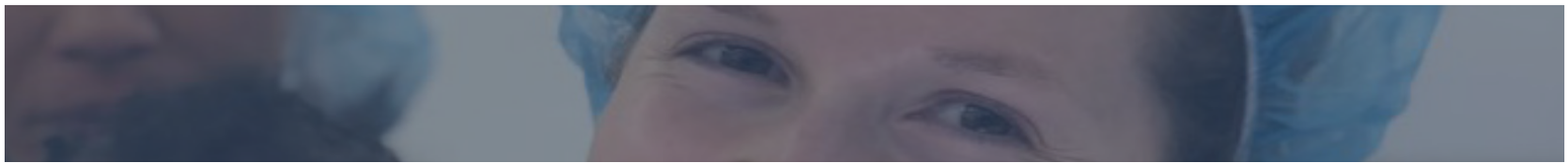
Global Surgery & Anaesthesia Statistics

The Importance of Data Collection

G4 alliance
surgical, obstetric, trauma & anaesthesia care

GGSA

PROGRAM IN GLOBAL SURGERY AND SOCIAL CHANGE
Harvard Medical School



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ABBREVIATIONS

DCP3	Disease Control Priorities 3
EHR	Electronic Health Records
G4 Alliance	Global Alliance for Surgical, Obstetric, Trauma, and Anaesthesia Care
GDP	Gross Domestic Product
GIEESC	Global Initiative on Emergency and Essential Surgical Care
GSSA	German Global Surgery Association
HIS	Health Information Systems
IHS	Integrated Household Survey
LCoGS	Lancet Commission on Global Surgery
LMIC	Low- and Middle-Income Countries
MEASURE DHS	Monitoring and Evaluation to Assess and Use Results, Demographic and Health Surveys
MICS	Multiple Indicator Cluster Surveys
MoH	Ministry of Health
NGO	Non-Governmental Organization
NSO	National Statistics Office
PGSSC	Program in Global Surgery and Social Change
PHR	Personal Health Records
POMR	Perioperative Mortality Rate
SARA	Service Availability and Readiness Assessment
SDGs	Sustainable Development Goals
SPA	Service Provision Assessment
UHC	Universal Health Coverage
USAID	United States Agency for International Development
WDI	World Development Indicators
WHA	World Health Assembly
WHO	World Health Organization
WHO-SAT	World Health Organization Situational Analysis Tool

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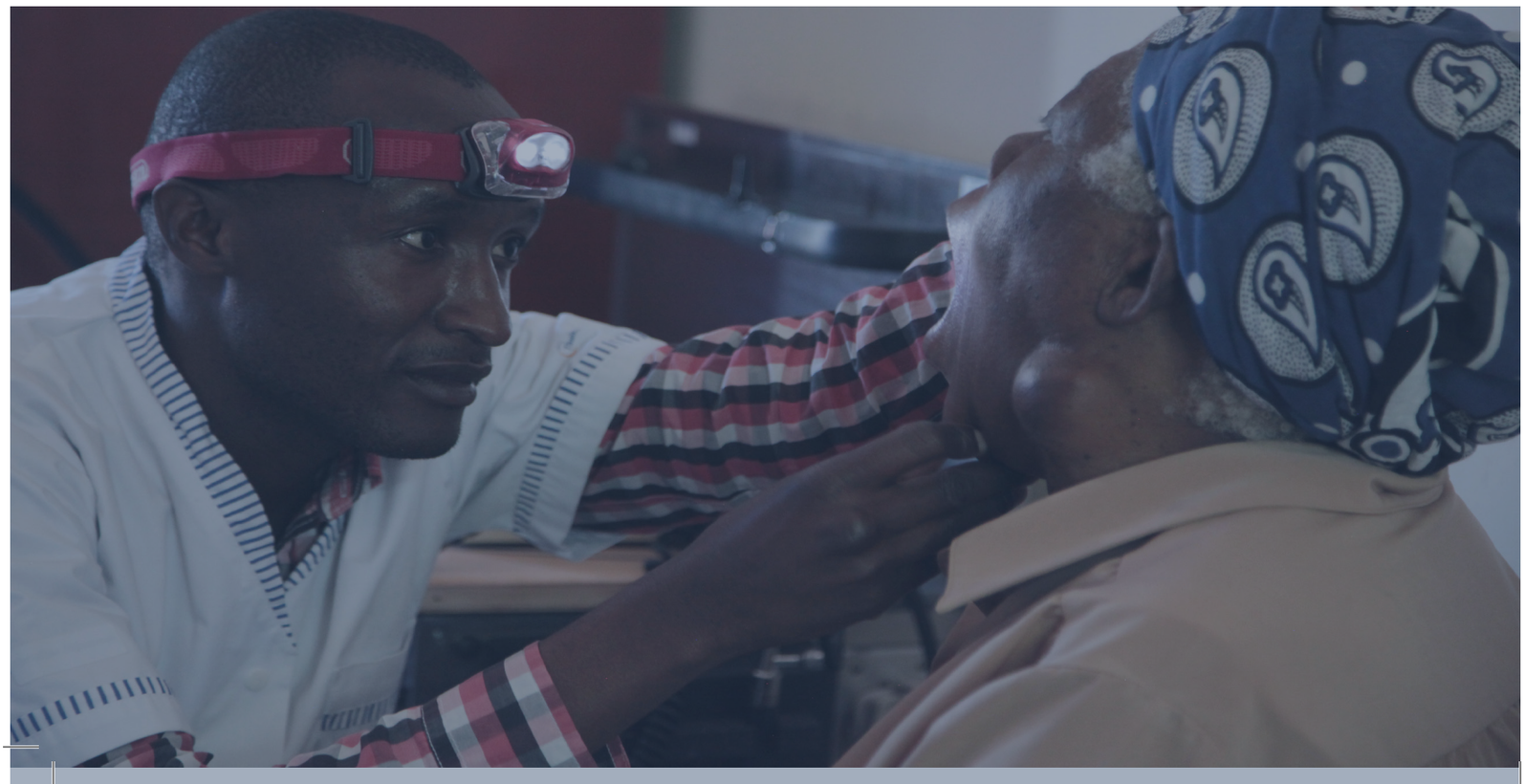

EXECUTIVE SUMMARY

The Sustainable Development Goals (SDGs) represent a new global agenda that calls for universal action to eradicate poverty, protect the planet and support greater peace and prosperity for all. This inclusive and interconnected agenda provides guidelines and targets for countries and international organizations to track national and global progress, while working collectively towards sustainable development.

One of the core tenets of the SDGs is universal health coverage (UHC), which calls upon world leaders to ensure that all people around the world have access to effective, affordable and quality health care when needed. The provision of surgical and anaesthesia care represents an integral component of UHC and the SDGs.

Recognizing this important linkage, World Health Organization (WHO) Member States unanimously approved resolution WHA68.15 during the World Health Assembly in May 2015, calling for strengthening of emergency and essential surgical and anaesthesia care as an integral part of UHC. This resolution urges countries to prioritize surgical and anaesthesia care as part of national health plans, emphasizing the importance of service delivery, quality, training, workforce, infrastructure and data collection to support monitoring and evaluation.

Despite this global momentum, there remains a paucity of data and information on global surgical and anaesthesia care. Experts estimate that nearly 5 billion people do not have access to safe, affordable surgical and anaesthesia care, contributing to as many as 17 million deaths each year. For those who are able to access care, out of pocket costs can be devastating. An estimated 81 million people are impoverished each year seeking essential surgical services.

When integrated as part of health systems, surgical care represents one of the most cost-effective public health interventions. Integrating safe, effective and affordable surgery into existing health systems has been shown to contribute to economic gains. For every $1 invested in surgical capacity building at the community level, $10 is generated through increased health and productivity.

Aligning surgical and anaesthesia care as part of UHC is a powerful strategy for saving lives, and contributes to the broader sustainable development agenda. However, a robust indicator framework will be essential to guide national, regional and global interventions, and to track progress towards UHC and the sustainable development agenda. The availability of surgical and anaesthesia data will further provide governments with the information needed to develop, implement and monitor national policies and allocate resources effectively.

This consensus statement focuses on the importance of data collection for surgical and anaesthesia care as an integral part of the SDG framework. The authors and signatories of this statement call for the establishment of an expert working group to analyze and provide recommendations on global surgery and anaesthesia statistics to be presented to the United Nations Statistical Commission in 2019.

To date, more than 120 global organizations have banded together in support of this consensus statement. If your organization would like to join this global call to action, we invite expressions of interest to be sent to the publishers at:
contact@theg4alliance.org.

SIGNATORIES

This publication has been endorsed by the following global organizations. Signatories support the recommendations set out in this report.

1. 2nd Chance Association
2. African Agency for Integrated Development
3. Aga Khan Hospital Mombasa
4. Alazhari Health Research Center Alzaeim Alazhari University
5. Alliance for Surgery and Anesthesia Presence
6. American College of Oral and Maxillofacial Surgeons
7. Arbutus Medical
8. Athiriver Shalom Community Hospital
9. Brain Spine and Rehabilitation Hospital
10. Brigham and Women's Hospital Center for Surgery and Public Health
11. Canadian Anesthesiologists Society International Education Foundation
12. Center for Global Surgery of the McGill University Health Center
13. Cents of Relief
14. ChildKind International
15. Coast General Hospital
16. Compassionate Resource Warehouse
17. College of Surgeons of East, Central and Southern Africa
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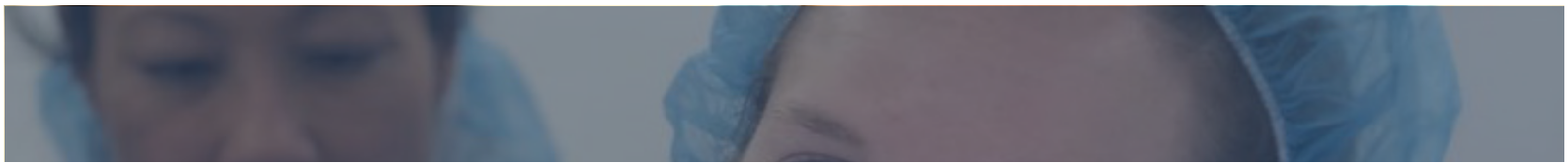
24. Dire Dawa University
25. Discovery Health
26. Dutch Obstetric Anesthesia
27. Edward Francis-Small Teaching Hospital, The Gambia
28. Egerton University Faculty of Health Sciences
29. Ethiopian Society of Anesthesiologists
30. Fernando Arias
31. FHI 360
32. Fistula Foundation
33. Flowminder Foundation
34. General Hospital Minna, Nigeria
35. German Global Surgery Association
36. Global Paediatric Surgery Network
37. Global Pediatric Surgical Technology and Education Project
38. Golden Hour Films
39. Gradian Health Systems
40. Harare Central Hospital
41. Haukeland University Hospital, Department of Anaesthesia and Intensive Care
42. HEAL Africa
43. HG Gulf FZ LLC
44. Hospital Clinica Kennedy, Guayaquil-Ecuador
45. Hospital Español de Veracruz
46. ICF International
47. International Student Surgical Network
48. International Association of Oral and Maxillofacial Surgeons
49. International Collaboration for Essential Surgery
50. International College of Surgeons
51. International Federation of Nurse Anesthetists
52. International Federation of Surgical Colleges
53. International Society for Burn Injuries
54. International Society of Surgery
55. Interplast Germany Munich
56. Jackson Fiah Doe Memorial Regional Referral Hospital
57. Jhpiego
58. Johns Hopkins University
59. Jos University Teaching Hospital
60. Kamenge Military Hosital
61. Kamuzu Central Hospital
62. Karolinska Institutet



63. King's Centre for Global Health & Health Partnerships, King's College London
64. King Faisal Hospital, Kigali
65. Korle-Bu Neuroscience Foundation
66. Lifebox
67. Lodwar County Referral Hospital
68. Lund University
69. Lurie Children's Hospital
70. Makerere University
71. Mazabuka General Hospital
72. Mending Kids
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100. Society of Obstetric Anaesthetists of Nigeria
101. St. Francis Community Mission Hospital
102. Stanford Surgery
103. Sudanese Urological Association
104. Surgery For the People/Operation Smile Nicaragua
105. Surgical Section, Vaiola Hospital, Nukualofa, Tonga
106. SURG UP
107. Tamale Teaching Hospital, Tamale-Ghana
108. The Finnish Association of Nurse Anesthetists
109. The G4 Alliance
110. The Indus Hospital
111. Topigs
112. UCSF Center for Global Surgical Studies
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118. University of Edinburgh / National Institute for Health Research Unit on Global Surgery
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121. University of Toronto
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123. Utopian Health Services Ltd
124. Vraeyda Media
125. WHO Collaborative Centre for Surgery and Public Health at Lund University
126. World Federation of Associations of Pediatric Surgery
127. World Federation Of Neurosurgical Societies
128. World Federation of Societies of Anaesthesiologists
129. World Health Organization

Global Surgery & Anaesthesia

Introduction

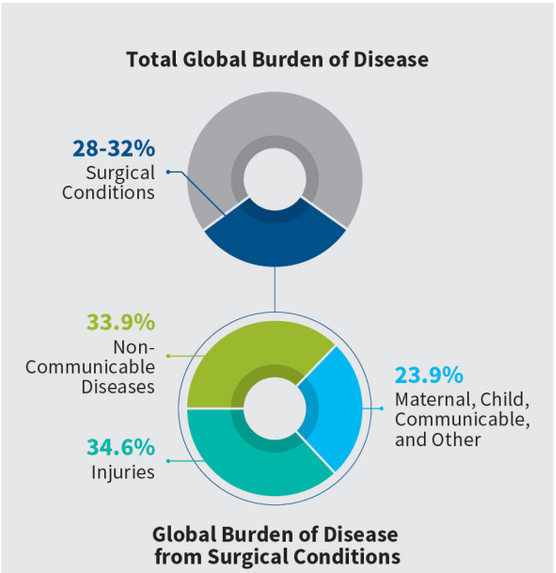
There is increasing acknowledgement of the linkages among universal access to surgical, obstetric and anaesthesia care, global health and sustainable development. Within the context of the 2030 agenda with its seventeen Sustainable Development Goals (SDGs), the aspiration for universal health coverage (UHC) and the 2015 World Health Assembly (WHA) Resolution 68.15, recognizing the importance of surgical care and anaesthesia as part of UHC,[1] there has never been a more opportune time for the international community, members of the research community, and the medical communities to merge efforts to support the integration of surgical and anaesthesia care into the global health agenda.

In the report "Global Surgery 2030: Evidence and Solutions for Achieving Health, Welfare, and Economic Development", the Lancet Commission on Global Surgery (LCoGS) highlighted that worldwide, five billion people do not have access to safe, affordable surgical and anaesthesia care when needed, and that between 28 percent and 32 percent of the global burden of disease requires surgical care, anaesthesia management, or both (Figure 1).[2,3] Access is most limited in low- and middle-income countries (LMICs), where nine out of ten people cannot access basic surgical care. Untreated, many surgical conditions are a source of lifetime disability and can cause premature mortality[4] – surgical conditions claim an estimated 16.9 million lives per year.[5]

In 2012, it was estimated that 143 million additional surgical procedures are needed in LMICs every year to prevent disability, economic loss, and to save lives. Of the 313 million procedures undertaken worldwide each year, only 6 percent occur in the poorest countries, where over one third of the world's population lives (Figure 2).[6] Low operative volumes are associated with higher case-fatality rates from common, treatable surgical conditions. The unmet need is greatest in eastern, western, and central sub-Saharan Africa, and south Asia.

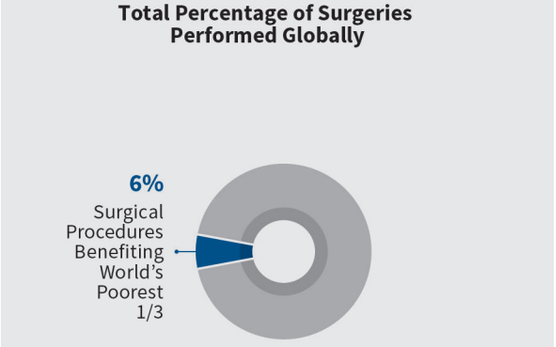
In 2015, the World Bank launched the first volume of its Disease Control Priorities 3rd edition (DCP3), dedicated to Essential Surgery, where 44 surgical procedures were identified as essential for population health.[7] The scope of diseases requiring

Figure 1. The Scale of the Problem



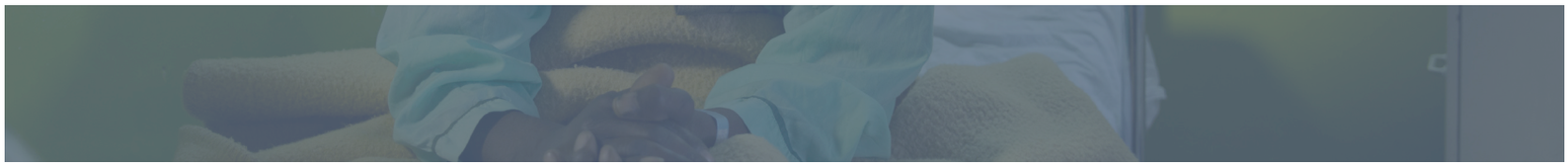
Source: Shrime MG, Bickler SW, Alkire BC, et al., 2015, and Rose et al. 2015

Figure 2. Disparity in Global Distribution of Surgical Procedures



The poorest 1/3 of the global population receives only 6% of all sugeries performed. To close this global gap, 143 million additional surgical procedures are needed.

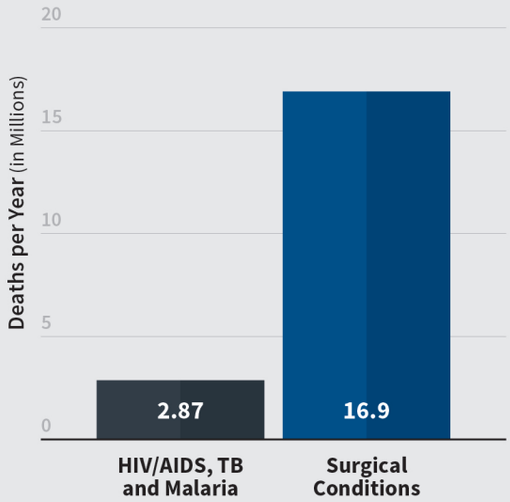
Source: Meara, et al. 2015.



surgical capacity is broad and includes the growing burden of non-communicable diseases such as diabetes, cardiovascular disease and cancer (Figure 3)[8,9,10] as well as injuries, including those sustained during humanitarian crises and conflicts. There is considerable regional and national heterogeneity in which surgical procedures are prioritized based on surgical capacity as well as the local epidemiology and disease burden.

Further, it is estimated that 33 million individuals face catastrophic health expenditure[11] due to out-of-pocket payments for surgery and anaesthesia care each year. Catastrophic expenditure is defined as the health expenditures greater than or equal to 40 percent of a household's non-subsistence income.[12] An additional 48 million cases of catastrophic expenditure are attributable to the non-medical costs of accessing surgical care such as transportation.[13,14] Globally, a quarter of people who have a surgical procedure 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 countries the financial burden inevitably lands most heavily on the poor.

Figure 3. Comparison of Leading Causes of Mortality



Surgical conditions kill more people each year than HIV/AIDS, TB, and malaria combined. Disparities in access to safe, quality emergency and essential surgical care and unmet surgical needs result in increased death and disability.

Source: Meara, et al. 2015, and WHO Global Health Estimates 2015

Investing in surgical services in LMICs is affordable, saves lives, and promotes economic growth. The cost to scale up surgical systems to meet the minimum requirements suggested by the LCoGS in LMICs is estimated at US$420 billion.[15] This is a small investment when compared to the estimated US$12.3 trillion loss of production in these countries if this is not undertaken.[16]

It is also important to see that the major shifts in global population dynamics will increase the need for working surgical systems in the future, through changing levels and trends in fertility, mortality, urbanization and migration. Demographic and epidemiological transitions are reshaping the requirements for investments in health. The rights of the individual, and a host of other related policy measures, as well as increasing life expectancy represent major challenges in addressing issues related to health care access.

The demographic structure, pace of growth and relative size of a population impacts the current and future demand for surgical care. This growth is primarily driven by the gender and age structure of sub-Saharan Africa and Southern Asia, despite the decrease in average number of births per woman. By 2030, the number of women in reproductive age in sub-Saharan Africa is projected to increase by 65 percent, to 353 million women.[17] All other regions of the world have already witnessed a peak in the size of their young population. In 2015, 42 percent of sub-Saharan Africa's population was under the age of 14 years, and there were 1.2 billion young people between the age of 15 and 24 years. Children under the age of 14 comprise up to half of the population in the lowest-resource areas, and have high levels of surgical need.[18] Overall, there is a gross mismatch between the number of children and the number of health providers to take care of them. As most efforts directed at reducing the high rates of infant and child mortality have overlooked the surgical needs of children, the mismatch is even greater when it comes to surgical providers trained in the care of children.[19] Greater longevity presents major challenges in addressing issues related to healthcare access and

quality. These structural changes are reshaping the requirements for investing in health and changing related policy measures. Population growth plays an essential role in achieving universal access to surgical and anesthesia care, including basic health services.

The world population continues to grow, although at a slower pace than in recent decades. World population growth has declined from 1.24 percent per year in 2005 to 1.18 percent in 2015. Between 2015 and 2050 an estimated 2.4 billion people are projected to be added to the world population. The implications of population growth are particularly relevant for Africa. More than half of global population growth until 2040 is projected to occur in Africa, the region with the highest rate of population growth currently growing at 2.55 percent annually and expected to remain above 2 percent per year through 2050. 1.3 billion people will be added in Africa, followed by Asia, Northern America, Latin America and the Caribbean and Oceania. Average annual rates of population change in 2015 ranged between 1.3 percent in Latin America, 1.2 percent in Asia, 0.85 percent in Northern America and 0.1 percent in Europe.[20]

In light of all of the above, and with the 2015 WHA Resolution 68.15 'Strengthening emergency and essential surgical care and anaesthesia as a component of universal health coverage'[21] recognizing the importance of surgical care and anaesthesia as part of UHC and the SDGs as well as WHA Decision Point 70.22[22] mandating Member States to report on implementation of Resolution 68.15, there has never been a more opportune time for the international community, including members of the research and medical communities, to join efforts to support the integration of surgical and anaesthesia care into the global health agenda.

Surgery and anaesthesia are an "indivisible, indispensable part of health care."[23] Indeed, surgical and anaesthesia services are a prerequisite for all people to live to their fullest potential and for the attainment of local and global health goals in areas as diverse as cancer, injury, cardiovascular disease, infections, pain management, and reproductive, maternal, neonatal and child health. Within the changing global health landscape, surgical, obstetric and anaesthesia care should therefore form an integral component of national health systems in all countries. It will be impossible to achieve the health aspirations set out in the 2030 agenda and its 17 SDGs without ensuring that safe, timely, and affordable surgical, obstetric, trauma and anaesthesia care are available and accessible (Figure 4).[24]

1 NO POVERTY	Improved access to safe, timely, and high-quality surgical, obstetric, trauma, and anaesthesia care contributes directly to preventing individuals from falling into extreme poverty. • 33 million individuals face catastrophic health expenditure due to out-of-pocket payments 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 such as transportation.
3 GOOD HEALTH AND WELL-BEING	Surgical care is essential to ensure healthy lives and promote well-being for all. It addresses infectious conditions, NCDs, and injuries and is a necessary component of Universal Health Coverage. • Each year, an estimated 17 million people die preventable deaths due to untreated surgical conditions. • 60% of cancers will require surgical intervention. • Improvements in trauma care, including essential surgery, could save up to 2 million lives in LMICs each year.
5 GENDER EQUALITY	Essential surgical care, including the availability of emergency cesarean section, is critical for achieving gender equality and empowering all women and girls. • 2-3 million women live with obstetric fistula, a surgically treatable condition, resulting from neglected obstructed labor, with up to 100,000 new cases added every year. • Timely detection and obstetric surgery can prevent up to 90% of maternal deaths.

Source: The G4 Alliance "SDG Infographic.pdf," 2017, accessed Feb. 2018.

Definitions

Definitions for key terms to be used in this statement include:

Global Surgery
Global surgery encompasses anesthesia, all surgical specialties including trauma surgery, general surgery, obstetrics & gynecology, perioperative medicine, critical emergency medicine, pain management and palliative care, rehabilitation, nursing and other health professions involved in the care of the surgical patient. Global surgery has been defined as "an area of study, research, practice, and advocacy that seeks to improve health outcomes and achieve health equity for all people who require surgical care, with a special emphasis on underserved populations and populations in crisis. It uses collaborative, cross-sectoral, and transnational approaches and is a synthesis of population-based strategies with individual surgical care."[25]

Essential Surgery
The International Collaboration for Essential Surgery defines essential surgery as "basic surgical procedures that prevent permanent disability & life-threatening complications […] and as simple, affordable surgery that saves lives."[26]

Surgery
The Cambridge dictionary further defines surgery as "the treatment of injuries or diseases in people […] by cutting open the body and removing or repairing the damaged part."[27]

Bellwether Procedures
The Bellwether Procedures have been defined by the LCoGS as "caesarean delivery, laparotomy and open fracture treatment" and "serve as proxy indicators for surgical systems that have the ability to provide a broad range of procedures."[28]

Measurement in Global Surgery

Surgical and anaesthesia services need to be adequately assessed for policy-makers and practitioners to be able to better meet present and projected demands. Indeed, measurement is the first step toward understanding and improvement. Yet, while a wealth of data has accumulated globally over the past decades in the areas of health and health care, there remains a dearth of data specific to surgical and anaesthesia care. This poses a challenge for policymakers in attempting to improve such services, as they cannot plan for what they cannot measure. At the global level, data are necessary to monitor progress towards UHC and the health-related SDGs.

The availability, accessibility and use of high-quality, timely and reliable data on surgery and anaesthesia need to be significantly increased, especially in resource poor areas. Experts in the field of global surgery have identified a clear need for the collection of a standardized set of indicators to monitor surgical systems.

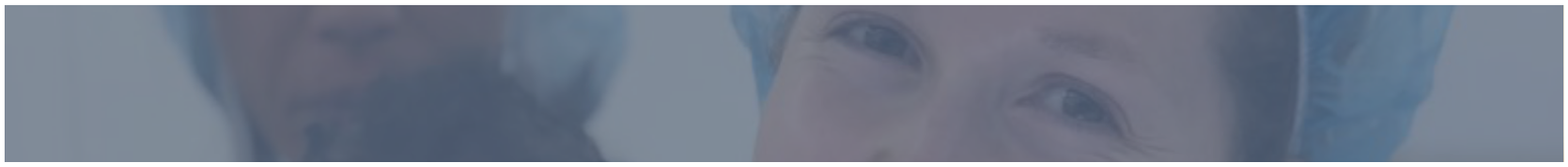
Recognizing the paucity of global data on surgery and anaesthesia, in 2015 the WHA resolution 68.15 urged Member States to collect and compile data on number, type and indications of surgical procedures, referrals and perioperative mortality in their respective countries, and to share such data as appropriate. This resolution further called upon the Director General to establish mechanisms to collect emergency and essential surgical and anaesthesia case log data, to devise relevant, meaningful and reliable measures of access to and safety of surgical and anaesthesia care, and to collect, assess and report related cost data on the delivery of emergency and essential surgical care.

During the 70th WHA in 2017, Member States approved an amendment to WHA resolution 69.11 on Health in the 2030 Agenda for Sustainable Development (decision point 70.22) calling upon the WHO Director-General to report every 2 years on progress towards strengthening emergency and essential surgical care and anaesthesia as a component of UHC, as detailed in WHA resolution 68.15. This further strengthened the imperative to measure surgical indicators in order to track progress.[29] The WHO African Group, representing 47 Member States, further called for the development of a Global Plan of Action to support implementation of this resolution.

Current Global Surgery & Anaesthesia Metrics

In 2014, the Global Alliance for Surgical, Obstetric, Trauma, and Anaesthesia Care (The G4 Alliance), a coalition of member organizations from around the world committed to the common goal of achieving safe surgical and anaesthesia care for 80 percent of the world's population by 2030, launched a campaign to prioritize surgical care indicators.[30] As a result of this collective advocacy effort, the following indicators, directly or indirectly associated with surgical care, have been included in the latest 2015 revision of the WHO Core Reference List of 100 Core Health Indicators:[31]

- Access to Emergency Surgery: Percentage of the population that can access, within two hours, a facility that can perform emergency caesarean section, laparotomy and open fracture fixation.
- Health Worker Density and Distribution: Number of health workers per 1,000 population, disaggregated by number of surgeons, anaesthetists and obstetricians by place of employment (rural/urban and district).
- Perioperative Mortality Rate (POMR): All-cause death rate prior to discharge among patients having one or more procedures in an operating theatre during the relevant admission.
- Health Expenditure: Out-of-pocket payment on health as a percentage of current expenditure on health at sub-national level, by financing source, disease, main type of care and provider, socio-economic status.



These indicators correspond with the six indicators that were proposed by the LCoGS:

- Indicator 1. Access to Timely Essential Surgery: Proportion of the population that can access, within 2 hours, a facility that can do caesarean delivery, laparotomy, and treatment of open fracture (the Bellwether Procedures). *Target 1: A minimum of 80% coverage of essential surgical and anaesthesia services per country by 2030.*
- Indicator 2. Specialist Surgical Workforce Density: The number of specialist surgical, anaesthetic, and obstetric physicians who are working per 100,000 population. *Target 2: 100% of countries with at least 20 surgical, anaesthetic, and obstetric physicians per 100,000 population by 2030.*
- Indicator 3. Surgical Volume: Surgical procedures per 100,000 population per year. *Target 3: 80% of countries by 2020 and 100% of countries by 2030 tracking surgical volume; a minimum of 5,000 procedures per 100,000 population by 2030.*
- Indicator 4. Perioperative Mortality Rate (POMR): All-cause death rate prior to discharge among patients who have undergone a procedure in an operating theatre, divided by the total number of procedures, presented as a percentage. *Target 4: 80% of countries by 2020 and 100% of countries by 2030 tracking perioperative mortality; in 2020, assess global data and set national targets for 2030.*
- Indicator 5. Protection Against Impoverishing Expenditures for Surgical Care: Risk of impoverishment for people due to seeking surgical care. *Target 5: 100% protection against impoverishment from out-of-pocket payments for surgical and anaesthesia care by 2030.*
- Indicator 6. Protection Against Catastrophic Expenditures for Surgical Care: Risk of catastrophic expenditure for people due to seeking surgical care. *Target 6: 100% protection against catastrophic expenditure from out-of-pocket payments for surgical and anaesthesia care by 2030.*

Since 2015, the World Bank has accepted the six indicators for inclusion as World Development Indicators (WDI), of which four with sufficient available data can already be found on the World Bank Data catalog:

1. Specialist surgical workforce density
2. Surgical volume
3. Risk of impoverishing expenditure and
4. Risk of catastrophic expenditure[32]

Evaluation of the Present Situation & Need for Action

In July 2015, after the LCoGS report was published, Commission members at Harvard began to collect nationally representative data for each indicator in the 215 countries and independent economies recognized by the World Bank. The Program for Global Surgery and Social Change (PGSSC) based at Harvard Medical School led this collection. This was the first attempt to systematically and comprehensively gather primary data on surgical systems on a global scale so as to improve on previously modeled estimates. In 2017, a second round of data collection was carried out under the leadership of the King's College.

In November 2015, the first report on the six surgical indicators was created, with data received from 64 countries (Table 1).[33] Data were collected for all indicators and the volume of data was enough for primary data for indicator 2, and modeled data for indicators 3, 5 and 6 to be included in the 2015 World Bank Development Indicators taking a mixed methods approach to collect these data, including data retrieval through:

1. Direct contact with official bodies
2. Systematic reviews of published literature and
3. Internet searches of the grey literature[34]

Table 1. Core indicators for monitoring realization of universal access to safe, affordable surgical and anaesthesia care when needed

Indicator	Definition	Data Sources	Responsible Entity
Group 1: Preparedness for surgical & anaesthesia care			
Indicator 1. Access to timely & essential surgery	Proportion of the population that can access, within two hours, a facility that can do caesarean delivery, laprotomy and treatment of open fracture (the Bellwether procedures)	Facility records and population demographics	Ministry of Health
Indicator 2. Specialist surgical workforce density	Number of specialist surgical, anaesthetic, and obstetric physicians who are working, per 100,000 population	Facility records, data from training and licensing bodies	Ministry of Health
Group 2: Delivery of surgical & anaesthesia care			
Indicator 3. Surgical Volume	Procedures done in an operating theatre, per 100,000 population per year.	Facility records	Facility, Ministry of Health
Indicator 4. Perioperative Mortality Rate (POMR)	All-cause death rate prior to discharge among patients who have undergone a pocedure in an operating theatre, divided by the total number of procedures, presented as a percentage.	Facility records and death registries	Facility, Ministry of Health
Group 3: Impact of surgical and anaesthesia care			
Indicator 5. Protection against impoverishing expenditure*	Proportion of households protected against impoverishment from direct out-of-pocket payments for surgical and anaesthesia care.	Household surveys, facility records	Ministry of Health, World Bank, WHO, USAID
Indicator 6. Protection against catastrophic expenditure†	Proportion of households protected against catastrophic expenditure from direct out-of-pocket payments for surgical and anaesthesia care.	Household surveys, facility records	Ministry of Health, World Bank, WHO, USAID

Access, workforce, volume, and perioperative mortality indicators should be reported annually. Financial protection indicators should be reported alongside the World Bank and WHO measures of financial risk protection for universal health coverage. These indicators provide the most information when used and interpreted together; no single indicator provides an adequate representation of surgical and anaesthesia care when analysed independently. USAID-US Agency for International Development.
*Impoverishing expenditure is defined as being pushed into poverty or being pushed further into poverty by out-of-pocket payments.
†Catastrophic expenditure is defined as direct out-of-pocket payments of greater than 40% of household income net of subsistence needs.

Adapted from Meara, John G., et al. 2015"Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development." The Lancet 386.9993 (2015): 569-624.

The number of countries providing data for at least one time-point in the last five years along the six indicators varies significantly.

- **Indicator 1.** Access to Timely Essential Surgery - 33 countries
- **Indicator 2.** Specialist Surgical Workforce Density - 71 countries
- **Indicator 3.** Surgical Volume - 60 countries
- **Indicator 4.** Perioperative Mortality - 29 countries
- **Indicator 5.** Protection Against Impoverishing Expenditures for Surgical Care - 16 countries
- **Indicator 6.** Protection Against Catastrophic Expenditures for Surgical Care - 16 countries

The current metrics have a number of challenges and will require further refinement, alongside concerted efforts to improve the amount and quality of data collected.

As with all statistics, global surgery and anaesthesia statistics are dependent on definitions of statistical units and populations. Surgical target goals are based on ensuring that a certain percentage of the population has access to specific services or resources, or achieves a certain level of social, economic, or physical health. These measurements require a solid and regularly updated understanding of not only how many people live in a country, but where and who they are.[35]

Variables and classifications need to be properly defined and definitions uniformly applied by all countries. For many of these topics various data sources are necessary, including population and housing censuses, sample surveys, and health information systems.

The burden of surgical conditions is large and growing, due to changing disease profiles worldwide and population growth, and surgical care is needed across all disease categories. Given the interrelation between surgery and the wider health and social development of nations, other indicators, including demographic, socio-economic and financial indicators are important to understand surgical care and the needs of populations within these contexts, including population distribution by age, sex and geography, population density, geospatial information on health facilities, Gross Domestic Product (GDP) per capita, infrastructure development, electricity, water supply, health expenditure and out-of-pocket cost of surgery insurance systems. An important first step is to include surgically correctable disease and surgical and anaesthetic care within existing population and facility-based monitoring systems.

External partners have led previous global surgery data compilation efforts. Data on the LCoGS indicators have been retrieved by direct contact with Ministries of Health, literature reviews and search of grey literature sources and open source databases.[36] These exercises represent the first efforts to compile data on surgical care at a global scale.

To achieve national ownership and sustainability, national data collection processes need to be driven by the respective National Statistical Offices (NSOs) and Ministries of Health (MoH), as they are the key stakeholders in the collection and utilization of health statistics. National ownership in this process is essential, as national realities and priorities must guide data collection. As the same time, data collection across multiple countries must be harmonized and standardized to ensure comparability of data and benchmarking of achievements.

While individual countries bear the responsibility for collecting data on global surgery, international organizations could act as the disseminator of this information. Ideally the structure would be that Ministries of Health report data to the WHO, which would make this data freely and transparently available on the World Development Indicators platform of the World Bank. There is presently a Data Sharing Agreement in place between the WHO and the World Bank Group to support this process.

Despite surgical and anaesthesia data still being limited in availability, the use of the WHO Service Availability and Readiness Assessment (SARA) and the WHO Situation Analysis Tool (WHO-SAT) administered by the WHO Global Initiative for Emergency and Essential Surgical Care (GIEESC) have collected substantial data at the facility level. Other organizations have also contributed vastly to the systematic collection of data relating to surgical care.[37, 38, 39, 40]

Effective sampling methods represent a possible option to lessen the statistical burden placed on

the national statistical system while capturing representative data at the subnational level.

Current research collaboratives between the German Global Surgery Alliance and the WorldPop Project are exploring possible data capture techniques to accurately represent national data, respecting national statistical laws, while considering national budget and human resource constraints.

From early data collection initiatives, it has become apparent that the following goals need to be achieved:

- Consistency of terminology, definitions and data collection methodology;
- Explanations of terminology, definitions and methodology;
- Guidance on systematic operationalization and data collection mechanisms;
- Comparable internationally published global surgery statistics;
- Improved use of data at sub-national, national and global levels to improve services;
- Avoiding unnecessary data collection.

Data Sources for Surgical Statistics

Health information systems, hospital records, population and housing censuses, sample and household surveys, facility-based surveys, vital statistics systems and population registers are key examples of existing data collection mechanisms important for global surgery data collection. Each is presented in more detail below.

The main data sources for surgery statistics can be divided into two categories: 1) facility-based data such as hospital and facility records and individual patient records and 2) population-based approaches, including population and housing censuses, civil registration and vital statistics, and population sample surveys.

A number of data-collection approaches and sources could fit in both of the above categories and can provide important information that may not be available elsewhere, for instance health surveys, research, and information produced by community based organizations and professional medical associations.

Data from different sources are used for multiple purposes at different levels of the health care system:

Patient level data including information on the patients' demographics, diagnosis and treatment, serve as the basis for clinical decision-making. Population level data are essential for public health decision-making and can generate information not only about those who use health services but also about those who do not use them, and why.

Health facility level data, both from aggregated facility-level data and administrative data sources, enable healthcare managers to determine resource needs, guide purchasing decisions for medications, equipment and supplies, and develop community outreach. Data from health facilities can provide immediate and ongoing information relevant to public health decision-making, especially if data are of high quality, representative of the services available to the population as a whole, and relate to all facilities (public and private).[41]

Health information systems (HIS) refer to any system that captures, stores, manages or transmits information related to the health of individuals or the activities of organizations that work within the health sector. HIS are essential for monitoring and evaluation, providing an alert and early warning capability, supporting patient and health facility management, enabling planning, supporting and stimulating research, permitting health situation and trends analysis, supporting global reporting, and underpinning communication of health challenges to diverse users. A good HIS brings together all relevant partners to ensure that users have access to reliable, official, useable, understandable and comparable data. [42]

Facility Records

Facility records include a variety of types of medical notes entered by healthcare professionals over time, recording observations and administration of medication and therapies, test results, x-rays, reports, orders for the administration of drugs and therapies,

etc. Facility records are traditionally compiled and maintained by health care providers in the hospital, clinic, etc. Yet, advances in online data storage have led to the development of Personal Health Records (PHR), sometimes maintained by patients themselves.

Facility-based patient exit surveys are an excellent source for collecting information on the true out-of-pocket cost for surgical procedures.

Electronic Health Records (EHR) provide the opportunity for health care organizations and institutions to improve the quality of patient care and safety, and also have the potential to reduce costs and improve efficiency of the workplace.[43] The use of electronic records has distinct advantages over paper records, including enabled access to medical records from remote locations, improved speed and ease of retrieval of records, and avenues to flag abnormal results.[44]

Population and Housing Census

The most comprehensive source of population data in most countries is the population census. Censuses generally provide population numbers, household or family size and composition, and information on sex and age distribution. They often include other demographic, economic and health-related topics as well. The unique advantage of the census is that it represents the entire statistical universe, down to the smallest geographical unit, of a country or region. Further, the census is usually the starting point for household surveys. However, it is not common practice in a census to ask questions related to surgery. Moreover, surgery is not classified as a core topic in international census recommendations, and there is no clear recommendation on the inclusion of a question on need of surgery in population censuses.[45]

Population Registers

Population registers have become an important source of information for various statistical surveys, including the population census. Population registers can be described as a mechanism of continuous recording of selected information pertaining to each member of the resident population of a country to provide up-to-date information concerning the size and characteristics of that population. Basic characteristics that may be included in a population register are date and place of birth, sex, date and place of death, date of arrival/departure, citizenship(s) and marital status, which are important indicators for baseline assessments regarding global surgery.[46]

Household Surveys

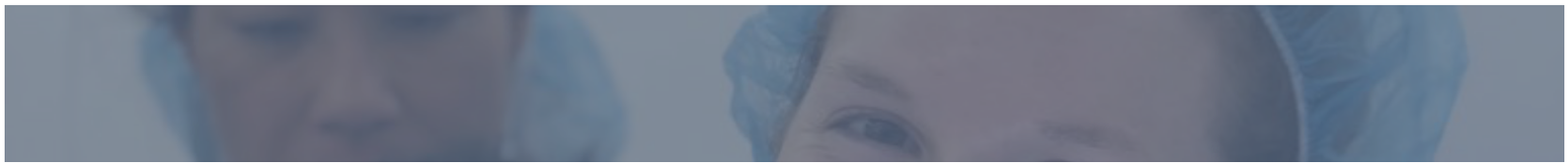
Several standardized international sample surveys have been designed for special purposes. Household surveys, such as the Demographic and Health Survey (DHS)[47], the Multiple Indicator Cluster Survey (MICS)[48] and the Integrated Household Survey (IHS) have become a primary source of data in developing countries where facility-based statistics are of limited quality. Yet, household surveys are important everywhere as they are the most reliable data source on individual knowledge, attitude and practice, critical determinants of health status and health care usage.[49] Compared to population censuses (and administrative registers), sample surveys can go into far greater depth and ask many more questions.

Household surveys could provide a useful source of detailed information on the characteristics and situations of populations in need for surgical treatment. Verbal autopsy could be used to gather health information about a deceased individual to determine his or her cause of death. These surveys could be particularly useful if they were conducted in a standardized and systematic manner, and covered a large number of countries. The advantage of these existing surveys is that they both cover a wide range of countries and are conducted in a regular or systematic manner. It may be possible to integrate specifically designed modules into some of these surveys to study surgery and anaesthesia.

Facility-Based Surveys

The WHO Emergency and Essential Surgical Care Program initially developed and the Harvard Program in Global Surgery and Social Change subsequently joined in revising a facility based survey tool, the Situational Analysis Tool (WHO-SAT).[50] The purpose of this tool is to evaluate the readiness of facilities to provide surgical care.

Data pertinent to a country's health service delivery, including surgical delivery, is collected in the Service Provision Assessment (SPA) survey developed by ICF



International under the USAID-funded MEASURE DHS project, which provides monitoring and evaluation to assess and use results for demographic and health surveys. The SPA surveys fill an urgent need for monitoring health system strengthening in developing countries as they collect information on the overall availability of different facility-based health services in a country and their readiness to provide those services. The key services and topics assessed in a SPA survey are: Infrastructure, Resources, and Systems, Child Health, Maternal and Newborn Health, Family Planning, HIV/AIDS, Sexually Transmitted Infections, Malaria, Tuberculosis, Basic Surgery and Non-Communicable Diseases. [51]

Subsequently drawing on experiences from the SPA the WHO has developed another comprehensive tool, SARA to evaluate service availability and readiness. This survey collects ample data relevant to surgery. Service availability is assessed by the collection of indicators in the three categories of Health Infrastructure, Health Workforce and Health Utilization. Service readiness is assessed from tracer indicators in the five domains: Staff and Guidelines, Diagnostics, Medicines and Commodities, Equipment and Diagnostics.

Vital Statistics

Components of a vital statistics systems refer to legal registration, statistical reporting and the collection, compilation and dissemination of statistics pertaining to vital events, including events concerning life and death of individuals, as well as their family and civil status. The vital events of interest to surgery, anaesthesia and obstetrics are: Live Births, Deaths, Maternal and Fetal Deaths.[52] The quality of demographic and epidemiological data depends on the extent to which countries have a functioning system of vital statistics.[53] Monitoring the status of vital statistics is the first step to guiding and assisting those in need.

Vital statistics are not always available for all countries in the world, many low- and lower-middle-income countries have only rudimentary systems, which cannot fulfill statistical or legal purposes. For some, basic birth and death statistics can only be obtained from other tools, such as sample surveys and projection models.

The Way Forward

This report has highlighted the challenges faced when assessing the surgical disease patterns and contextual factors as well as access, quality and financing of surgical and anaesthesia services and systems worldwide.

There is much to be gained from improved international coordination on global surgery and anaesthesia statistics, which would enable high-quality standards for obtaining official statistics. Limited global, regional or country-specific coordination can result in incoherent support, major funding gaps or duplicative funding of specific tasks, indirectly encouraging countries to postpone critical decisions and activities. Another consequence is the over scheduling of scarce host-country resources to service multiple data collection efforts, resulting in ill-sequenced activities, lost institutionalization opportunities and collection of data of compromised quality. These issues have become more severe with the increasing scarcity of financial resources in support of statistical activities worldwide. Particularly important will be cooperation between National Statistical Offices, Ministries of Health, health facilities, providers, professional societies, non-governmental organizations (NGOs), academia and international organizations.

While the latter are expected to guide the collection, compilation and dissemination of global surgery and anaesthesia statistics, greater involvement of national statistical offices in implementation of data collection would be beneficial to all. Greater investments are needed to improve data collection efforts at the national level.

International organizations such as the WHO, the World Bank, national and international NGOs and all international agencies using comprehensive household surveys, facility surveys and health information systems will ideally support countries in collecting global surgery data.

A set of recommendations for surgical indicators will be crucial for governments and international organizations to improve data collection methods, data reporting, disaggregation and overall quality. Such recommendations will offer benefits to both national and international actors in charge of

collection and distribution of surgical data, in terms of accuracy and compatibility of data.

As progress is made in strengthening health information systems and surgical care delivery, indicators could be refined further and new indicators could be added to focus on other critical areas including outcomes monitoring, outcomes relevant to individual surgical specialties, additional aspects of safety, unmet need and human impact that were not included in this current indicator set due to additional challenges of feasibility and supporting data. As an example, the G4 Alliance along with 90 global organizations have published an indicator framework that builds on the existing LCoGS, proposing 15 consensus indicators that may be adapted and used as relevant to a setting to measure the effectiveness of a surgical ecosystem. [54] While meeting individualized needs, these indicators would be comparable across settings.

As a community of global surgery and anaesthesia experts, we recommend drafting international recommendations on global surgery and anaesthesia statistics. This set of recommendations would consolidate international agreements on surgical metrics and definitions as well as principles for data collection to inform these metrics. These could be developed by a group of experts from national statistical authorities, line ministries, international organizations and academia who are working in this area under the leadership of the WHO Emergency and Essential Surgical Care Programme.

Currently, there is no forum or event for discussion centered on global surgery and anaesthesia statistics and analysis. An international conference or seminar, focusing on evaluation of the state of the art with respect to these statistics, would be vital in this regard. Such a conference could bring together experts from national statistical offices, Ministries of Health, international and non-governmental organizations, and academia.

More data collection and analysis are needed in domains such as identifying the unmet need for and inequalities in access to surgical and anaesthetic care at global, national and sub-national levels, barriers to seeking care at the individual level; types of surgical disease, quality of surgical care; and sub-national distribution in access to services.

Call for Action

The signatories of this paper commit themselves to:

- Establish a working group of experts on global surgery and anaesthesia statistics, with participants drawn from national statistical authorities, line ministers, health facilities, health service providers, professional societies, national and international NGOs, academia and international organizations and the research community.
- Organize a first meeting among the working group of experts on global surgery and anaesthesia statistics in 2018.
- Draft preliminary recommendations on global surgery and anaesthesia statistics as well as a global surgery statistics compiler manual (both tentatively set for issuance in 2019).

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