogastric tubes and suturing kits, patients who are able to reach the health center still may not receive needed care.

For many patients, the only way to receive even minor surgery or emergency procedures may be to have the means and ability to travel to a hospital for care. Some studies have supported the decentralization of surgical care to rural areas by task-shifting to non-physician surgical providers or surgical “camps” to provide intermittent services (26). However given the resource limitations at primary hospitals in Ethiopia (27), this solution may not be reasonable in this setting. Additionally, the Ethiopian MOH has continued to build new hospitals and train non-physician surgical providers (IESOs) in the interim, therefore some of these delays may be expected to improve, although these mid-level providers staff hospitals and usually not HCs.

Most or all centers reported difficulty diagnosing perforated ulcer, gallstones, cholecystitis, and renal stones, all of which are diagnoses typically confirmed through the very imaging modalities these centers lack. Unsurprisingly, health care workers identified a lack of diagnostic aids as the number one barrier to making definitive diagnoses in their centers. None of the eight centers ever had access to radiographs or ultrasound. The general pattern of resource availability demonstrates that health centers are better equipped for managing infectious and communicable diseases than they are for making diagnoses that require imaging equipment. Difficulties in diagnoses contribute to the “third” delay in care, that is a delay in accessing appropriate care (15)(16). While this study was unable to follow patients to their encounters at the surgical referral hospital, further study may be useful to determine the impact of such delays on patient outcomes.

Studies have demonstrated that ultrasound can be effectively introduced into such limited-resource settings with success (28). This presents a possible mode of intervention to improve diagnosis and referral decisions in South Wollo health centers. Basic ultrasonography can potentially aid in diagnosis and management of soft tissue infections, intraabdominal pathologies, bleeding in trauma and obstetric complications. While definitive management for such conditions would not be expected at the health center level, ultrasound may be a helpful aid in increasing efficiency of diagnosis and triage of patients who need hospital-level care. Of note, however, introducing ultrasound equipment to health care centers will require more than the purchase of ultrasound machines. Dedicated intensive ultrasound training would likely need to take place for this intervention to be successful in improving health center diagnostics. While

this is one possible avenue reported by providers at health centers for further training, emphasis should be placed on provision of basic resources, such as clean water, suturing materials, NG and rectal tubes for urgent decompression, and the like, prior to a large-scale investment in resources like ultrasound or radiograph that require additional training and sometimes personnel for use and interpretation.

*Framing the study within the context of SaLTS*

Ethiopia is currently implementing the SaLTS program, a national surgical plan to improve access to and quality of surgery nationwide. This plan, which encompasses human resource and infrastructure development, data quality, service quality, and monitoring and evaluation will be crucial for closing gaps in access to surgical care (14). As part of the SaLTS initiative, an evaluation of surgical hospitals in two regions, one of which encompasses this study's health centers, revealed that access to surgical care may be limited by difficult roads and delays in transport, as well as limitations all five basic domains of surgical care (service delivery, infrastructure, workforce, information management, financing) (27).

Suboptimal road conditions and hospital resource limitations may be time-consuming and costly to address, however the patient barriers, healthcare provider resource and training constraints may also contribute to delays and offer important context to the ongoing implementation of the SaLTS program, particularly as it relates to Health Centers.

**Limitations**

This study had several limitations; data collection time periods varied across sites, and different farming or weather patterns may have affected the number of patients presenting to health centers throughout the year as well as their presenting diagnoses, such as work-related injuries or road traffic accidents. The survey completion rate was low, with 40% of health centers in the zone completing surveys, therefore the data may not be representative of the entire South Wollo zone. Also, small numbers of patients reported which barriers were affecting their decision or ability to be referred for surgery and, while descriptive, were not reported in large enough numbers to draw larger conclusions about the population.

Additionally, there are wide variations in culture and economic prosperity between regions in Ethiopia, which may affect healthcare seeking behavior and perceived barriers to care. This study was conducted in the South Wollo Zone of Amhara region, Ethiopia, and therefore findings may not necessarily be applicable to other regions in Ethiopia.

**Conclusion**

This study represents a contribution to the literature as the only survey of health center resources and diagnostic capabilities in Ethiopia, and of rural populations that may often present with surgical complaints but fail to reach a hospital with surgical capacity due to sociocultural or financial reasons. This study must be taken in context with the ongoing Ethiopian National Surgical Plan, which clearly sets the stage for any evaluation and change in terms of surgical services in Ethiopia, but demonstrates that health centers may lack essential resources and training needed to treat and triage surgical patients. Community and patient barriers must also be mitigated as much as possible to ensure surgery is acceptable and affordable when needed.

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## Contributors

NS conceived and designed the study and survey tool with input from GK and MW. NS, SC, AS, RC and MW participated in data collection and interpretation of data. NS, SC and MC conducted data analysis. NS and SC drafted the manuscript. SC, AS, MC, GK and MW critically revised the manuscript and approved final version of the paper.

## Competing Interest Statement

None of the authors have any competing interests to declare.

Figure 1: Amhara Region and South Wollo Zone Map with Study Site Locations

Figure 2: Availability of Resources at Health Centers

Figure 3: Difficulty in Making Diagnoses

Figure 4: South Wollo Zone Health Centers: Surgical Patient Diagnoses



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**Table 1: Baseline Characteristics of Health Centers (N=8)**

<b>Baseline Characteristics</b>	<b>N (%)</b>
Distance from Referral Hospital km (mean $\pm$ SD)	93.9 km $\pm$ 59.3 km
Woreda (Administrative Zone) Population (mean $\pm$ SD)	36,300 $\pm$ 19859
Total patients seen in 30-days (mean $\pm$ SD)	1212 $\pm$ 1345
Surgical patients seen in 30-days (mean $\pm$ SD)	25 $\pm$ 7.5
Number of healthcare providers (mean $\pm$ SD)	18 $\pm$ 4
<b>Frequency of providers at all health centers</b>	
Physicians	
None	6
1-5	0
5-10	1
>10	0
Health officers	
1-5	6
5-10	1
>10	1
Nurses & Nursing Assistants	
1-5	---
5-10	5
>10	3
Anesthetists	
None	8
Midwives	
1-5	8
Lab Technician	
None	4
1-5	4
Pharmacy Technician	
None	4
1-5	4

**Table 2: Reasons provided by Health Center Staff for difficulty in making Diagnoses (N=8)**

Diagnosis	Reason for difficulty		
	Lack of Diagnostic Aids	Lack of Training	Atypical Presentation
Traumatic injury	4	----	----
Incarcerated hernia	2	1	1
Appendicitis	2	----	1
Gallbladder Disease	6	----	----
Bowel Obstruction	4	1	----
Indication for cesarean section	1	2	----
Perforated ulcer	5	----	----
Ruptured ectopic pregnancy	5	----	----
Hernia	2	----	2
Renal Stones	4	1	
Intraabdominal tumors	----	----	----
Peptic Ulcer Disease	4	----	----
Skin/soft tissue tumors	----	3	----

**Table 3: Baseline Characteristics of Surgical Patients at district health centers (N= 168)**

Baseline Characteristics	N (%)
Age (mean ± SD)	34.2 ± 16.8
Sex	
Male	107 (63.6%)
Female	61 (36.3%)
Referral for Surgery	
Yes	97 (57.7%)
No	71 (42.2%)
Reason for lack of referral (n=71)	
Minor injury treated in clinic	62 (87.3%)
Refused referral	9 (12.7%)
Referred patients receiving surgery (N=97)	
Yes	49 (50.5%)
No	35 (36.1%)
Unknown	13 (13.4%)
Transportation to Hospital	
Ambulance	45 (46.4%)
Car	38 (39.2%)
Animal	4 (4.1%)
Not Reported	10 (10.3%)

**Table 4: Barriers to receiving surgery (N= 35)**

<b>Patient factors</b>			
Patient is not the decision maker to have surgery	7	20.0%	
Lack of family or social support	6	17.1%	
No one to accompany patient to surgery	4	11.4%	
Fear of surgery, anesthesia or bad outcomes	4	11.4%	
Lack of information about disease, process of surgery, or post-op care	2	5.7%	
Lack of time	1	2.9%	
Patient does not understand severity of condition	1	2.9%	
<b>Financial Factors</b>			
Patient cannot afford- hospital fees, transport,	5	14.3%	
Patient cannot afford- to lose wages during surgery/recovery	1	2.9%	
<b>Structural Factors</b>			
Poor roads	1	2.9%	
None Reported	3	8.6%	



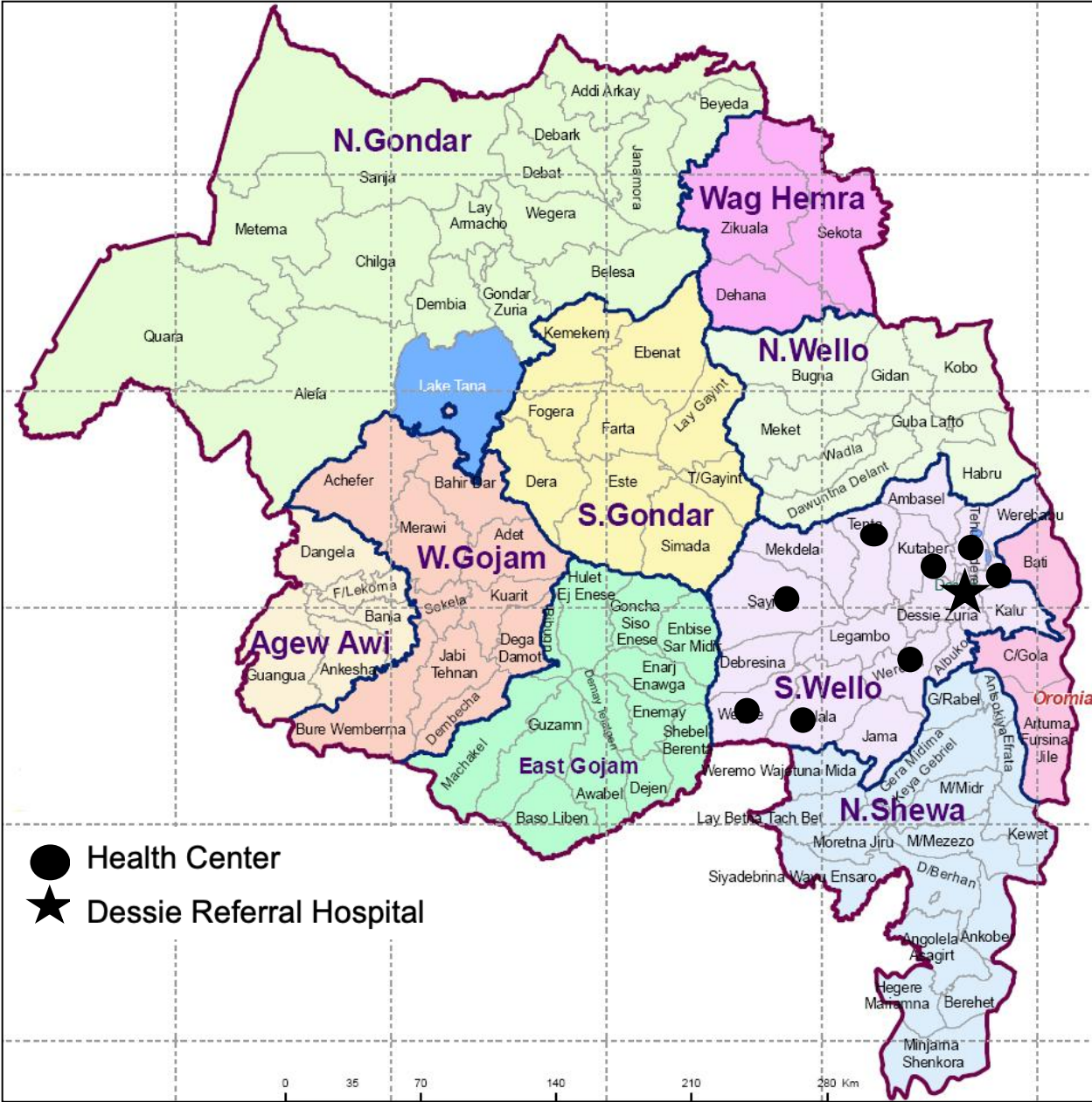
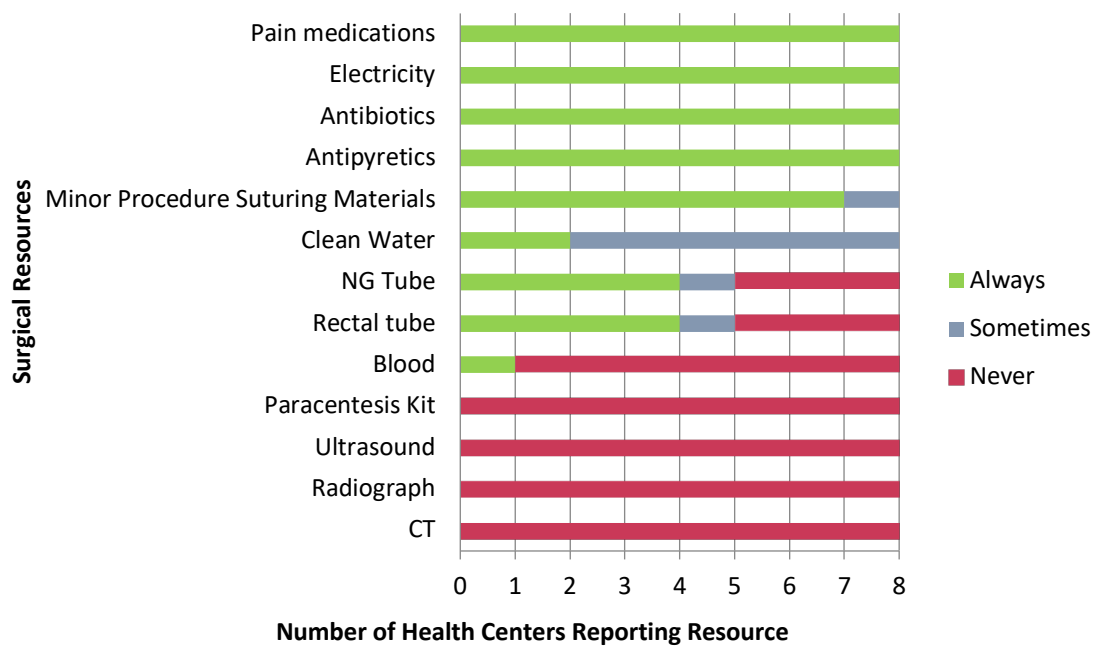


Figure 1: Amhara Region and South Wollo Zone Map with Study Site Locations



**Figure 2. Availability of Resources at Health Centers**

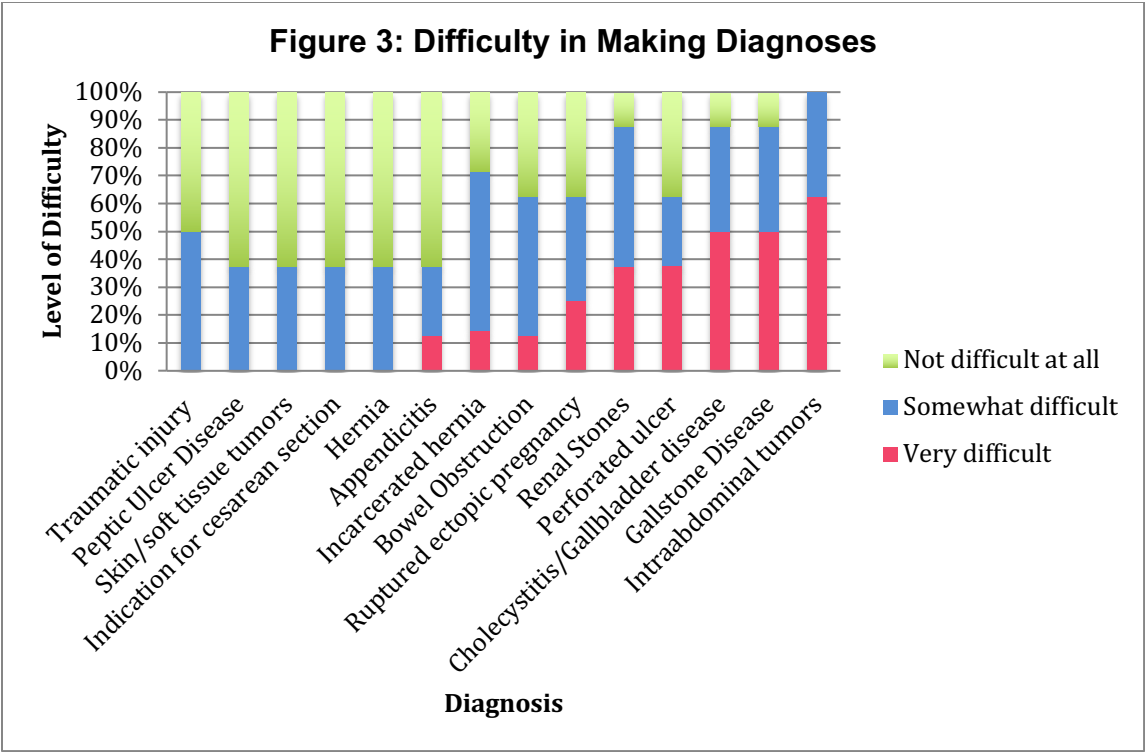
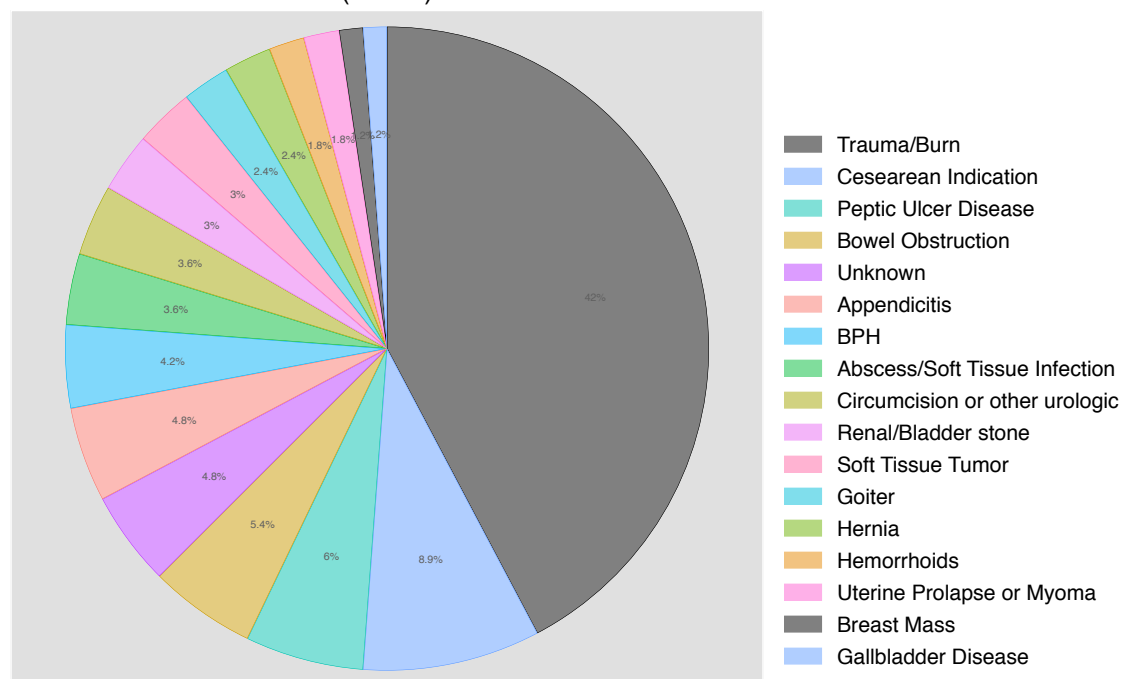


Figure 4:  
South Wollo Zone Health Centers: Surgical Patient Diagnoses  
(n=168)



STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

Page	Item No	Recommendation
1,2 Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
<b>4 Introduction</b>		
4 Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
5 Objectives	3	State specific objectives, including any prespecified hypotheses
<b>Methods</b>		
5 Study design	4	Present key elements of study design early in the paper
5 Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
5 Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (b) For matched studies, give matching criteria and number of exposed and unexposed
6 Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
6 Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
6 Bias	9	Describe any efforts to address potential sources of bias
6 Study size	10	Explain how the study size was arrived at
6 Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
6 Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) If applicable, explain how loss to follow-up was addressed (e) Describe any sensitivity analyses
<b>Results</b>		
7 Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
7 Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Summarise follow-up time (eg, average and total amount)
7 Outcome data	15*	Report numbers of outcome events or summary measures over time
N/A Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period

N/A Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
<b>Discussion</b>		
8 Key results	18	Summarise key results with reference to study objectives
9 Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
9 Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
9 Generalisability	21	Discuss the generalisability (external validity) of the study results
<b>Other information</b>		
10 Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.