

Deaths from surgical conditions in malawi A randomised cross-sectional nationwide household survey

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Research article

Keywords: Surgical, deaths, national survey, SOSAS

Posted Date: December 3rd, 2019

DOI: <https://doi.org/10.21203/rs.2.11572/v3>

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Version of Record: A version of this preprint was published at BMC Public Health on September 25th, 2020. See the published version at <https://doi.org/10.1186/s12889-020-09575-8>.

Abstract

Background The prevalence of untreated surgical conditions in Malawi has been estimated at 35% with 24% of the deaths associated with untreated surgical conditions. In SSA, the primary emphasis for health research has been on communicable diseases, and relatively little is known about deaths from surgical conditions in most middle- to low-, income African countries, including Malawi. This study aimed to address this knowledge gap by quantifying and describing the deaths from surgical conditions in Malawi.

Methods To access the deaths associated with surgical conditions in Malawi, a randomised multi-stage cross-sectional national household survey was carried out using the Surgeons Overseas Assessment of Surgical Need (SOSAS) tool. Randomisation was done on 48 233 settlements, using 50 villages from each district as data collection sites. Two to four household were randomly selected from each village. Two members of each selected household were interviewed. 1487 households were involved in the survey. Data collection was done using an electronic questionnaire.

Results The total number of reported deaths from all causes was 616 in the 1479 households, ranging from 0 to 9 dead household members. Further data related to the deaths were available for 558 persons, with 294 (52.7%) males and 259 (46.4%) females. A total of 13 women died during pregnancy (5% of deceased women). Non-surgical conditions accounted for 408 (73.5%) of all the total deaths. Symptoms such as body swelling, abdominal distension and injuries were among the common associations of deaths: (6.0%, 5.3% and 4.6%). Almost half of the deaths occurred at home (234 persons - 41.9%) while 288 (51.6%) died at a health facility. Thirty persons died on their way to a health facility. Seventy-two persons (12.9%) who died had sought care from a traditional herbalist prior to attending a health facility.

Conclusion In Malawi, body swelling, abdominal distension and injuries were the main conditions reported to be related to surgical causes of death. These occurred while the patients were either waiting at home or at health centre. Some patients initially consult a traditional herbalist prior to seeking modern health care. This delayed the possibility of timely surgical intervention.

Background

Surgically treatable diseases are a major contributor to the global burden of surgical pathology, and it is estimated that 11% - 15% of the global burden of surgical conditions measured as disability-adjusted life years (DALYs) could be treated and corrected surgically worldwide [1, 2]. In low and middle-income countries (LMICs), surgery may be looked at as the neglected stepchild of global health. In LMICs, there are few surgical care providers and there is low priority given to surgical conditions [2]. The surgical need assessment in these countries has shown that injuries, malignancies, congenital anomalies, complications of pregnancy and cataracts are the most predominant conditions [1, 3].

Over 100 million people sustain traumatic injuries globally each year. Every year more than 5 million people die from injuries reflecting more deaths than from HIV, malaria, and tuberculosis combined. Almost 90 % of these deaths take place in low- and middle-income countries (LMICs) [4].

There is increasing knowledge that deaths and morbidity from surgically related diseases in LMICs might be reduced by scaling up basic, life-saving surgical care [5, 6]. Reducing deaths from surgical conditions, including deaths from acute abdominal conditions, requires knowledge of both where deaths occur, and what barriers there are that affect access to surgical care are [7, 8]. Surgical conditions are responsible for avoidable cause of premature death in LMICs, but receive little attention as a priority in public health care [9]. It has been estimated that untreated surgical conditions contribute to 20% of the deaths affecting young adults and globally about 10% of all deaths [4]. Surgical diseases account for up to 15% of total disability-adjusted life years (DALYs) lost globally. This might be estimated to 38 DALYs lost per 1 000 people [4]. Shrimpe et al. estimated that 31.3% of surgical deaths globally were related to surgical conditions, and 25.1 % DALYs were lost to be due to surgical conditions [10]. In Malawi, we have previously found the prevalence of conditions needing surgical consultation or treatment to be 35 % of the general population [11], and transportation as a barrier to timely presentation for surgical health care [12]. When they are left undiagnosed and untreated, the acute and chronic surgical diseases correctable by surgical consultation or operative intervention provides a substantial social-economic toll on individuals and communities [13].

The aim of this study therefore, was to outline the causes and magnitude of death from surgical conditions in Malawi households by using enhanced verbal autopsy methods.

Methods

The method used in this study is very similar to two other publications which had the same data collectors, a broad questionnaire with different domains and a pool of data that was collected at the same time. Analysis of relevant specific data was extracted based on the required specific question and aims of the different study topics from this data base [11, 12].

Setting

In Malawi the estimated population is 18.4 million (2018 Malawi population and housing census) http://www.nsomalawi.mw/index.php?option=com_content&view=article&id=226&Itemid=6. According to the World Bank Group database of 2016, the GDP per capita was USD 300 in 2016. Malawi has 3 geographic regions; Northern, Central and Southern, with the Central and Southern regions being more densely populated with 6.4 and 6.8 million people respectively. Malawi has 28 administrative districts with a total of 48 233 registered settlements (2008 Malawi population and housing census). The majority of these settlements are located in the rural areas. Forty percent and 18% of the population depend on subsistence farming and small-scale businesses respectively [11].

Study design

This study was a cross-sectional, nation-wide survey, with systematic sampling of participants at the household level. This method was chosen since there are no public records or registers with information about diseases, and surgical condition related deaths at a national level in the Malawi population [11, 12].

The sample size of the households needed for this prevalence study was estimated to be 1487 persons, based on a pilot study which was carried out in rural areas of the capital city, Lilongwe, in 2016 [11, 12]. The sample size of individuals was estimated to be 2994 (95% CI) with a design effect of 1.5 at 25 % prevalence of unmet surgical needs in reference to the prior LMIC region reports [11, 12]. We planned to perform the sampling in all 28 districts.

The National Statistics Office provided a list of enumeration areas from the Malawi Census Board for the 2008 national census records. There were 48 233 recorded settlements identified as potential enumeration areas. Fifty-five settlements were randomly selected using a computer generated randomisation, choosing settlements from each district. Two or four households were systematically selected in each settlement depending on its size [11, 12]. Two households were selected in a settlement with less than 10 households, whereas four households were selected in a larger settlement. The systematic household selection was based on spinning a bottle on the floor and choosing the third or fourth household in the bottle top direction based on size of the settlement. Subsequently this process was repeated after completing the household interview to select a new household for the next interview within the settlement [11, 12]. The third household was picked in smaller settlements while the fifth was selected in larger settlements, then repeating the process for the next household. Two household members were selected and interviewed per household, by first interviewing the head of the household, and then selecting the next member at random, using computer generated random numbers assigned to members of the household. If a child (age below 5 years) was randomly selected, then the guardian of the child was interviewed, and an assent form was used to obtain permission [11, 12].

We visited 1486 households and interviewed 2963 people in 27 of the 28 districts in Malawi from 1 July to 31 August 2016. 2 household heads refused to participate, and data from 5 households was incomplete and had to be excluded. This left data from 1479 households and 2958 interviewed people included for analysis.

Survey instrument

Surgeons OverSeas (SOS) developed the Surgeons OverSeas Assessment of Surgical need (SOSAS). The Surgeons Overseas Assessment of Surgical Need tool (SOSAS) [11, 12] was used to collect data. This is a questionnaire based tool with three components. The first component outlines the general household information i.e. number of persons per household, location of household, gender of information provider and age distribution of interviewees, and area type; urban, rural or slum. The second and third parts focus on the occurrence of deaths in the household the past 12 months, the type of medical condition household members thought was the cause of death; including maternal and surgical related conditions; and type of intervention including surgical consultations; major surgery or minor surgery, and traditional herbalist consultation and treatment; and location of the death occurrence. These were based on the household level, as reported by the two interviewees [11, 12].

The questionnaire was installed on 17 tablet computers (iPad 2, Apple inc.), using File Maker Pro 12.0v3 (File maker inc., USA) software for data collection in English.

Data collection

Collection of data was done by trained medical students at the end of their third year of academic training. They underwent a 5-day training session on how to use the tool for data collection (Questionnaire loaded on a computer tablet). There was a pilot study carried out in Lilongwe prior to rolling out the main study in April 2016, to test the study tool and estimate the sample size [11, 12]. Training was conducted prior to the pilot study and a refresher session after the pilot to prepare for the national survey. There were 32 trained data collectors, 14 females and 18 males. The period for data collection was from 1st July to 30th August 2016, during the main holiday for the medical students who did the data collection [11, 12]. Data collection was split into 2 phases. The first phase involved half of the data collectors covering all identified enumeration sites in the northern part of the Central region and the whole of Northern region. The second part involved coverage of the rest of the Central region and the Southern region of the country. In some of the enumeration areas people belonged to smaller population groups with unique languages or dialects. In these cases local translators were hired to secure good communication between the interviewer and the household member [11, 12].

Each data collector visited approximately 4 households per day, therefore 60 – 64 households were interviewed every day. Interviews were done privately in the interviewees homes. Data was exported directly into an Excel (Microsoft 2010) data-base on a computer at the end of each day for data security and to spot check data quality [11, 12].

Data analysis

Data analysis was done by using SPSS version 24. Descriptive statistics were calculated.

Results

Total number of deaths due to all causes reported in 1479 households included over the last 12 months preceding the interview was 616, of whom we had further data for 558, with missing data for 58 entries. Most locations were rural (90.1%). The gender distribution was slightly weighted towards men (52.7%). Children below 18 years represented 45.9% of the recorded deaths, and 33.9% were children below the age of five (Table 1).

The median household size was six persons, and the households had a median age of 22 (range 0 – 112).

Out of all recorded deaths, a total of 13 women died during pregnancy due to bleeding from the childbirth process. They were all in the age group 18 – 49 years and accounted for 7.3 % of deaths in this age group, and 2.3% of all surgical deaths (Table 2).

Prior to dying, 456 persons (81.7%) sought health care, while 99 persons (17.7%) did not seek health care. 17 (3.0%) of those who presented at a health facility were treated with major surgery, and 15 (2.7%) with

a minor surgical intervention.

Household heads reported that 418 (74.9%) of those who died sought health care prior to their death, either from a health facility (62%) or a traditional medicine provider (12.9%), respectively, for consultation and traditional medicine treatment.

Out of the total deaths analysed (555 persons), 408 were non-surgical conditions or other medical conditions. Conditions associated with surgical care were responsible for 147 (26%) of the total deaths. Surgical conditions described as body swelling or body mass 6.3%, injury 5.6%, and abdominal distension 4.9% were the most commonly associated with deaths (Table 2).

Thirty-one persons (5.6 %) died from some type of injury and of these 16 were related to traffic accidents, mostly were due to car or bus accident (40%). Most deaths (46.7%) occurred in the age group 18-49 years old (Table 3).

Most deaths occurred at a health facility (51.5%); 41.9 deaths occurred at home. Most deaths were in the under-five age group, 33.8%. There were 30 (5.4%) people who died while on the way to a health facility (Table 4).

For those who attended a health care facility, 418 persons (74.9%) did not receive surgical care, 17 (3%) had a major surgical procedure and 15 (2.7%) were treated by a minor surgical procedure. There was no reported data for 108 persons.

Household heads reported that they did not have sufficient money to cover transport to attend health care for 12 persons. They reported also that 52 persons died while waiting for transport to arrive, and three persons died because they did not have enough money to attend to a health care centre. They reported that no health care facility was available for 29 persons, while four were afraid of attending a health care facility, and had made no attempt to be treated there. For 414 deaths, the household heads reported that they had no reason to attend a health facility. There was missing data for 44 persons

Discussion

The main findings in this study demonstrate that surgical conditions significantly affect mortality in Malawi (26% of all deaths), the majority were below 18 years old and the dominant causes of death were swelling of the abdomen and injuries.

In this survey we found that of the people dying, 33.9% were children under the age of five years. The most common surgical cause as seen in this study was body swelling or mass (6.3%), followed by injury or trauma (5.6%) and abdominal distention (4.9%). Bowel obstruction is the commonest cause of abdominal emergencies in Malawi, and most lay people report this as abdominal distention. This is in line with findings from a previous study in Malawi, showing that overall 44% of patients had unspecified cause of intestinal obstruction, and in children congenital surgical condition e.g. Hirschsprung's disease and anorectal malformations accounted for 29% and 18.5% of intestinal obstruction respectively [14].

Similarly, mortality rates from a Kenyan study [15] show the highest mortality rates among neonates and infants. The occurrence of acute abdomen was the cause of death among 7%, a figure that is comparable to the 4.6% of abdominal distension found in our present study. The Kenyan study was based on information from households, like our study. However, they used other categories for the reasons for death and had a longer observation period, and the results cannot be compared on all aspects [15].

Absence of appropriate surgical care in Low and middle-income countries results in many unnecessary deaths from curable surgical diseases and contribute to significant disability, ultimately compromising the quality of life in these regions.

Key barriers to accessing surgical services are distance, poor roads, and lack of suitable transport [16]. Most people present late to health facility due to different transportation barriers delaying them to reach the health facility for timely intervention [12]. Therefore, the complications of bowel perforation, gangrene, dehydration and respiratory compromise lead to high morbidity and mortality rates. A study in East Africa reported morbidity rate of 24% and mortality rate of 12.9% from abdominal surgical conditions due to bowel obstruction [17].

Another study in a paediatric population reported a mortality rate of 23.3% in neonates due to different causes of intestinal obstruction, of which most were congenital [18]. In our study there were 11 neonates that died from congenital surgical conditions. Intestinal obstruction in neonates constitutes a major portion of neonatal surgical problems due to congenital causes. This is associated with high mortality if not diagnosed promptly and treated adequately in time. The barriers to prompt surgical health care have led to delays and inefficient diagnostic and therapeutic interventions in low and middle-income countries like Malawi.

Also in this study it is demonstrated that 32.3% of the deaths from a surgical condition was in the middle age group (18 – 49 years). This age category is the one mostly linked to financial support within the family and community hence may be exposed to different hazardous environments leading to injury. In addition to traumatic injuries (5.6%) abdominal conditions and other swellings and masses, (4.9 % and 6.3 % respectively) have shown to be the leading causes of death.

Total number of injuries treated at a referral centre in Malawi showed an increase of 62% over 7 years from 2447 in 2009 to 3975 in 2015. These injuries showed a predominance in road traffic accidents that was high in pedestrians and cyclists [19], correlating with findings in our study on the high prevalence (5.3%) of injuries causing deaths, mostly from motor vehicle crash (40%).

Though 13 women died while they were pregnant, the specific cause of death was in most cases not documented. Death from child birth complications occurred in 12 women. This was due to excessive haemorrhage associated with child delivery, i.e. post-partum haemorrhage. This figure could reflect the true statistical finding of Maternal Mortality Ratio in Malawi estimated at 675 maternal deaths/100 000 live births during the period 2004 – 2010 [20]. MMR is the most common measure of maternal mortality

and is expressed as the number of maternal deaths/100 000 live-births, where a maternal death is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy. This figure is far from the Sustainable development goal 3.1, which states to reduce the maternal mortality to less than 70 per 100 000 live births (www.who.int/sdg/targets/en/).

Some deaths occurred while in transit to a health facility, while others happened at home (41.9%). Some health facilities are far away from the communities, and family members may not have enough financial resources to help with transportation to the hospital [14]. This further delayed presenting to the health facility leading to loss of life. Not all surgical conditions will need operative intervention, but even just consultation and non-operative management could help halt these deaths.

The strengths of the study are its size, covering the whole of Malawi, evenly distributed in the country and high response rate. Most importantly the interviewers were skilled and trained for the study. However, the interviewers did not know the households beforehand, and this may have reduced the information flow from the persons interviewed. Some persons do not like to tell about this type of sensitive topics to strangers. Another limitation of this study was that the information of the cause of death is uncertain, since in many cases, no clear diagnosis was set so data relied on the understanding of the informant. Also, the information might be hampered by recall bias from the past year.

Conclusion

In Malawi, body swelling, abdominal distension and injuries are the main conditions reported to be related to surgical causes of death - that occur while waiting at home or at health centre. This could be due to late presentation for health care. In addition some people initially consult the traditional herbalist prior to seeking modern health care, which may further delay the possibility of timely surgical intervention.

Abbreviations

CAM: Complementary and Alternative Medicine

CI: Confidence Interval

DALYs: Disability Adjusted Life Years

EHP: Essential Health Package

LIC: Low income countries

LMIC: Low and middle income countries

MMR: Maternal Mortality Ratio

NGO: Non-Government Organisation

NORAD: Norwegian Programme for Capacity Development in Higher Education and Research for Development

SOSAS: Surgeons Overseas Assessment of surgical need

SPSS: Statistical Package for Social Scientists

SSA: Sub – Saharan Africa

WHO: World Health Organisation

Declarations

Ethics approval and consent to participate

The research was approved by the College of Medicine Research Ethics Committee (P03/15/1696, and Norwegian Regional Research ethics committee (2016/1392/REK Vest). Consent (for the adults) and assent (for the minors) forms were designed and translated into the local languages. These were used to seek informed consent prior to conducting the interviews.

Consent to publish from interviewees

This was not applicable.

Availability of Data materials

The data sets used and analyses during the study are available from the corresponding author on reasonable request.

Funding

Permission to use the SOSAS tool was granted at no cost by the Surgeons Overseas group. The Norwegian Agency for Development Cooperation (NORAD) financed a “Norhed” programme supporting the training of surgeons and surgical research in Malawi. This programme provided a PhD grant to authors CGV and LNB, payed the costs for data collection exercise and financed the computer tablets for data collection. The computer tablets were donated to the Kamuzu Central Hospital Surgery Department for further surgical research at the end of the study. The Norhed programme also covered costs in relation to data collectors support for meals, transport costs and accommodation during the data collection period.

Competing interests

There are no competing interests available from all authors

Authors` contributions

CGV: project idea, planning implementation, data collection, first manuscript draft and revisions

SV: project idea and planning, supervision, data interpretation, manuscript revisions

NM: supervision, data interpretation, manuscript revisions

RG: supervision, data interpretation, manuscript revision

LNB: data collection, manuscript revisions

AV: project idea and planning, supervision, manuscript revisions, assisted with data analysis and interpretation. Corresponding author.

BEM: supervision, planning and manuscript revisions

Acknowledgements

The authors would like to thank the data collectors: Manduwa Saka, Wongani Mumba, Blessings Phakati, Lovemore Malunga, Peter Jere, Annie Chimaimba, Loviisa Mulanje, Samuel Mpinganjira, Mercy Josiah, Watipaso Mkhuta, Patricia Muwanya, Andrew Malanga, Henry Mwakalinga, Trasizio January, Dickson Hangiwa, Timothy Mutafya, Dan Msamanyada, Denis Chauma, Agatha Mlenga, Prince Goliati, Moses Msukuma, John Phalula. Without their hard and dedicated work over two months in 2016, this study would not have been possible.

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Tables

Table 1: Household deaths in preceding 12 months from a study in Malawi, location of household, age and gender of the dead persons

	Frequency	(%)
House hold location		
Rural	1332	90.1
Urban	107	7.2
Slum	13	0.9
Not recorded	27	1.8
Total households		
	1479	100
Total Reported deaths		
Male	294	52.7
Females	259	46.4
Not recorded	5	0.8
All	558	100
Total Deaths by age group (years)		
0 - 4	188	33.8
5 - 17	67	12.1
18 - 49	172	31.0
50 -100	128	23.1
Missing	3	
Total	558	100

Table 2: Cause of death the past by age groups, reported from 1479 households in Malawi

Injury	Infected wound	Bleed from child birth	Visible body mass	Congenital deformity	Acquired deformity	Abdominal distention	Non-surgical/ Medical	% of surgical deaths	Total deaths
1	3	0	7	11	0	5	156	33.1%	184
3	1	0	4	2	0	7	49	11.9%	66
14	8	13	10	0	6	13	115	32.3%	179
13	4	0	14	2	4	2	88	22.7%	126
31	16	13	35	15	10	27	408	100%	555
(5.6%)	(2.9%)	(2.3%)	(6.3%)	(2.7%)	(1.8%)	(4.9%)	(73.5%)		

Table 3 Traumatic causes of death in 1497 households in Malawi

fatal traumatic
deaths (n) 30

	Bite/animal attack	Burn/ explosion	Car/ Truck/ Bus crash	Fall from height	Motor cycle crash	Pedestrian Bicycle crash	Stab/ slash	Train crash	Death % (age group)
	0	1	0	0	0	0	0	0	3.3%
rs	0	1	0	1	0	1	0	0	10%
rs	1	0	6	1	1	0	4	1	46.7%
yr	1	0	6	2	0	1	2	0	40%
	2	2	12	4	1	2	6	1	
se	(6.7%)	(6.7)	(40%)	(13.3%)	(3.3%)	(6.7%)	(20%)	(3.3%)	100%
c									

* Responses from household members in reply to the question:"condolences for your loss.....which one of the above injuries may have caused the death of your family member?"

Table 4 Location of death during the last year among 558 persons in 1497 households in Malawi

	Home	Health facility	In transit to health facility	% (Age group)
0 – 4 years	75	101	6	33.8
5 – 17 years	31	35	0	12.0
18 – 49 years	59	104	14	31.0
50 – 100 years	69	48	10	23.1
Total	234 (41.9)	288 (51.6%)	30 (5.4%)	
Missing	6			

Total Deaths (n) = 558

*Response of household head "... Condolences for your loss, where did your family member die from one of the above locations...?"