The *Lancet* Commission on Global Surgery

Data for the sustainable development of surgical systems:

A global collaboration

June - September 2015

Program in Global Surgery and Social Change
HARVARD MEDICAL SCHOOL

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Global partners: Please see *Appendix 6* for a list of all organizations that contributed data, without whom this report would not have been possible.

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Introduction

In many countries, access to surgical and anaesthesia care is not optimal, and many people die or experience disability as a result. The Lancet Commission on Global Surgery (LCoGS) is a collaborative intersectoral partnership consisting of twenty-five clinicians, researchers, and policymakers serving as commissioners with advisors and collaborators from over 110 countries. The Commission aims to assess the current state of surgical care around the world and make concrete recommendations as to its improvement through 2030.

The Commission released its seminal report in April 2015 titled “Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic growth”. Among the report’s most substantive contributions was a global consultative process leading to recommendations for global adoption of six core indicators of national surgical system strength. Two indicators measure a surgical system’s preparedness for delivering surgical care. These are the proportion of the population within two hours’ travel time of a surgical hospital and the number of surgical, anaesthetic, and obstetric specialists per 100,000 population. Two measure realized access to safe surgery, namely the surgical volume per 100,000 population each year and the perioperative mortality rate. Finally, since access cannot be conferred without affordability, the final two indicators examine the risk of impoverishment and catastrophic expenditures that people might experience by seeking surgical care. Together, these indicators allow for a rapid assessment of strength and weakness in a surgical system, defining opportunities for improvement for national governments.

Little is known, however, as to the current values of these metrics for different countries worldwide. Further, few national governments and their ministries of health are aware of these metrics or systematically report on them. We launched a global effort to (1) contact ministries of health and provide them background on these core indicators and (2) to collect from them any existing data on these indicators. This document outlines the methodology we used and highlights key findings relevant to each indicator.

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Methodology

After the Lancet Commission on Global Surgery report was released in April 2015, the Commission's leadership convened a working group on surgical indicators. This group consisted of representatives from Harvard Medical School, Lund University, King's College London, University of California-San Diego, Stanford University, The Lancet, and Redivis. We compiled existing nationally-representative data on the Commission's six indicators. The Lund team contributed primary country-level data on specialist surgical workforce, the Stanford team contributed modelled country-level estimates of surgical volume, and the Harvard team contributed modelled country-level estimates of the risk of catastrophic and impoverishing expenditure when individuals require surgical care. The Lund team, along with the World Health Organization, provided a list of country contacts in ministries of health worldwide.

Over the next two months, we developed a global strategy for data collection. We developed communications to ministries of health through an iterative process and compiled a streamlined list of required data. We translated communications into French and Spanish. To communicate effectively with ministries and other contacts, we trained a team of eight research associates and developed an online data management system.

We began our communications in July 2015. We used the World Bank's list of 215 countries and independent economies (hereafter referred to simply as "countries"). We classified these as High-Income Countries (HIC), Upper-Middle-Income Countries (UMIC), Lower-Middle-Income Countries (LMIC) and Low-Income Countries (LIC), based on World Bank Gross National Income per capita thresholds. We employed email and telephone communication with ministries of health, U.S.-based embassies and consulates, United Nations offices, World Health Organization offices and other professional and personal contacts.

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Key Findings

Over the course of ten weeks, we developed collaborations with partners in 119 countries. By September 22, 2015, we had received primary data from 64 countries (**Figure 0.1**). These included data for all six LCoGS indicators though the number of countries that provided data for each varied.

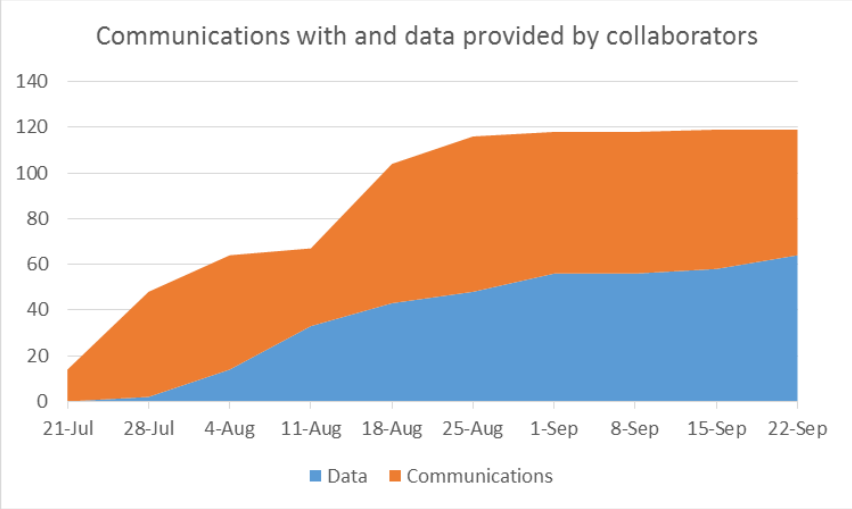

Figure 0.1. Time course of communications and data provided by collaborators.

Indicator 1

Indicator Name	***Access to timely essential surgery***
Definition	The proportion of the population in each country that can reach, within two hours, a facility capable of providing the Bellwether Procedures (caesarean section, laparotomy, and treatment of open fracture).
Number of countries with new data	14
Total number of countries with data	14
Suggested citation	*Data for the sustainable development of surgical systems (LCoGS), 2015*
Notes	More data and interactive maps are available at http://med.stanford.edu/weiserlab/surgical_coverage.html (Available soon)

We mapped the locations of hospitals providing laparotomy, caesarean section, and open fracture repair (the Bellwether procedures) in 14 countries and calculated the proportion of the population living within 2 hours' traveling time of these facilities. This process is easily replicable in other countries, simply requiring a list of hospitals with the capacity to safely provide the Bellwether procedures.

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Indicator 2

Indicator Name	*Specialist surgical workforce density*
Definition	The number of specialist surgical, anaesthetic, and obstetric (SAO) providers who are working in each country per 100 000 population.
Number of countries with new data	64
Total number of countries with data	176
Suggested citation	*Data for the sustainable development of surgical systems (LCoGS), 2015*
Notes	This work builds on that of the WHO global surgical workforce database. These new data will be provided to the WHO.

Reported specialist surgical (SAO) workforce density varied widely between countries, from 0.15 (Sierra Leone) to 278.38 (Monaco). Many countries, particularly low- or lower-middle income countries, will need to train additional providers to reach the Commission's threshold of 20 specialist surgical providers per 100,000 population. Combining data from this effort with previous data, specialist surgical workforce density is now available for 176 countries.

Indicator 3

Indicator Name	*Surgical volume*
Definition	The number of procedures undertaken in an operating theatre per 100 000 population per year in each country. A procedure is defined as the incision, excision, or manipulation of tissue that needs regional or general anaesthesia, or profound sedation to control pain.
Number of countries with new primary data	33
Number of countries with modelled data	184
Suggested citation	Weiser TG, Haynes AB, Molina G, Lipsitz SR, Esquivel MM, Uribe-Leitz T, Fu R, Azad T, Chao TE, Berry WR, Gawande AA. Changing rates and distribution of the global volume of surgery, 2004 to 2012: Increased volume, but disparities persist. – under review

As with workforce density, the numbers of surgical procedures varied widely, ranging 258 (South Sudan) to 30,091 (Monaco) per 100 000 population. Only high-income countries consistently met the Commission's target of 5000 procedures per 100 000 population per year. These data were used to validate an existing model estimating annual surgical volume in each country.

Indicator 4

Indicator Name	*Perioperative mortality rate*
Definition	The number of in-hospital deaths from any cause in patients who have undergone a procedure done in an operating theatre, divided by the total number of procedures, presented as a percentage.
Number of countries with new data	16
Total number of countries with data	16
Suggested citation	*Data for the sustainable development of surgical systems (LCoGS), 2015*
Notes	There was variation in the definitions used by countries on this indicator. See the methodology section below for further information.

The Oceania region and Europe lead the world in the reporting of national perioperative mortality rates. Sixteen countries provided data eligible for inclusion in our dataset, including three middle-income Pacific Island nations. Australia, providing data for 2009-2013, was able to demonstrate decreasing perioperative mortality with time.

Indicators 5 & 6

Indicator Name	*Risk of impoverishing expenditure for surgical care & Risk of catastrophic expenditure for surgical care*
Definition	The probability of experiencing impoverishment (using a threshold of $1.25 PPP/day) when surgical care is required & the probability of experiencing catastrophic expenditure (10% of total income) when surgical care is required.
Number of countries with new cost data	12
Total number of countries with modelled data	186
Suggested citation	Shrime MG, Dare A, Alkire BC, Meara JG. Cured into destitution: the financial burden of surgery in 186 countries. *British Journal of Surgery*—under review

Partners provided the cost of surgical procedures for twelve countries. These were used to validate a model estimating the proportion of the population at risk of catastrophic and impoverishing expenditures for 186 countries. The risk of impoverishing expenditure threatened up to 98.7% of individuals (Burundi), and the risk of catastrophic expenditure was as high as 92.8% (Afghanistan). The models predict complete or near-complete protection from impoverishing and catastrophic expenditure in many high-income countries.

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Conclusions

This effort rests on previous efforts to collect and model surgical data. We now have updated primary data on the specialist surgical workforce, and validated modelled estimates of surgical volume, the risk of impoverishing expenditure, and the risk of catastrophic expenditure when individuals need surgical care. We also have new data on the patient-borne costs of surgical procedures, a proof-of-concept that the collection of nationally-representative perioperative mortality data is possible in LMICs, and a standardized approach to assessing the geographic accessibility of surgical facilities. These data can be used to inform the policy decisions of governments looking to strengthen health systems through an up-scaling of surgical care. We expect that these data will be strengthened over time, as improved methodology for their collection is developed and their use becomes more widely adopted. These data offer a baseline against which governments can measure improvements during the era of the Sustainable Development Goals.

Indicator 1: Access to timely essential surgery

> "The first indicator—access to timely essential surgery— is of temporal access to essential surgical and anaesthesia care. The indicator is defined as the proportion of the population that can reach, within 2 h, a facility capable of doing the Bellwether Procedures [caesarean section, laparotomy, and treatment of open fracture]. . .Global access to safe, timely, and affordable surgical and anaesthesia care is grossly inadequate, resulting in a large unmet need for procedures. The Bellwether Procedures serve as a proxy of systems, resources (both human and physical), and skill sets needed to treat a broad range of essential surgical conditions. Use of the Bellwether Procedures within this indicator is therefore not merely to capture treatment of conditions needing those procedures, but rather to more broadly measure the presence of functioning, comprehensive care delivery platforms."
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Methods

During the data collection period from July to September 2015, we requested information from ministries of health, country embassies in the US, United Nations offices, WHO offices and personal contacts in 212 of 215 World Bank-defined countries. We asked contacts for the names and addresses of all hospitals performing the Bellwether procedures. We also searched public databases on the advice of ministries of health. This was undertaken as a pilot study to a) determine the feasibility of data collection for this indicator and b) to develop tools to maximize the efficiency of data analysis and visualization.

Inclusion criteria

To merit inclusion in this dataset, we required data in the form of a spreadsheet or list of hospitals provided by the ministry of health or a credible researcher.

Exclusion criteria

We excluded incomplete data from the dataset. This included lists missing addresses, simple statements of the numbers of surgical hospitals, or lists of either public hospitals or private hospitals (but not both). We also excluded lists of surgical hospitals without an attestation that each provided the Bellwether procedures.

Once we established a list of hospitals for each country, we converted hospital addresses into latitude and longitude coordinates.[1] In partnership with Redivis, an organization focused on data

[1] We used an online tool for conversion, available at http://www.findlatitudeandlongitude.com/batch-geocode

management and visualization, these geocoded points were used to determine the proportion of the population living within two hours of relevant hospitals.

Specifically, Redivis utilized OpenStreetMap[2] roads data to dynamically run a cost-distance algorithm and calculate a coverage area for each country;[3] it overlaid this coverage area with population density statistics from WorldPop[4] to determine the coverage ratio.

Results

We obtained hospital lists for 14 countries. Of these, 12 lists were provided by the ministry of health, and two were provided by researchers at medical universities. Most were high-income countries (10), and half were smaller than 30,000 km^2 (**Table 1.1**). We developed coverage maps for each country (**Figure 1.1**).

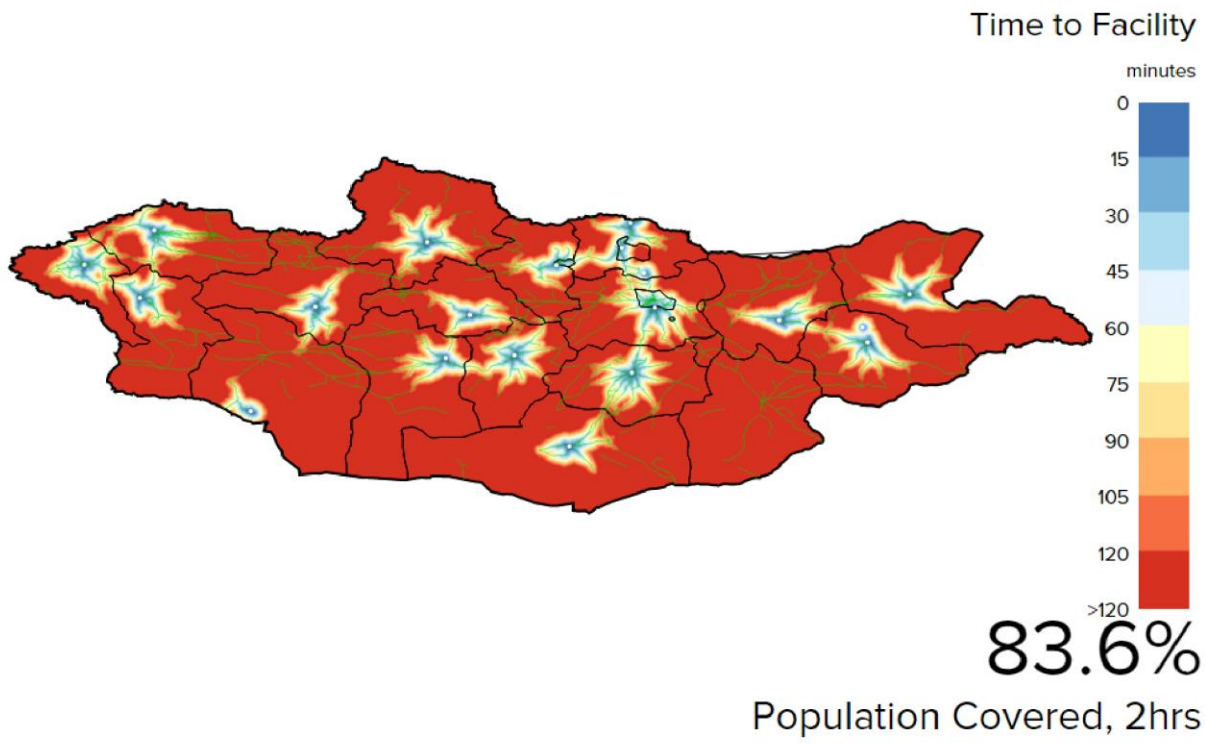

Figure 1.1. Coverage map of Mongolia. Dots indicate facilities capable of delivering the Bellwether procedures. Red areas are further than two hours from such facilities. More data and interactive maps are available at http://med.stanford.edu/weiserlab/surgical_coverage.html (Available soon).

[2] OpenStreetMap. 2015. https://www.openstreetmap.org. Accessed October 20, 2015.
[3] ESRI. 2007. http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Cost_Distance_algorithm. Accessed July 10, 2015
[4] WorldPop. 2015. http://www.worldpop.org.uk/. Accessed October 20, 2015.

Count	Country	Region	Income Level	Number of hospitals	Country size (km^2)	Percent population coverage
1	Andorra	Europe	HIC	1	468	100.0%
2	Austria	Europe	HIC	81	83855	100.0%
3	Belize	Latin America & Caribbean	UMIC	4	22966	95.2%
4	Cayman Islands	Latin America & Caribbean	HIC	4	259	100.0%
5	Channel Islands (Jersey)	Europe	HIC	1	119.5	100.0%
6	Finland	Europe	HIC	26	338424	98.9%
7	Iceland	Europe & Central Asia	HIC	3	103001	93.5%
8	Latvia	Europe & Central Asia	HIC	20	64589	100.0%
9	Monaco	Europe & Central Asia	HIC	1	2	100.0%
10	Mongolia	East Asia and Pacific	UMIC	22	1565000	83.6%
11	Seychelles	Sub-Saharan Africa	HIC	1	455	83.7%
12	Sri Lanka	South Asia	LMIC	55	65610	99.9%
13	St. Vincent and Grenadines	Latin America & Caribbean	UMIC	1	389	100.0%
14	Sweden	Europe & Central Asia	HIC	44	449964	99.6%[5]

Table 1.1. Countries for which *Indicator 1* data are available.

Among this group of predominantly small, higher-income countries, resulting coverage outputs usually exceeded 90%.

Discussion

We were able to develop maps describing the geographic accessibility of surgical hospitals to national populations. This process required only a simple hospital list as a data input. Hospital maps were combined with publicly available population data and OpenStreetMap travel data to create a population coverage metric.

Limitations

Travel times were calculated using known speed limits, or if unknown then recommended speed, for each type of road by applying geocoded data within OpenStreetMap. Road conditions are not considered; they are highly variable and maximum speeds are unlikely to be used throughout an entire route. Additionally, this method assumes access to *immediate*

[5] A previous version listed Sweden's coverage at 91.0%. This was incorrect, due to a technical error. This is the correct value.

vehicular transport, and that such access is equal across each country regardless of rural or urban setting. This is unlikely in rural regions, and variability in access to transportation is high in low-income countries. Therefore, the methodology naturally overestimates the proportion of the population living within a two-hour travel time to these facilities.

We used the Manhattan Distance (distance along road infrastructure) and not Euclidean Distance (as the crow flies) as it represents a more accurate measure of geographic accessibility. This method is more complex in its implementation and analysis and required a significant amount of effort, time, and programming to complete. As this process is refined, however, the effort required to complete such analyses will be substantially reduced.

This indicator strictly assesses the time to travel to facilities that offer the three Bellwether procedures. The Bellwether procedures were used as a proxy to identify facilities that offer urgent surgical care, but no facility level information was included on the volume of surgery, the type of surgical personnel, the minimum equipment and supplies available for safe surgery (eg. oxygen, intravenous fluids, sterilizer, etc), or the infrastructure (eg. electricity availability) at these facilities. These additional factors are critical when assessing timely access to *safe* surgical care. As will be mentioned several times in this report, timely geographic access to surgical care is only one component, or one barrier, to surgical care and must be considered in context with the other key indicators outlined in this report.[6]

[6] Alkire BC, Raykar NP, Shrime MG, et al. Global access to surgical care: a modelling study. *The Lancet Global health* 2015; **3**(6): e316-23.

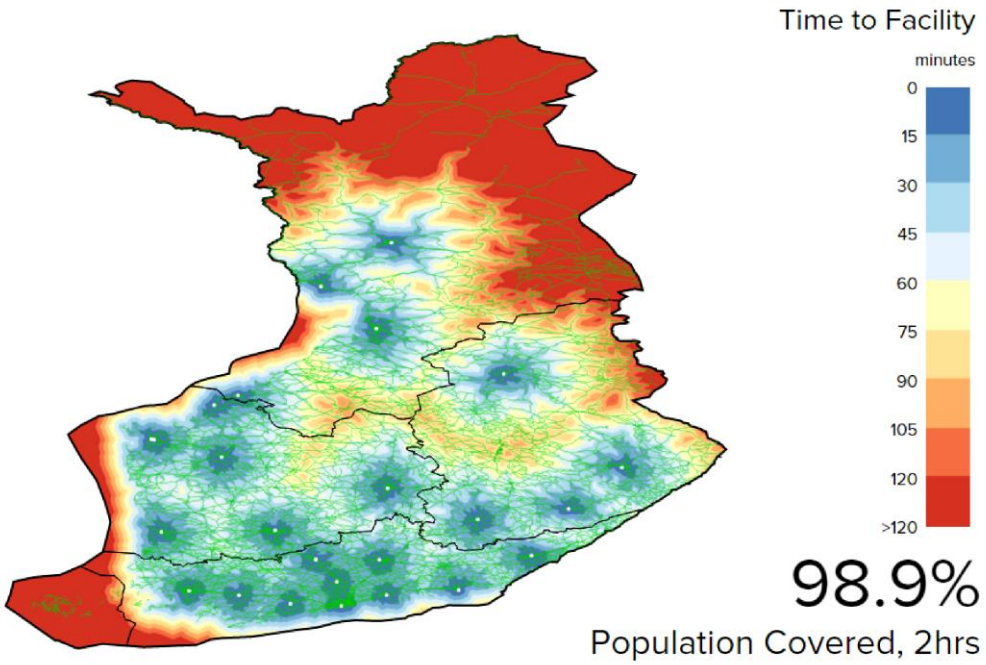

Figure 1.2. Coverage map of Finland. More data and interactive maps are available at http://med.stanford.edu/weiserlab/surgical_coverage.html (Available Dec 4, 2015).

Conclusions

Collecting data for this indicator allows for both numerical and visual representation of the geographic accessibility of surgical services. This extends the utility of the indicator to countries with high coverage, providing an opportunity to visually identify regions of the country that are sparsely populated (therefore contributing little to the numerator of the indicator) but nonetheless are further from surgical care (**Figure 1.2**).

This data collection effort is a proof of concept that determining the proportion of the population living within two hours of a hospital delivering the Bellwether procedures is feasible. To maximize the utility of this indicator, countries can maintain hospital lists with the specific surgical capacity of each hospital verified through regular facility surveys. Hospitals included in these analyses should include the regular, safe delivery of all three Bellwether procedures on a 24-hour-per day basis. Such lists would enable governments to rapidly determine the geographic proximity between populations and facilities equipped to deliver surgical care.

This indicator must be interpreted in the context of those that follow. An illustration might be drawn of a single surgical hospital with a single surgeon in a large city. While all who live in the city might be within two hours of this provider, the capacity of the surgeon to safely manage all surgical disease would quickly be overwhelmed. Placing this example in the context of countries we studied, a single surgical hospital in Ulaanbaatar or Rejkyavik would, by definition, provide

coverage for 45% and 60% of the population of Mongolia and Iceland, respectively. Yet this does not imply that these populations are automatically conferred timely access to surgery. Therefore, this indicator must be considered alongside indicators of workforce (*specialist surgical workforce density*), delivery (*surgical volume*), and safety (*perioperative mortality*). Furthermore, even if safe, affordable surgery is available nearby, patients might choose not to access it for fear of the financial consequences, making *protection from impoverishing and catastrophic expenditures* for surgery critical to this panel of indicators.

Indicator 2: Specialist surgical workforce density

> "The second indicator—surgical workforce density—is an indicator of surgical workforce availability. The indicator is defined as the number of specialist surgical, anaesthetic, and obstetric providers who are working per 100 000 population. . .Surgical and anaesthesia care cannot be delivered without a surgical workforce. This Commission delineates the large gap and inequity in distribution of the surgical workforce in LMICs."
>
> *Global Surgery 2030*

Methods

During the data collection period from July to September 2015, we requested information from ministries of health, country embassies in the US, United Nations offices, WHO offices and personal contacts in 212 of 215 World Bank-defined countries. We asked contacts for the numbers of fully trained, licensed specialist surgeons, anaesthetists, and obstetricians (SAO) practising in each country.[7] We also searched public databases on the advice of ministries of health. We included all available SAO data from the year 2000 and beyond. We used these data to calculate provider density, which is defined as the number of specialist SAO providers per 100,000 population in each country.

Country contacts provided the latest available data on absolute numbers of surgeons, anaesthetists and obstetricians for individual countries. In addition, we queried the Eurostat database.[8,9]

The total number of SAO providers was calculated by summing the number of surgeons, anaesthetists and obstetricians. This served as the numerator for SAO density. The denominator, total population, was obtained from the World Bank. The year for which the population was estimated corresponded to the year for which SAO data were available. For data in which information on year of data was missing we used the population in 2014. Our final

[7] This indicator excludes generalist physicians and non-physician clinicians (i.e. task-sharers) providing these services.
[8] "Physicians by specialty - European Commission." 2015. 22 Sep. 2015 <http://ec.europa.eu/eurostat/cache/metadata/Annexes/hlth_res_esms_an2.pdf>
[9] The Eurostat database uses definitions that differ slightly from those used by the Commission.
Surgeons: Those doctors who specialize in the use of surgical techniques to treat disorders and diseases. The definition included the following specialties: General Surgery, Neurological Surgery, Plastic Surgery, Orthopaedics, Thoracic Surgery, Vascular Surgery, Urology, Accident and Emergency Medicine, Otorhinolaryngology, Ophthalmology
Anaesthetists: Physicians who specialize in perioperative care, including intensive care.
Obstetricians: Physicians who specialize in pregnancy and childbirth including gynaecologists who are physicians concerned with the functions and diseases specific to women and girls, especially those affecting the reproductive system. The definition also included: Child/paediatric Gynaecology, Reproductive Medicine, Genetics
Furthermore, medical residents specializing in these specialties were enumerated along with fully-trained specialists.

results described below include data collected through our efforts this year and data collected in the year 2014 by Holmer and others on 165 countries.[10] This previous work was completed in partnership with the WHO and its many collaborating organizations to create a Global Surgical Workforce Database.[11] For 55 countries for which data were available from both efforts, we used the most recent figures.

Results

Partners provided new data for 64 countries, including data obtained from Eurostat. Europe was well-represented (primarily through the Eurostat database), with variable contributions from other World Bank regions. The majority of new primary data came from high-income countries and upper-middle income countries. We obtained data for ten countries for which enumerated SAO data were previously not available. We assembled the most recent data on 176 countries (**Table 2.1**).

World Bank Region	Number of Countries
East Asia & Pacific	26
Europe & Central Asia	54
Latin America & Caribbean	31
Middle East & North Africa	14
North America	2
South Asia	8
Sub-Saharan Africa	38
Other	3
TOTAL	176

Table 2.1 Countries with data meriting inclusion, by World Bank Region.

[10] Holmer H, Lantz, A., Kunjumen, T., Finlayson, S., Hoyler, M., Siyam, A., Montenegro, H., Kelley E.T., Campbell, J., Cherian, M.N., Hagander, L. . Global distribution of surgeons, anaesthesiologists, and obstetricians. *The Lancet Global Health* 2015; **3**(Suppl 2): S9-S11.

[11] See http://who.int/surgery/eesc_database/en/ WHO, 2015

SAO Density							
Surgeons		Anaesthetists		Obstetricians		Total	
Max	Min	Max	Min	Max	Min	Max	Min
191.89	0.08	70.27	0.01	100	0.04	278.38	0.15

Table 2.2 Ranges of surgeon, anaesthetist, and obstetrician density, and total SAO density among 176 studied countries. Reported minimum values exclude any countries with null values for surgeons, anaesthetists, or obstetricians.

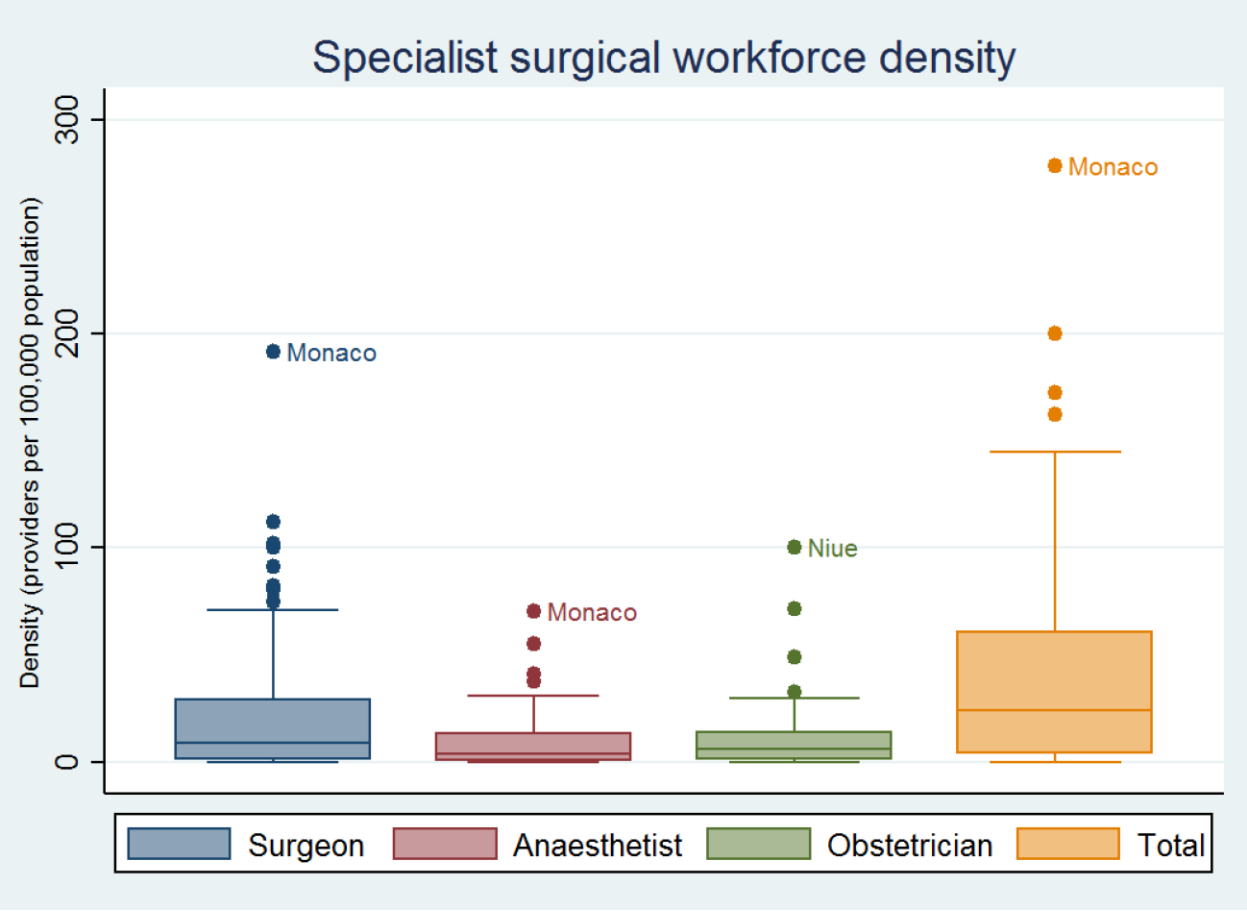

Figure 2.2 Ranges of surgeon, anaesthetist, and obstetrician density, and total SAO density among 176 studied countries. Tukey boxplot. Line indicates median, box indicates interquartile range (IQR, 25th-75th centiles), and whiskers indicate the highest and lowest data points within 1.5 times the IQR of the median.

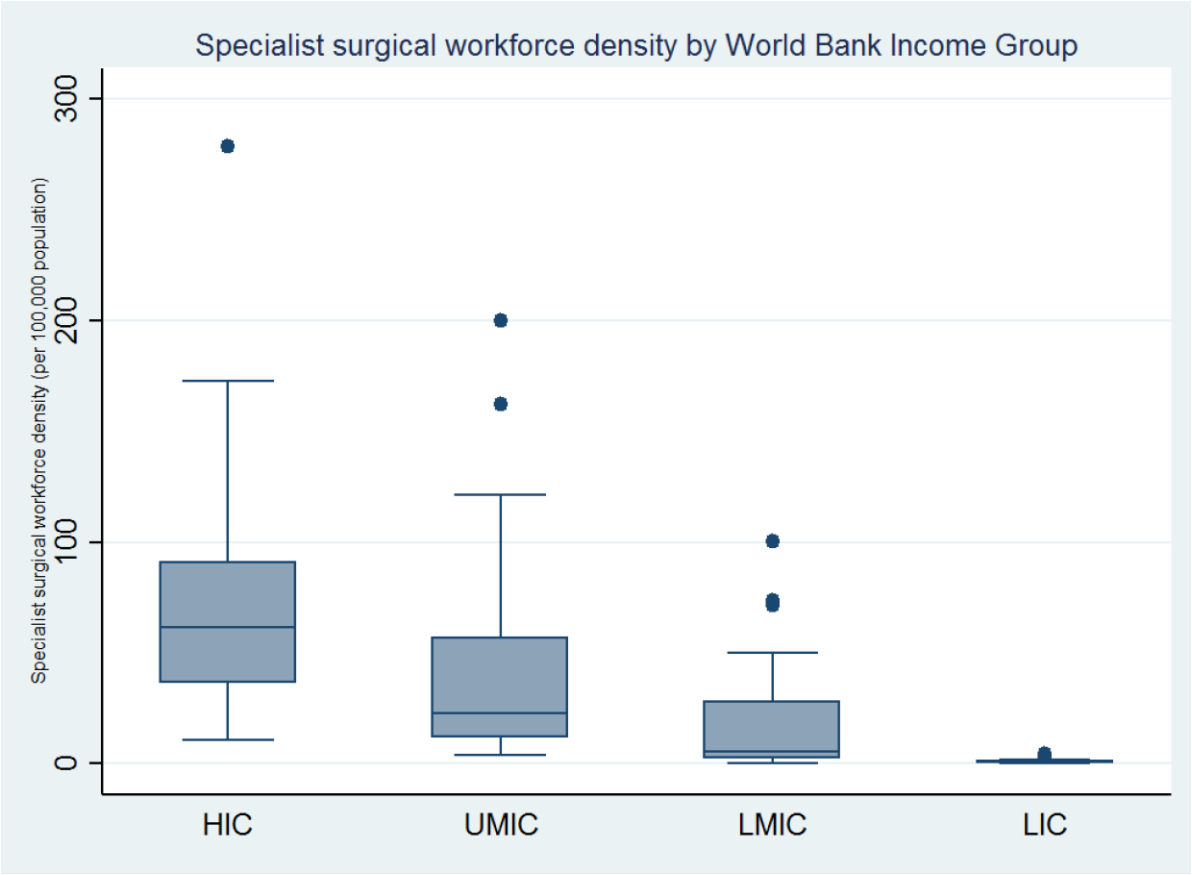

Figure 2.3 Ranges of total SAO density among 176 studied countries, by income group. Tukey boxplot. Line indicates median, box indicates interquartile range (IQR, 25th-75th centiles), and whiskers indicate the highest and lowest data points within 1.5 times the IQR of the median.

Discussion

Combining our new data with that from the WHO Global Surgical Workforce Database, we now have SAO numbers and specialist surgical workforce density for 176 countries. For most countries, numbers of all three specialist types were available. Null values for any of the three should be interpreted as the absence of data, not the absence of providers.

Limitations

1. Since the Commission's definition of SAO providers is new to the literature, there is ongoing variability in the definitions of SAO providers used by ministries of health.
2. In 21 countries for which data were available in both this data collection effort and the dataset from Holmer and others, differences of >30% in SAO density were noted. These discrepancies may be due to differing definitions of SAO providers, or due to different enumeration strategies.

3. We have utilized *specialist* SAOs as a standard proxy for the surgical workforce. However, we acknowledge that the surgical workforce also includes other healthcare personnel including nurses, clinical officers, midwives, and community health workers. In many health systems, non-specialist physicians and associate clinicians operate on patients and provide anaesthesia using a variety of task-sharing and task-shifting models. This indicator does not account for their contributions.

Conclusions

No health care system can function in the absence of a strong surgical workforce. Through this data collection effort, we have attempted to quantify the number of specialist SAO clinicians at the country level. We noted significant variation between countries, and between income groups.

Among countries for which new data were available, Europe was strongly represented. This was thanks to a robust, publicly available data source. It is our hope that through the publication of these indicators, such transparency in surgical workforce reporting might become a global standard. We received workforce data from countries of all income levels, indicating that this indicator is feasible to collect in all countries at all resource levels. Low- and middle-income countries have an opportunity to contribute to global surgical workforce knowledge through the voluntary annual reporting of workforce data. Furthermore, to promote greater understanding of the broader surgical workforce, future efforts can quantify the number of non-specialist physicians and associate clinicians providing surgical and anaesthesia care.

Indicator 3: Surgical volume

> "The third indicator—surgical volume—is of met need for surgical and anaesthesia care. It is defined as the number of procedures undertaken in an operating theatre per 100 000 population per year. A procedure is defined as the incision, excision, or manipulation of tissue that needs regional or general anaesthesia, or profound sedation to control pain."
>
> *Global Surgery 2030*

Methods

During the data collection period from July to September 2015, we requested information from ministries of health, country embassies in the US, United Nations offices, WHO offices and personal contacts in 212 of 215 World Bank-defined countries. We asked contacts for the total number of procedures (performed in operating theatres) in each country. Where gaps existed, follow-up contacts were made with individual data providers.

To calculate surgical volume as the number of procedures per 100 000 population, we divided the total number of surgical procedures by the World Bank's total population mid-year estimates for the year data were reported by an individual country, and multiplied this quotient by 100 000. In cases where specific years were not provided for the given data and countries could not be reached to confirm, 2014 was used as the default year. Finally, we externally validated a 2012 model of surgical volume for 184 countries from Weiser and others using the new data we received.[12] For each country for which primary data and modelled estimates of surgical volume were available, we calculated the percentage error, considering the primary data received from individual countries as an independently collected test of validity.

Results

New Primary Data

During the study period, we contacted 212 of 215 World Bank-defined countries and obtained new primary data for 33 World Bank countries (**Table 3.1**)

World Bank Region	Number of Countries
East Asia & Pacific	7
Europe & Central Asia	13

[12] Weiser TG, Haynes AB, Molina G, et al. Estimate of the global volume of surgery in 2012: an assessment supporting improved health outcomes. *Lancet* 2015; **385 Suppl 2**: S11.

Latin America & Caribbean	5
Middle East & North Africa	-
North America	1
South Asia	1
Sub-Saharan Africa	6
TOTAL	33

Table 3.1 Countries with data meriting inclusion, by World Bank Region.

Data for these countries are provided in **Appendix 3**. Our assessment revealed a surgical volume ranging from 258 to 38,907 per 100 000 population. As expected, High-Income Countries achieved high surgical volumes, as illustrated in **Figure 3.1**.

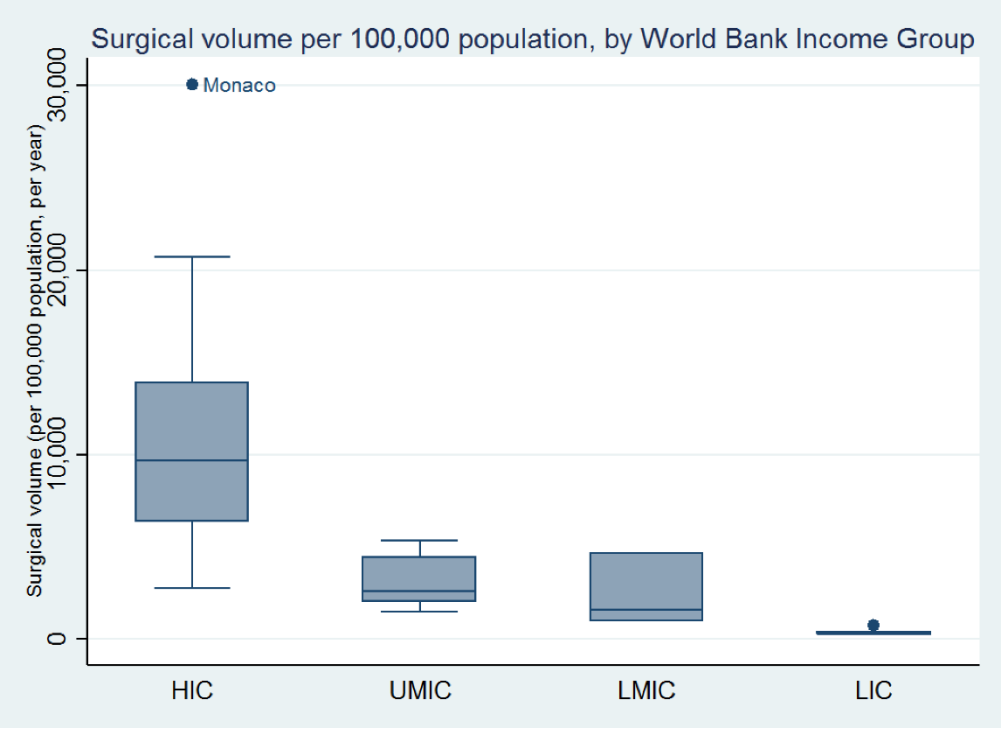

Figure 3.1. New primary data: Surgical volume by World Bank Income Group. Tukey boxplot. Line indicates median, box indicates interquartile range (IQR, 25th-75th centiles), and whiskers indicate the highest and lowest data points within 1.5 times the IQR of the median

Model validation

To compare the accuracy of the 2012 model with data received from our country contacts, we calculated percent error. We calculated minimum, maximum, median, mean and interquartile range (IQR) values for the percent error are reported in **Table 3.2**.

	Minimum	25th percentile	Median	75th percentile	Maximum	Mean
Procedures per 100,000	**258**	**1928**	**5106**	**9723**	**30091**	**6900**
Percent error model versus primary data	**-207.0%**	**-34.0%**	**-1.4%**	**13.3%**	**77.6%**	**-19.8%**

Table 3.2. Accuracy of modelled data

We determined that the model was accurate (within 20%) for surgical volume in sixteen countries: Australia, Austria, Belgium, China, Cyprus, Czech Republic, Estonia, Finland, The Gambia, Mongolia, Niger, New Zealand, Seychelles, Sierra Leone, Spain, and Uganda. The model *overestimated* surgical volume in seven countries: Andorra, Belize, Brazil, Ecuador, Slovak Republic, St. Vincent and Grenadines, and the U.S.A. The model *underestimated* surgical volume in three countries: Latvia, Myanmar, and Sri Lanka. These estimates can be further broken down by income status of responding countries, which is illustrated in **Figure 3.2**.

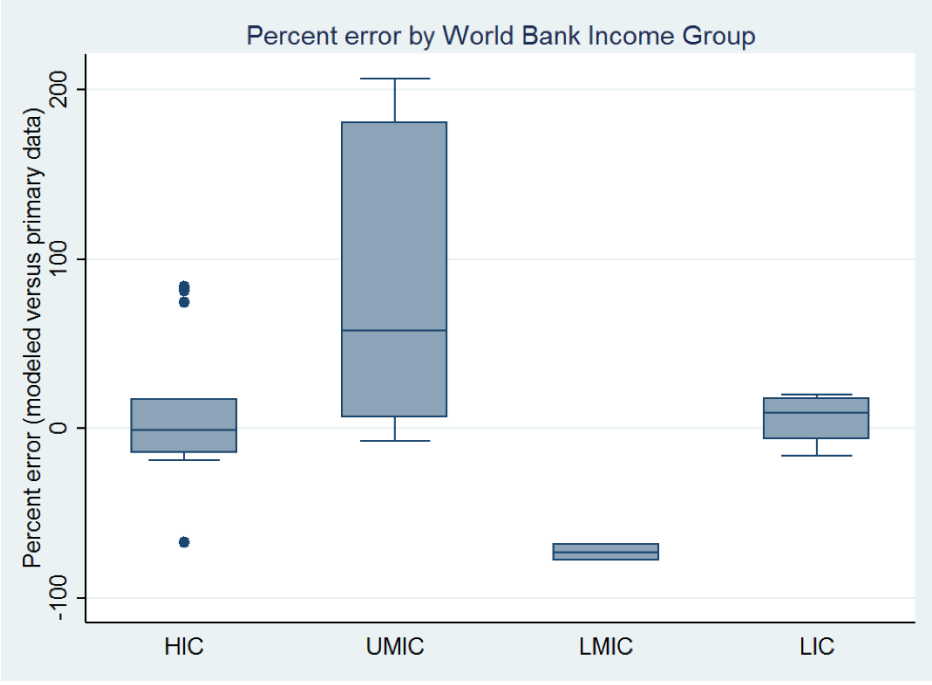

Figure 3.2. Modelled estimate of volume versus new primary data. Percent Error by World Bank Income Group. N for comparison: HIC=14, UMIC=6, LMIC=2, LIC=4. Tukey boxplot. Line indicates median, box indicates interquartile range (IQR, 25th-75th centiles), and whiskers indicate the highest and lowest data points within 1.5 times the IQR of the median.

There was some variation in model accuracy. Nevertheless, the model showed no evidence of systematic bias.

Modelled Estimates

Weiser and others, provided modelled estimates of surgical volume for 184 countries, using health systems spending as a main predictor variable. Data are available in **Appendix 3**. The distribution of surgical volume across World Bank income groups is similar to that seen for the primary data provided by contributors (**Figure 3.3).**

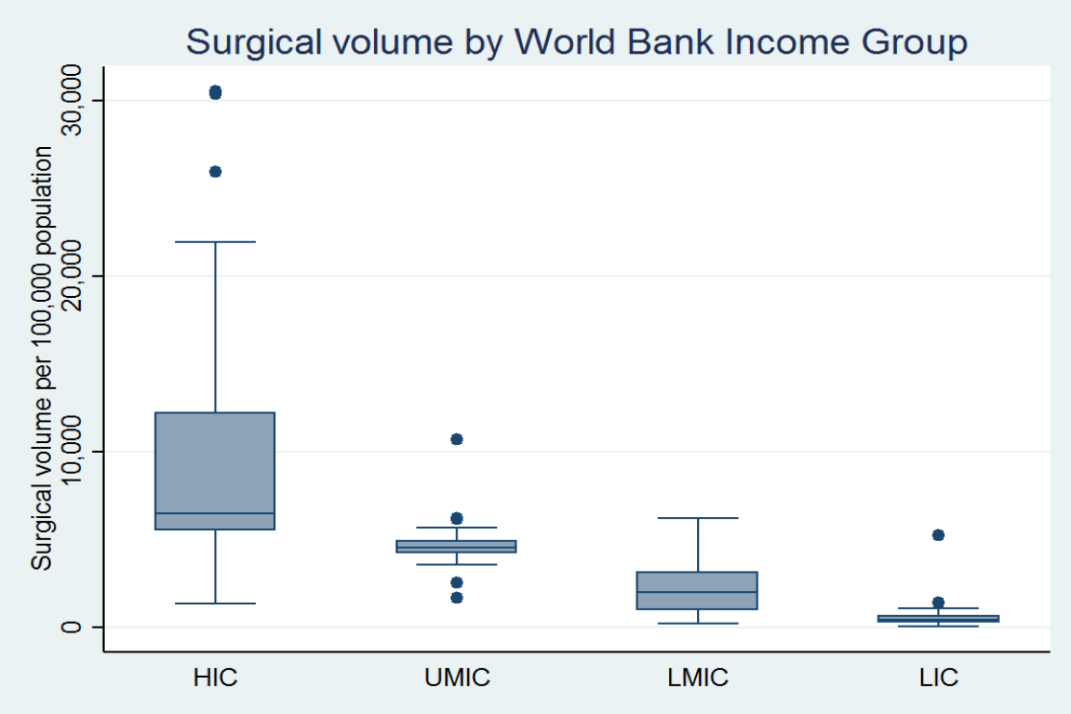

Figure 3.3. Modelled estimate of surgical volume for 184 countries, by World Bank Income Group. Tukey boxplot. Line indicates median, box indicates interquartile range (IQR, 25th-75th centiles), and whiskers indicate the highest and lowest data points within 1.5 times the IQR of the median.

In this model, surgical volume per 100,000 population ranged from 53 in Chad to 30537 in the USA (median 4241, IQR 1524 - 5730).

Discussion

Our data confirm that it is predominantly HICs that meet the Lancet Commission on Global Surgery target of 5000 procedures per 100 000 population for surgical volume.
The Weiser model relies exclusively on health care spending per capita: volume of surgical procedures in countries spending more per head on health care was higher than that in countries spending less per head on healthcare. This model was designed to provide global estimates of surgical volume, rather than country-specific estimates, though it also provides the latter. We collected primary data from countries to examine the accuracy of these country-specific estimates.

It should be noted the Weiser model provides estimates for 2012, whereas the primary data we received represented years ranging from 2010 to 2015. The model resulted in over- or under-estimation for 10 of the 26 countries/economies for which we received primary data and had a modelled estimate. Some of these differences are likely related to idiosyncrasies in the data we received; for example, data from Belize, the USA, and Ecuador accounted for only a segment of hospital types in each country (public, non-federal private, and public, respectively). Additionally, these data from the USA do not include outpatient surgery cases which comprise a substantial proportion of the country's total surgical volume.

Our analysis also revealed differences in the definition of a procedure. The Lancet Commission on Global Surgery defined an operation as “a procedure taking place in an operating room,”[13] but many countries sent data based on hospital discharges after surgery. This definition excludes all procedures done in surgical centres, and may also exclude day surgeries, depending on the country.

There are several other possible country-specific explanations for differences between our data and those from the 2012 model. For small countries, such as Belize and Andorra, patients may go to neighbouring countries to receive surgical care. Alternatively, some UMICs market themselves as “medical tourism destinations,” which may boost the overall number of procedures performed**.** Overall, there was no evidence of systematic bias in the modelled country-specific estimates.

Conclusions

We conclude that only HICs are consistently meeting the Lancet Commission on Global Surgery target of 5000/100,000 procedures per year. The Weiser model provides unbiased modelled estimates of volume for 184 countries.

[13] Meara JG, Leather AJ, Hagander L, et al. Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Lancet* 2015.

Indicator 4: Perioperative mortality rate

> "The fourth indicator—perioperative mortality—is crucial for surgical and anaesthesia safety, and has been adopted by the WHO Safe Surgery Saves Lives initiative. The indicator is defined as the number of in-hospital deaths from any cause in patients who have undergone a procedure done in an operating theatre, divided by the total number of procedures, presented as a percentage."
>
> *Global Surgery 2030*

Methods

During the data collection period from July to September 2015, we requested information from ministries of health, country embassies in the US, United Nations offices, WHO offices and personal contacts in 212 of 215 World Bank-defined countries. To simplify data collection, we asked for two variables to calculate a national perioperative mortality rate (POMR) for each country:

- *Numerator*: number of people who die each year in each country following any surgical procedure (with specification of either in-hospital deaths or deaths within 30 days of procedure)
- *Denominator*: total surgical volume in each country (number of surgical procedures per year; this is Indicator 3)

Inclusion criteria

For data provided by collaborators to merit inclusion in our dataset:

1. A clear description of the numerator was required (in-patient deaths or deaths within 30 days of procedure)
2. A clear description of the denominator was required (all surgical admissions, all inpatient surgical procedures, all surgical procedures, or all inpatients undergoing surgery)

Exclusion criteria

Data were deemed insufficient for our dataset if:

1. The numerator was estimated rather than enumerated
2. A convenience sample of facilities was used
3. Mortality data were provided for a specific procedure rather than a national surgical population

Results:
During the study period, we contacted 212 of 215 World Bank defined countries. We obtained POMR data for 25 countries. Of these, 16 countries provided sufficiently robust data and data descriptors to merit inclusion in our dataset. These included ten High Income Countries (HICs), four Upper Middle Income Countries (UMICs), and two Lower Middle Income Countries (**Table 4.1**).

World Bank Region	Countries
East Asia & Pacific	Australia, New Zealand, Solomon Islands, Taiwan, Tonga, Tuvalu
Europe & Central Asia	Andorra, Belgium, Cyprus, Finland, Kosovo, Latvia, Monaco, Spain
Latin America & Caribbean	Belize, Brazil
Middle East & North Africa	-
North America	-
South Asia	-
Sub-Saharan Africa	-
TOTAL	16

Table 4.1. Countries providing data meeting inclusion criteria, by World Bank Region

Definitions of perioperative mortality varied between countries, although most (9/16) provided all in-patient deaths as the numerator, and half used all procedures performed as the denominator (**Table 4.2**).

Numerator	Countries
All in-patient deaths	Andorra, Australia, Belgium, Brazil, Finland, Kosovo, Monaco, New Zealand, Spain (9)
All deaths within 30 days of a procedure	Belize, Cyprus, Finland, Kosovo, Latvia, Solomon Islands, Taiwan*, Tonga, Tuvalu (9)
Denominator	**Countries**
All procedures	Andorra, Australia, Cyprus, Monaco, Solomon Islands, Taiwan, Tonga, Tuvalu (8)
All inpatient procedures	Belize, Brazil, Finland, Kosovo, Latvia, Spain (6)
All inpatients undergoing a procedure	Latvia
All surgical admissions	Belgium
All surgical admissions with at least one general anaesthesia	New Zealand

Table 4.2. Definitions of POMR used. N.B. Several countries provided POMR by more than one definition. *Deaths in the Taiwanese dataset are enumerated within 30 days of outpatient surgery or 30 days of hospital discharge.

Denominators upon which POMR was based varied from 220 surgical cases (Tuvalu) to 4,299,646 (Brazil). POMR ranged from 0.062% (inpatient mortality, Kosovo) to 1.7% (inpatient mortality, Brazil). Median POMR was 0.46% (**Figure 4.1**). Two countries, Finland and Kosovo, provided POMR for two time points: mortality during the inpatient stay, and mortality at 30 days following a surgical procedure. For Finland, 30-day mortality exceeded in-patient mortality by a factor of 2.8 (0.85% versus 0.30%). For Kosovo, this value was 6.4 (0.40% versus 0.06%).

Latvia provided two definitions of POMR, one using the total number of inpatient procedures as the denominator, and one using the total number of patients having had at least one inpatient procedure as the denominator. The latter exceeded the former by 27% (1.30% versus 1.02%)

Andorra and Australia provided at least three separate years of data, allowing testing for trends. Using a chi-squared test for trend, a significant linear decrease in POMR was noted in Australia over the years 2009-2013 from 0.42% to 0.36% ($X^2(3)=59.62$, $p<0.0001$). No such trend was seen in Andorra, where POMR stably hovered around 0.5%.

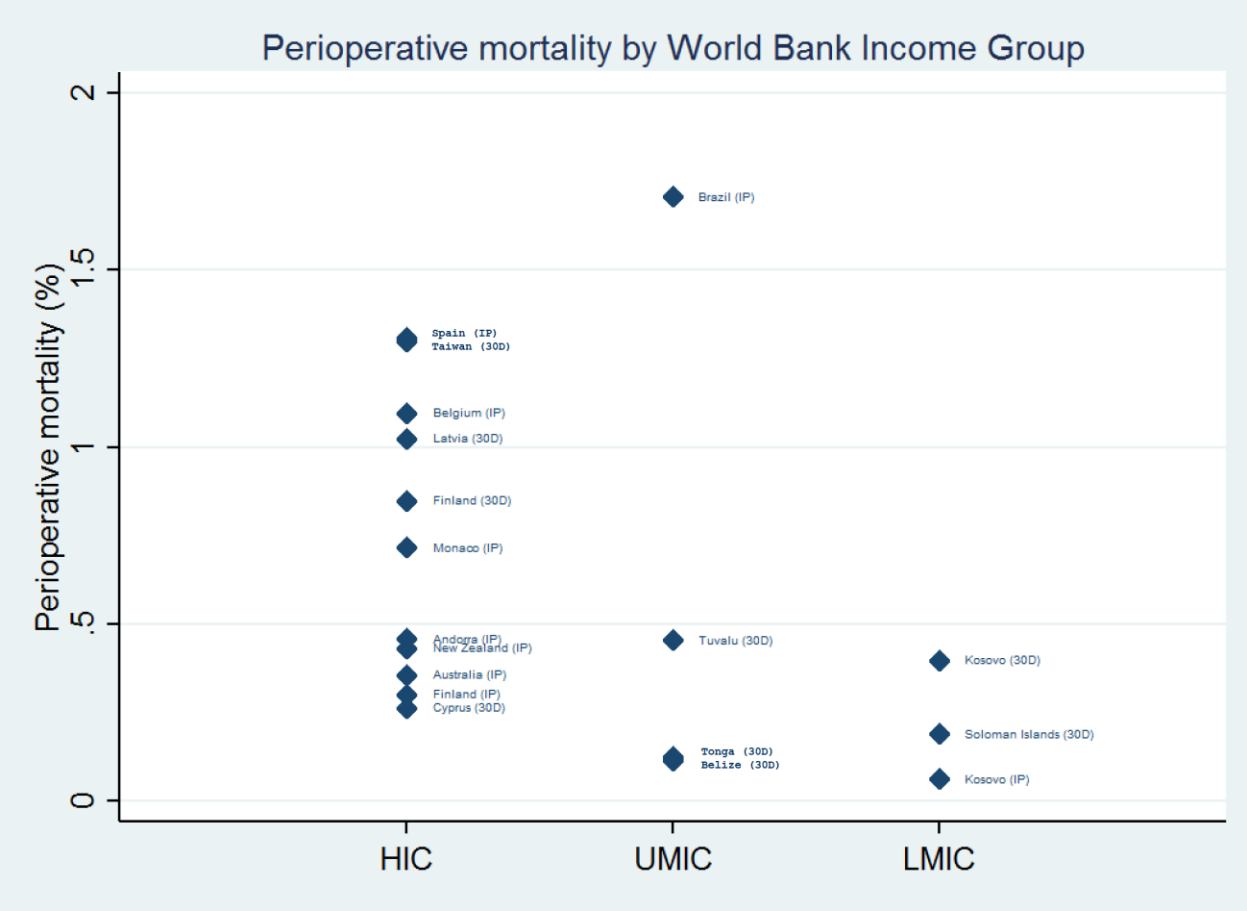

Figure 4.1. Perioperative mortality by World Bank Income group. Most recent year of data included. IP= In-Patient mortality; 30D= 30-Day mortality; HIC=High-Income Country; UMIC= Upper-Middle Income Country; LMIC=Lower-Middle Income Country; POMR= Perioperative Mortality Rate. NB. Andorra, Australia, Solomon Islands, Taiwan, Tuvalu, and Tonga defined the denominator of POMR as all procedures; Brazil, Finland, Kosovo, Spain, and Latvia defined the denominator as the number of inpatient procedures; Belgium defined the denominator as the number of surgical admissions involving at least one procedure. New Zealand defined the denominator as all surgical admissions involving at least one general anaesthesia.

Discussion

This effort to collect perioperative mortality data revealed that many countries already track deaths after surgery within national health records. The Pacific region is well-represented in this group, as is Europe and Central Asia. Further nationally-representative data are required from the Americas, Sub-Saharan Africa, and South Asia. No data are yet available from low-income countries.

The data reported by each country differ in definition and methodology of enumeration. While crude POMR appears to demonstrate substantial variability between countries, we made no attempts at risk adjustment, nor did we attempt to reconcile differences in methodology or overall reporting of POMR between different countries. Rather than comparing countries on values of perioperative mortality alone, we recommend an approach that contextualizes its interpretation within the suite of surgical indicators contained in this report. This approach might take the form of a POMR matrix as presented by the Lancet Commission on Global Surgery (**Figure 4.2**). Furthermore, to track progress in surgical safety, year-over-year comparisons offer much more meaningful insights than comparisons of two countries with different surgical populations.

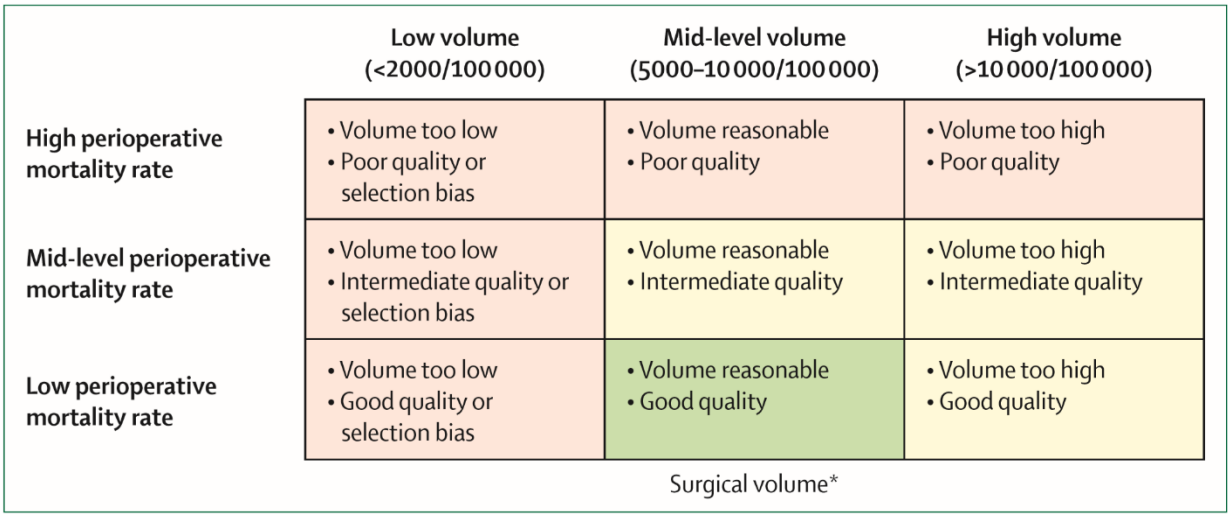

Figure 4.2. POMR matrix. Reprinted from *The Lancet*, Meara JG, Leather AJ, Hagander L, et al., *Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development*, page 44, Copyright (2015), with permission from Elsevier.

Academics have undertaken such direct country comparisons in the past, including Pearse and others in the European Surgical Outcomes Study.[14] These endeavours offer the opportunity to

[14] Pearse RM, Moreno RP, Bauer P, et al. Mortality after surgery in Europe: a 7 day cohort study. Lancet 2012;**380**(9847):1059-65 doi: 10.1016/S0140-6736(12)61148-9[published Online First: Epub Date]|.

standardize methodology between countries. They offer remarkable insights as to how best to collect outcomes data and risk-adjust for fair comparisons. However, they offer limited national representativeness, and their observations represent a single snapshot in time. Ongoing studies that will provide further methodological and clinical insights include the International Surgical Outcomes Study, the African Surgical Outcomes Study, and GlobalSurg I.[15,16,17]

The data we received directly from ministries of health and hospitals signal the institutional capacity to monitor clinical outcomes outside of an academic study environment; we encourage the enumeration of all perioperative deaths at both a hospital and national level.

The reporting of perioperative mortality data should invite international cooperation to offer each surgical patient worldwide the best outcome possible.

Conclusions

Perioperative mortality can be collected in LMICs, as demonstrated by the collection of this indicator by several Pacific Island nations. Standardization of the definition is important (preferring the Commission's definition of inpatient deaths divided by the total number of procedures performed, including both inpatient and ambulatory surgery). If countries collect perioperative mortality data using a consistent definition on an annual cycle, progress in improving surgical safety can be tracked over time.

One example of a robust national system for collecting, reporting, and using the perioperative mortality rate is that of New Zealand. The country's Perioperative Mortality Review Committee collects and analyses national surgical mortality data, produces an annual report, and advises the country's Health Quality and Safety Commission on reducing perioperative deaths. In addition to describing outcomes following several marker procedures and presenting risk-stratified analyses, the 2015 report provides POMR data for the 10 most common procedure types performed, and the 10 that are most commonly associated with death.[18] This report provides sufficient information to identify specific populations that are at high risk of perioperative mortality with a view to providing safe surgical and anaesthesia care for all. All countries can work toward this model of systematic surgical outcomes data collection, reporting, and meaningful use.

[15] GlobalSurg. GlobalSurg I: Determining universal markers of quality in abdominal surgery: an international evaluation. 2014. http://globalsurg.org/projects/globalsurg-1/ (accessed November 18 2015)
[16] ISOS. International Surgical Outcomes Study. 2015. https://isos.org.uk/isos.php (accessed November 2 2015).
[17] ASOS. African Surgical Outcomes Study. 2015. http://www.asos.org.za/ASOS%20protocol%20version%201%20final.pdf (accessed November 2 2015).
[18] POMRC. Perioperative Mortality in New Zealand: Fourth Report of the Perioperative Mortality Review Committee. http://www.hqsc.govt.nz/assets/POMRC/Publications/POMRC-fourth-report-Jun-2015.pdf (accessed Nov 5 2015).

Indicator 5: Risk of impoverishing expenditure

&

Indicator 6: Risk of catastrophic expenditure

> "33 million individuals face catastrophic health expenditure due to payment for surgery and anaesthesia care each year. An additional 48 million cases of catastrophic expenditure are attributable to the non-medical costs of accessing surgical care. A quarter of people who have a surgical procedure will incur financial catastrophe as a result of seeking care. The burden of catastrophic expenditure for surgery is highest in low-income and lower-middle-income countries and, within any country, lands most heavily on poor people."
>
> *Global Surgery 2030*

Methods

The Lancet Commission on Global Surgery defines impoverishing expenditure (Indicator 5) as direct out-of-pocket payments for surgical and anaesthesia care which drive people below a poverty threshold. Catastrophic expenditure (Indicator 6) is defined as direct out-of-pocket payments for surgical and anaesthesia care exceeding 10% of total income. A model predicting the proportion of the population at risk of such expenditures has been developed by Shrime and others [publication under review]. This model approximates the out-of-pocket costs of surgery by multiplying the system cost of a caesarean delivery by the proportion of health spending that is paid out-of-pocket in each country. We sought to a) collect primary cost data from countries to validate the cost inputs to this model, and b) describe the global variation in the risk of catastrophic and impoverishing expenditure when surgery is required.

During the data collection period from July to September 2015, we requested information from ministries of health, country embassies in the US, United Nations offices, WHO offices and personal contacts in 212 of 215 World Bank-defined countries. We asked contacts to provide the following data for each country:

- Cost of caesarean section at a first-level hospital
- Cost of caesarean section at a tertiary hospital
- Cost of laparotomy at a first-level hospital
- Cost of laparotomy at a tertiary hospital
- Cost of fracture repair at a first-level hospital
- Cost of fracture repair at a tertiary hospital

Results:

Cost Data

We received data on the cost of surgery from a total of 12 countries (**Table 5.1**).

World Bank Region	Countries
East Asia & Pacific	China, Taiwan
Europe & Central Asia	Andorra, Belgium, Estonia, Latvia, Spain
Latin America & Caribbean	Brazil, Cayman Islands, Ecuador
Middle East & North Africa	-
North America	-
South Asia	-
Sub-Saharan Africa	Niger, Seychelles
TOTAL	12

Table 5.1. Countries providing data meriting inclusion, by World Bank Region

There was substantial variability as to how data were reported; some countries presented ranges of costs and some presented data from only certain health centres. However, when these data were compared to the cost inputs of the models below, no evidence of systematic bias was seen.

Impoverishing and Catastrophic Expenditure

The model developed by Shrime and others predicts the proportion of the population at risk of catastrophic and impoverishing expenditures in 186 countries. This model accounts for the average direct medical cost of surgery, the average out-of-pocket proportion of health expenditure, average income and expenditure, and population income distribution (Gini index) and uses a poverty threshold of $1.25 PPP/day.

Across these countries, the median probability of impoverishing expenditures when surgery is required is 32.4% [IQR 7.4-61.5%, mean 36.0%] (**Figure 5.1**). In high income countries, the median risk was 1.6% [IQR 0.3-12.6%], but in low-income countries, over 80% of the population

risked being impoverished by seeking surgical care [median 83.1%, IQR 77.1-87.5%]. The highest risk, at 98.7% of the population, was seen in Burundi.

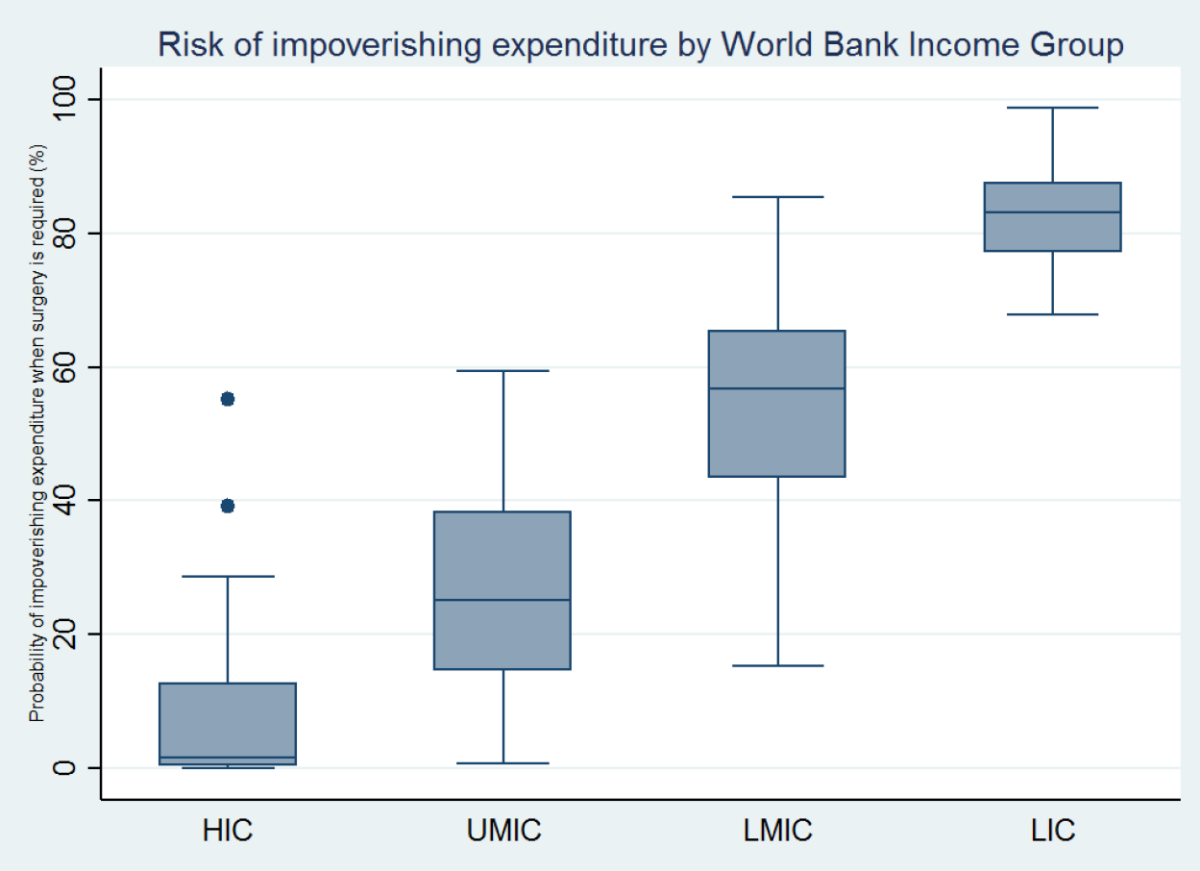

Figure 5.1. Modelled probability of impoverishing expenditure when surgery is required, by country. Poverty line= $1.25PPP/day. HIC= High-Income Country, UMIC=Upper-Middle Income Country, LMIC= Lower-Middle Income Country, LIC=Low-Income Country. Tukey boxplot. Line indicates median, box indicates interquartile range (IQR, 25th-75th centiles), and whiskers indicate the highest and lowest data points within 1.5 times the IQR of the median.

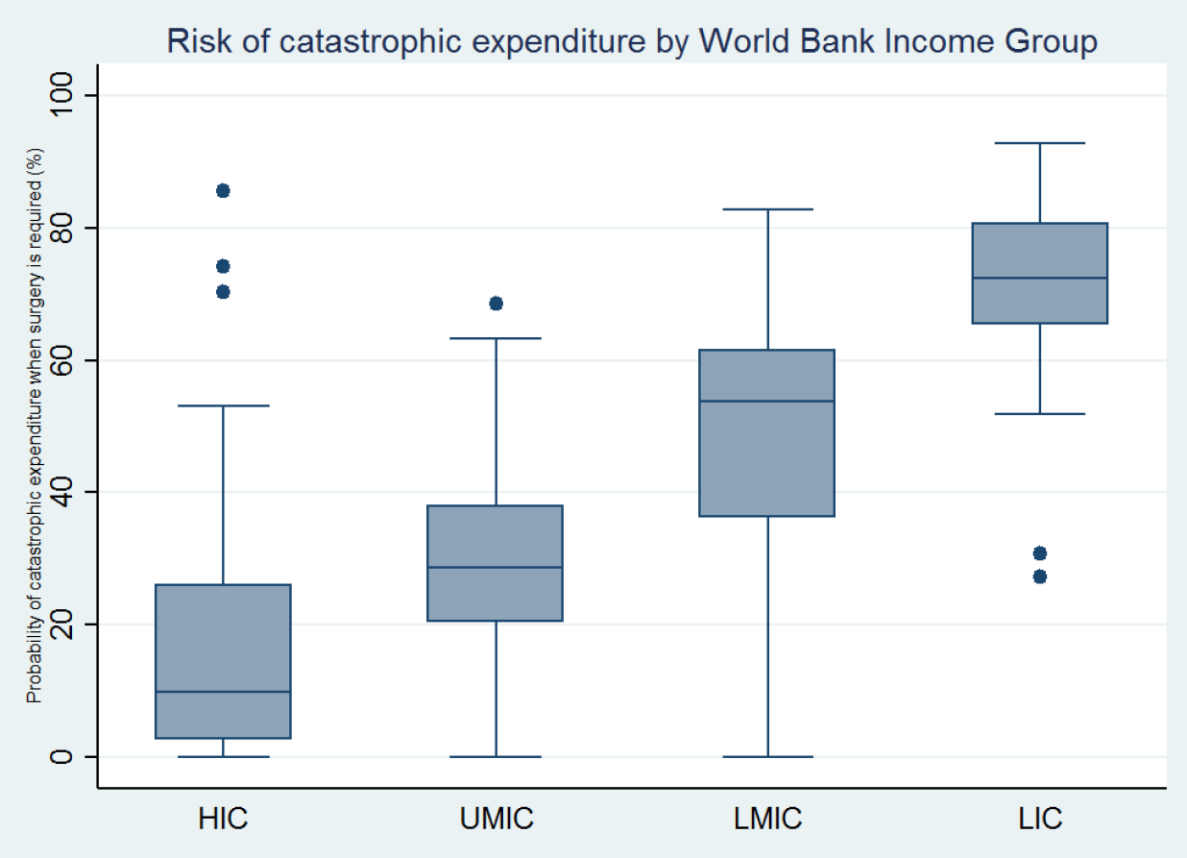

Figure 5.2. Modelled risk of catastrophic expenditure, by country. HIC= High-Income Country, UMIC=Upper-Middle Income Country, LMIC= Lower-Middle Income Country, LIC=Low-Income Country. Tukey boxplot. Line indicates median, box indicates interquartile range (IQR, 25th-75th centiles), and whiskers indicate the highest and lowest data points within 1.5 times the IQR of the median.

The median probability of catastrophic expenditures when surgery is required is 31.7% [IQR 13.6-57.3] (**Figure 5.2**). In high-income countries, median risk was 9.8% [IQR 2.7-26.1], but in low-income countries, almost three-quarters of the population risked financial catastrophe in seeking surgical care [median 72.4%, IQR 65.3-80.6]. The highest risk, at 92.8%, was seen in Afghanistan.

Discussion

Access to surgery implies not just geographic proximity to health facilities, sufficient numbers of trained surgical and anaesthesia providers, and the equipment necessary to perform surgery. Sustainable, equitable surgical systems require strategic financing decisions to reduce economic barriers to care and to reduce the financial consequences to those who choose to access it. The World Bank and the World Health Organization have set a global goal of 80%

essential health services coverage by 2030.[19] Surgical conditions cause almost a third of the world's burden of disease and 33 million individuals experience financial catastrophe paying for surgery each year.[20] Therefore, early inclusion of an essential package of surgical and anaesthesia care in pathways to universal health coverage is critical to reaching this goal.

While primary patient-level data on the out-of-pocket costs of surgery are preferable to the cost approximation used in these models, such data are largely unavailable. Primary cost data from three discharge surveys in sub-Saharan Africa show no evidence of bias in estimated costs (and may, in fact, suggest that these are underestimates). Cost estimates were further validated by national figures provided by collaborators. The models presented here provide the best available country-level estimates of the risk of catastrophic and impoverishing expenditure when surgical care is required.

Conclusions

Both protection from impoverishment and catastrophic expense are important indicators: Individuals can be pushed further into poverty by accessing surgical care without meeting thresholds for catastrophic spending, and vice-versa. This new dataset allows each national government to assess the degree of financial risk borne by its population, and to develop policies to meet the targets set out by the World Bank and the WHO by 2030.

Modelled estimates of catastrophic and impoverishing expenditure, as well as cost data provided by ministries, are available in **Appendix 5**.

[19] World Health Organization and World Bank Group. Monitoring progress towards universal health coverage at country and global levels. Geneva, Switzerland: WHO press; 2015.
[20] Meara JG, Leather AJ, Hagander L, et al. Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Lancet* 2015.

Appendices 1-5: Datasets for each indicator

1. Indicator 1: Access to timely essential surgery—see accompanying file *Appendix1_Ind1_WDI_2015.xlsx*
2. Indicator 2: Specialist surgical workforce density—see accompanying file *Appendix2_Ind2_WDI_2015.xlsx*
3. Indicator 3: Surgical volume—see accompanying file *Appendix3_Ind3_WDI_2015.xlsx*
4. Indicator 4: Perioperative mortality rate—see accompanying file *Appendix4_Ind4_WDI_2015.xlsx*
5. Indicator 5: Protection against catastrophic and impoverishing expenditures for surgical care—see accompanying file *Appendix5_Ind5&6_WDI_2015.xlsx*

Appendix 6: Acknowledgements

This work would not have been possible without assistance from colleagues in surgery, health policy, and public health around the world. We would like to take the opportunity to thank members of the following institutions for their support:

Permanent Mission of the Principality of Andorra to the United Nations
Hospital Nostra Senyora de Meritxell, Principality of Andorra
Department of Health: Research, Data, and Evaluation Division, Commonwealth of Australia
Royal Australasian College of Surgeons
Federal Ministry of Health, Republic of Austria
Ministry of Social Affairs and Public Health, Kingdom of Belgium
Ministry of Health, Belize
Ministry of Health, Federative Republic of Brazil: DATASUS
National Statistical Institute, Republic of Bulgaria
Canadian Institutes for Health Information
Ministry of Health and Culture, Cayman Islands
Central Freedom of Information Unit, States of Jersey
National Health and Family Planning Commission of the People's Republic of China
International Federation of Medical Student Associations-China
Croatian National Institute of Public Health
Cyprus Ministry of Health, Statistical Service of Cyprus
Ministry of Health of the Czech Republic
Statens Serum Institut, Kingdom of Denmark
Ministry of Health, Social Services, and Equality, Republic of Ecuador
National Institute for Health Development, Republic of Estonia
Eurostat: The statistical office of the European Union
Colonial War Memorial Hospital, Republic of Fiji
National Institute for Health and Welfare, Republic of Finland
Ministry of Social Affairs, Health, and Women's Rights, French Republic
Ministry of Health and Research, French Polynesia
German Medical Association
Hellenic Statistical Authority
Ministry of Public Health and Population, Republic of Haiti
Department of Health, Hong Kong Special Administrative Region
Ministry of Welfare, Republic of Iceland
Department of Health, Ireland
Department of Health and Social Care, Isle of Man
National Institute of Statistics, Italian Republic

Ministry of Health, Republic of Kenya, Medical Practitioners and Dentists Board, Kenya
Hospital and University Clinical Service of Kosovo
Ministry of Health, Kyrgyz Republic
Ministry of Health, Republic of Latvia
Office of Health, Principality of Liechtenstein; Embassy of Liechtenstein, USA
Ministry of Health, Republic of Lithuania
Ministry of Health, Grand Duchy of Luxembourg
Mater Dei Hospital, Republic of Malta
Department of Social Affairs and Health, Principality of Monaco
Mongolian National University of Medical Sciences
National Program in Surgery, Republic of Mozambique
Department of Surgery, University of Medicine 1, Republic of the Union of Myanmar
University of Namibia; Medical and Dental Council of Namibia
Statistics Netherlands
Ministry of Health, New Zealand
Perioperative Mortality Review Committee, Health Quality and Safety Commission, New Zealand
National Hospital of Niamey, Ministry of Public Health, Republic of Niger
Commonwealth Healthcare Corporation, Commonwealth of the Northern Mariana Islands
Norwegian Directorate of Health
Norwegian University of Science and Technology
Ministry of Health, Republic of Peru
University of the Philippines Manila
Ministry of Health, Republic of Poland
Statistics Portugal, Portuguese Medical Association
Romanian National Institute of Statistics
Ministry of Health, Republic of Seychelles
Embassy of the Slovak Republic, Ministry of Health, Slovak Republic
National Institute of Public Health, Republic of Slovenia
National Referral Hospital, Honiara, Solomon Islands
Ministry of Health, Republic of South Sudan
Ministry of Health, Social Services, and Equality, Kingdom of Spain
Ministry of Health, Democratic Socialist Republic of Sri Lanka
Ministry of Health, Wellness and the Environment, Saint Vincent and the Grenadines
National Board of Health and Welfare, Sweden
Swiss Federal Statistical Office
Swiss Medical Association (FMH)
Ministry of Health and Welfare, Taiwan
Ministry of Health and Social Welfare, Republic of the Gambia
Vaiola Hospital, Kingdom of Tonga

General Directorate for Health Services, Ministry of Health and ESPC Higher Education Statistics, Republic of Turkey

Princess Margaret Hospital, Tuvalu

Department of Surgery, University of Utah School of Medicine

Intermountain Surgical Specialists, Utah, USA

State University of Zanzibar

Ministry of Health, Republic of Zimbabwe

University of Zimbabwe

Asia Pacific Association of Medical Journal Editors

Appendix 7: Communications with country contacts

English

Dear Dr XXX,

In many countries access to surgery is not optimal, and many people die or are unable to work as a result. In recognition of this, in October 2013, we started a commission on global surgery to determine the number of people in the world who lack access to surgery, how to improve access to surgery, and the economic benefits for countries of doing so. As part of that process, the Lancet Commission on Global Surgery found that five billion people lack access to safe, affordable surgical and anaesthesia care when they need it.

Publishing the report was just the first step in the process of helping countries and regions to improve their surgical services if needed. Now that this is done, we are collecting data to get a more accurate idea of surgical systems worldwide and how to strengthen these.

The Commission developed a set of indicators that will point to opportunities for strengthening the surgical system in each country. The World Bank would like to publish these data as part of their World Development Indicators.

We would appreciate your help in finding the most accurate data for your country.

For your country, we have estimated that there are:

- XXX qualified, licensed surgeons, anaesthetists, and obstetricians in practice (year), and
- XXX total surgical procedures per 100,000 people performed every year (year)

But we recognize that these are just estimates and that they may not accurately reflect the situation in your country. ***If your government is able to provide data on any of the following****, it would greatly facilitate the development of country-specific recommendations for surgical systems strengthening.*

- Surgical Workforce
    - Number of qualified, licensed surgeons actively working in your country
        - This includes all surgical specialties, but excludes generalist physicians providing surgery and non-physician clinicians
    - Number of qualified, licensed anaesthetists actively working in your country
        - This includes all anaesthetic specialties, but excludes generalist physicians providing anaesthesia and non-physician clinicians
    - Number of qualified, licensed obstetricians actively working in your country
        - This includes all specialist obstetricians, but excludes generalist physicians providing obstetric care and non-physician clinicians
- Surgical volume and perioperative mortality
    - Total surgical volume in your country (number of surgical procedures per year)

    - Number of caesarean sections, laparotomies, and open fracture repairs performed per year in your country
    - Number of people who die each year in your country following any surgical procedure (please specify either in-hospital deaths or deaths within 30 days of procedure)
- Cost of a caesarean section, laparotomy, and open fracture repair at a first-level hospital and at a tertiary hospital in your country
- Locations of all hospitals in your country providing all of these three procedures
- Sources of the above information (for example, Ministry of Health or professional societies)

With best wishes,

The Lancet Commission on Global Surgery

Commissioners
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French

Cher Dr XXX,

Veuillez recevoir nos salutations les plus distinguées.

Dans de nombreux pays, l'accès à la chirurgie est sous-optimal et beaucoup de gens se retrouve par conséquent invalidé ou pire encore en meurent. En connaissance de cause, en Octobre 2013 nous avons commencé une Commission sur la Chirurgie Mondiale visant à déterminer le nombre de personnes à travers le monde n'ayant pas d'accès aux services chirurgicaux; la façon d'améliorer l'accès à ces services et les avantages économiques qu'un investissement en chirurgie pourrait apporter dans chaque pays. Dans le cadre de ce processus, la Commission Lancet sur la Chirurgie Mondiale a révélée que cinq milliards de personnes souffrent d'un manque d'accès à des soins chirurgicaux et d'anesthésie sécuritaires et abordables quand ils en ont besoin.

La publication de ce rapport n'était que la première étape d'un processus visant à aider ces pays et régions à améliorer leurs services chirurgicaux selon leurs besoins.

Maintenant, nous recueillons des données supplémentaires qui nous aideront dans le développement d'une meilleure compréhension des différents systèmes chirurgicaux à travers le monde. La Commission a élaboré un ensemble d'indicateurs qui faciliteront la reconnaissance d'opportunités pouvant mener à la fortification des différents systèmes chirurgicaux de chaque pays. La Banque Mondiale souhaite publier ces données dans le cadre de leurs Indicateurs de développement dans le monde (WDI).

Nous apprécierions votre aide dans le recueillement d'informations plus précises concernant votre pays.

Nous avons estimé qu'il y a dans votre pays:
XXX chirurgiens, anesthésistes, et obstétriciens qualifiés et avec un permis de pratique, ayant une pratique active (year) et
XXX procédures chirurgicales par 100.000 personnes réalisées chaque année (year)

Nous reconnaissons que ces chiffres ne sont que des estimations et qu'il est possible qu'ils ne reflètent pas la véritable situation dans votre pays. De ce fait, si votre gouvernement est en mesure de nous fournir des données plus justes, cela faciliterait grandement le développement de recommandations spécifiques afin de fortifier le système chirurgical dans chaque pays.

Si possible, nous aimerions obtenir les données suivantes :
1. Main-d'œuvre chirurgicale

- Nombre de chirurgiens qualifiés avec un permis de pratique, travaillant activement dans votre pays

Cela comprend toutes les spécialités chirurgicales excluant les médecins généralistes et autres cliniciens qui ne sont pas des médecins offrant des services chirurgicaux

- Nombre d'anesthésistes qualifiés avec un permis de pratique, travaillant activement dans votre pays

Cela comprend toutes les spécialités anesthésiques excluant les médecins généralistes et autres cliniciens qui ne sont pas des médecins offrant des services d'anesthésie

- Nombre d'obstétriciens qualifiés avec un permis de pratique, travaillant activement dans votre pays

Cela comprend tous les obstétriciens spécialisés, excluant les médecins généralistes et autres cliniciens qui ne sont pas des médecins offrant des soins obstétricaux

2. Le volume chirurgical et la mortalité péri-opératoire

- Le volume chirurgical dans votre pays (nombre d'interventions chirurgicales par an)
- Nombre de césariennes, laparotomies et réparations de fractures ouvertes réalisées par an dans votre pays
- Nombre de personnes qui meurent chaque année dans votre pays après toutes interventions chirurgicales

3. Coût d'une césarienne, laparotomie, et réparation d'une fracture ouverte dans un hôpital de premier niveau et dans un hôpital de soins tertiaries

4. Emplacement de tous les hôpitaux de votre pays qui fournissent ces trois procedures

5. Les sources d'ou proviennent l'information donnée ci-dessus (par exemple, le Ministère de la Santé ou des associations professionnelles)

Nous vous remercions pour votre participation dans ce projet,

Avec nos meilleurs vœux,

La Commission Lancet sur la Chirurgie Mondiale

Commissaires
John Meara (USA), Andy Leather (UK), Lars Hagander (Sweden), Edna Adan Ismail (Somaliland), Eunice Merisier Derivois (Haiti), Nivaldo Alonso (Brazil), Emmanuel Ameh (Nigeria), Lesong Conteh (UK), Anna Dare (UK), Shenaaz El-Halabi (Botswana), Paul Farmer (USA), Rowan Gillies (Australia), Sarah

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Spanish

Estimado Dr. XXX,

Es un gusto saludarlo y amablemente pedir su colaboración en un proyecto de cirugía global. En el mundo, el acceso a servicios quirúrgicos no es óptimo. Muchas personas mueren o viven discapacitadas sin poder trabajar a causa de no tener acceso a una cirugía. Al reconocer esta realidad, en Octubre del 2013 comenzamos la comisión en cirugía global con tres fines: calcular el número de personas alrededor del mundo sin acceso a cirugía, investigar cómo mejorar el acceso a servicios quirúrgicos y dar a conocer los beneficios económicos que esto implica para cada país. Como parte de este proceso, la Comisión Lancet de Cirugía Global determinó que cinco billones de personas alrededor del mundo no tienen acceso a servicios quirúrgicos y anestesia que sean seguros y económicamente accesibles cuando las personas lo requieren.

La publicación fue el primer paso para ayudar a los países y regiones (que consideren necesario) mejorar sus servicios quirúrgicos. Ahora finalizado el reporte, estamos colectando datos para entender a fondo los sistemas de servicios quirúrgicos a nivel mundial y ver como se podrían fortalecer.

La Comisión desarrolló un grupo de indicadores que identifican oportunidades para fortalecer el sistema quirúrgico en cada país. El Banco Mundial busca publicar estos datos como parte de los Indicadores del Desarrollo Mundial.

Agradeceríamos su ayuda en identificar los datos más precisos para your country.

Para your country, hemos estimado que hay:

- XXX cirujanos, anestesiólogos y obstetras con licencia y practicando (year)
- XXX procedimientos quirúrgicos por 100000 personas por año (year)

Sin embargo, reconocemos que estos son solo estimados y que los números posiblemente no reflejen la realidad en su país. ***Si su gobierno podría proporcionar los datos de los siguientes puntos,*** *facilitaría el desarrollo de las recomendaciones específicas para su país con el fin de fortalecer el sistema de cirugía.*

1. Fuerza Laboral Quirúrgica
   - Número de cirujanos con licencia, calificados y activamente en práctica en su país.
     - Esto incluye todas las especialidades de cirugía, pero excluye médicos generales que proveen servicios quirúrgicos o médicos sin licencia.
   - Número de anestesiólogos con licencia, calificados y activamente en práctica en su país.
     - Esto incluye todas las especialidades de anestesia, pero excluye médicos generales quienes proveen servicios de anestesiología o médicos sin licencia.
   - Número de obstetras con licencia, calificados y activamente en práctica en su país.

- Esto incluye todas las especialidades de obstetricia, pero excluye médicos generales quienes proveen servicios de obstetricia o médicos sin licencia.

2. Volumen de Procedimientos Quirúrgicos
   - Volumen total quirúrgico en su país (número de procedimientos quirúrgicos por año).
   - Número de cesárias, laparotomías y fracturas abiertas por año en su país (en caso que sea disponible).
   - Número de personas quienes mueren anualmente en su país después de recibir cualquier procedimiento quirúrgico (por favor especificar si el fallecimiento ocurrió en el hospital o si sucedió dentro de un periodo de 30 días después del procedimiento).

3. El costo de una cesária, laparotomía y reparación de fractura abierta en un hospital de 1er nivel y también en un hospital de 3er nivel en su país.

4. Localidad de los hospitales en su país que proveen todos los procedimientos mencionados previamente.

5. Fuente de la información adquirida (por ejemplo, ministerio de salud o sociedad profesional).

Gracias por su colaboración.

Sinceramente,

La Comisión Lancet de Cirugía Global

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Appendix 8: Errata

Page 12: A previous version listed Sweden's coverage at 91.0%. This was incorrect, due to a technical error. The correct value is 99.6%.