

Learning Objectives

- Distinguish between the terms catastrophic and impoverishing expenditure
- Explain the variety of cost considerations patients face in accessing health care
- Explain the amount of money it would take health systems to reach recommended surgical performance targets and the associated economic risks of failing to make these investments
- Be able to name LCoGS key messages 3 and 4

Materials

Read

1. Meara, "[Global Surgery 2030](#)", read **Key Messages 3 and 4**, and the **Economics and Financing** section. (pages 2-14)
2. Shrimpe and Meara, "[How Surgery can Fight Global Poverty](#)" (pages 15-17)
3. Jumbam, "[Investing in Surgery: A Value Proposition for African Leaders](#)" (pages 18-19)
4. Gutnik, "[Financial Contributions to Global Surgery](#)" (pages 20-25)
5. Jumbam, "[How much does it cost to scale up surgical systems in low-income and middle-income countries?](#)" (pages 26-29)
6. Visualizations from the article "[Evolution and Patterns of Global Health Financing 1995-2014](#)" (pages 30-34)
7. For a deeper dive, check out the supplemental readings.

Listen

8. [NPR Podcast, Planet Money](#), episode from 3 April 2020 "**The Economics of Hospital Beds**".
 - a. Find this episode in one of two ways:
 - i. Visit the Planet Money home page and search for this episode by clicking the "Load more episodes" link at the bottom of the page until this episode appears.
 - ii. A downloaded copy of this episode is available in the next step of this Module of the Engage Course.
 - b. Episode [transcript](#)
 - c. If interested, dive deeper into the materials referenced in the episode [here](#).

**Please watch the Health Financing Module summary video after working through the above materials.

Things to Think About

- Imagine you are a Minister of Health in a LMIC. How do you decide to divvy up the limited funds you have for your health system? How do you determine priorities, while also responding to the requirements set out by international donors?
- Imagine you are a patient in need of medical care. What are all of the financial considerations that affect your decision to seek medical care?
- What is the impact of failing to provide adequate medical care on a country's population and economy?

our definition of access goes beyond geographic terms and basic service delivery to encompass the additional dimensions of timeliness, safety, and affordability.

This access chasm is consistent with existing evidence. Of an estimated 312·9 million surgical procedures undertaken worldwide in 2012, only 6·3% were done in countries comprising the poorest 37·3% of the world's population.⁷ Assessment of access to emergency obstetric care in Uganda, Kenya, South Sudan, and Rwanda showed that only 2·1–18·5% of expected direct obstetric complications were treated, and that caesarean delivery as a proportion of all births was between 0·1% and 1%.³⁰ An estimated 951 million women are without access to emergency obstetric care should they become pregnant.³¹ Similarly, assessment of stage of presentation and outcomes of patients with breast cancer in Uganda suggests that patients either cannot, or do not, access necessary care in a timely way.³² More than 77% of patients presented with stage III or IV disease,³² compared with 11% in the USA.³³

Inadequate access to surgical and anaesthesia care is deadly. A nationally representative population-based study of deaths from acute abdominal conditions in India reported that postal code areas with high age-standardised acute abdominal mortality were more likely to be located further from a hospital capable of providing appropriate emergency surgical care than were areas with low mortality. When the distance to the nearest well resourced hospital was more than 100 km, the odds ratio of living in a high mortality area compared with a low mortality area was 16·1 (95% CI 7·9–32·8), even after adjusting for socioeconomic status and belonging to a scheduled caste or tribe (appendix p 13).³⁴

Key message 2

143 million additional surgical procedures are needed each year to save lives and prevent disability

An understanding of unmet surgical need is fundamental to the improvement of surgical care in LMICs. We are not aware of any worldwide estimate that translates absence of access to surgical and anaesthesia services into unmet need for surgical care, or how many surgical procedures might be needed to address disease prevalence. To assess how surgical and anaesthesia provision could affect disease burden, we did a three-step analysis at the worldwide level to identify minimum surgical need, met surgical need, and unmet surgical need. Full methods and results can be found in the accompanying papers (appendix p 8).^{7,27,35}

We first measured the recorded frequency of surgery per condition. Because surgery is a facility-based intervention, the relation between admission diagnosis and subsequent undertaking of an operation in a well functioning and nationalised health-care system allowed us to estimate operative need on the basis of diagnostic categories. This estimation has previously been calculated for the USA.⁹ However, the USA is an outlier

in terms of its operative volumes³⁶ and health-care expenditure per person,³⁷ making it a poor model for determination of ideal or feasible surgical rates. To generate a more realistic model estimating overall surgical need, we queried New Zealand's national health-care database. New Zealand has a high-quality health-care system with good population coverage and reasonable per-person spending; we used data from the New Zealand database to calculate frequency of operation (any procedure needing general or neuroaxial anaesthesia) per WHO Global Health Estimate (GHE) disease subcategory based on admission diagnosis codes (appendix p 14).

We then applied the estimated surgical frequency for each disease subcategory to condition prevalence data (obtained from GBD 2010¹⁰) for each of the 21 GBD regions; this generated crude estimates of surgical need per condition for each geographic region (total need). Finally, we updated estimates of surgical volume for each country (met need),⁷ and calculated unmet need by subtracting met need from total need.

Consistent with previous findings,⁹ we noted that surgical care is needed in some way for all GHE disease subcategories. Minimum estimated need was very large—321 million surgical procedures worldwide—and geographically variable, ranging from 3384 operations per 100 000 population in central Latin America to 6495 procedures per 100 000 population in western sub-Saharan Africa. Of the 21 GBD regions, we calculated that 12 do not do enough procedures to address the basic surgical needs of their populations. These regions had an unmet need ranging from 301 to 5625 cases per 100 000 population, totalling 143 million procedures. The regions with the greatest unmet need per 100 000 population were western, eastern, and central sub-Saharan Africa, followed by south and southeast Asia (table 2).

These methods probably underestimate actual surgical need within a region. Surgical rates in New Zealand do not cover all needed surgery in the country;³⁸ the New Zealand admission database only includes inpatient procedures, and since GBD prevalence data are missing from many disease subcategories, extrapolated global surgical need underestimates ideal rates. Finally, the need for surgery will vary from one region to the next owing to many factors, such as disease progression, on the basis of available care. Because New Zealand's health-care population coverage is quite good, progression of some conditions to needing surgical care is less likely compared with systems with weaker health services. Therefore, our annual unmet need estimate of 143 million additional procedures is probably conservative.

Start here.

Key message 3

33 million individuals face catastrophic health expenditure due to payment for surgery and anaesthesia each year

Protection against catastrophic out-of-pocket (OOP) health-care expenditure is essential.³⁹ Global health and

	Population size of region (millions)	Estimated total need of region		Estimated unmet need* of region	
		Surgical cases (millions)	Cases per 100 000 population	Surgical cases	Cases per 100 000 population
Andean Latin America	53	2.0	3773	0	0
Australasia	26	1.2	4669	0	0
Caribbean	44	2.2	5080	131 050	301
Central Asia	80	3.5	4339	910 432	1136
Central Europe	119	6.6	5515	678 358	570
Central Latin America	231	7.8	3384	0	0
Central sub-Saharan Africa	97	6.0	6255	4 192 980	4343
East Asia	1398	57.8	4136	27 956 507	2000
Eastern Europe	207	10.3	4967	0	0
Eastern sub-Saharan Africa	356	21.9	6145	17 555 748	4935
High-income Asia Pacific	178	9.4	5291	0	0
High-income North America	340	15.8	4647	0	0
North Africa and Middle East	446	19.8	4456	2 115 011	474
Oceania	10	0.4	4501	55 196	555
South Asia	1613	72.9	4520	57 791 550	3582
Southeast Asia	610	25.8	4225	12 480 939	2045
Southern Latin America	60	3.0	4906	0	0
Southern sub-Saharan Africa	70	3.6	5093	291 000	413
Tropical Latin America	202	7.2	3581	0	0
Western Europe	416	22.3	5366	0	0
Western sub-Saharan Africa	336	21.8	6495	18 909 507	5625
Global total	6893	321.3	..	143 068 278	..

Data are from Rose and colleagues²⁷ based on calculations provided by Weiser and colleagues⁷ and Hider and colleagues.³⁵ *There is a modelling artifact in the regions that seem to have an unmet need of zero. In these regions, countries with higher surgical rates skew the regional unmet need, even though great disparities in unmet need for surgery might still exist. This is why surgical need should be measured at the country or possibly even the sub-national level for large countries to achieve the sensitivity needed to identify true surgical need. As such, this model underestimates the surgical need in all regions owing to this averaging effect.

Table 2: Estimated minimum total need and unmet need for surgery by Global Burden of Disease epidemiological region

development organisations have recently supported prioritisation of financial risk protection within UHC,^{39–42} and the World Bank and WHO have targeted 100% financial protection from catastrophic expenditure from OOP payments for health services by 2030.³⁹ OOP payments for health care are the predominant form of health financing in many regions,⁴³ and an estimated 150 million people face financial catastrophe every year from direct OOP costs of medical care.⁴⁴ Data for financial costs of care for a small number of surgical conditions in individual countries or regions show substantial catastrophic expenditure.^{45–47} However, little is known about the magnitude of OOP payments for surgical services on a worldwide scale.

To elucidate the contribution of OOP payments for surgery to overall catastrophic health expenditure, we estimated the financial effects of accessing surgical

services. We looked at three primary outcomes of accessing surgical and anaesthesia care: the annual number of cases of catastrophic expenditure from OOP medical costs, the annual number of cases of catastrophic expenditure from OOP non-medical costs, and the number of people at risk of catastrophic expenditure should they need surgical and anaesthesia care. Full methods can be found in the accompanying paper.²⁸

We calculated that an estimated 32.8 million (95% PCI 32.4–33.1) cases of catastrophic expenditure occur directly from the medical cost of accessing surgical services annually. This value represents roughly 22% of the previously estimated 150 million people who endure catastrophic expenditure from accessing all types of health care,⁴⁴ and is similar to the proportion of global disease burden that is surgical.^{2,4} However, these numbers under-represent financial ruin secondary to disease, because they do not include potentially impoverishing non-medical costs of accessing care, such as for transportation, lodging, and food. When non-medical costs were considered in the model, we noted that an additional 48 million cases of catastrophic expenditure occur annually. This amount results in 81.2 million (95% PCI 80.8–81.7) annual cases of catastrophic expenditure attributable to accessing surgical care. Finally, we noted that half the world's population, or 3.7 billion (95% PCI 3.2–4.2) people, are at risk of catastrophic expenditure if they were to need surgery because they do not have financial risk protection. Most of these individuals live in sub-Saharan Africa and south and southeast Asia.

This financial burden is shouldered mainly by poor people. Both the risk for, and the occurrence of, financial catastrophe fall primarily on individuals from LMICs and, within any country-income level, on the poorest wealth quintiles (figure 3). On a worldwide scale, we calculated that the poorest patients are 61 times more likely to face catastrophic expenditure compared with the richest patients. This inequity becomes increasingly more prominent with increasing country gross national income (GNI) per person. In low-income countries, 12% of the poorest four quintiles face catastrophic expenditure compared with 7.5% of the richest quintile. However, in upper-middle and high-income countries, nearly all catastrophic expenditure falls on people who have a low income.

Our calculations of the number of cases of catastrophic expenditure that result from accessing surgical care (81.2 million annual cases) do not take into account patients who are not able to access surgical and anaesthesia care in the first place, whether as a result of the absence of appropriate systems or failure of resource allocation. We note that the proportion of the population incurring financial catastrophe from accessing surgery is actually higher in lower-middle-income countries than in low-income countries, probably because of an inability of the poorest people to reach appropriate services.

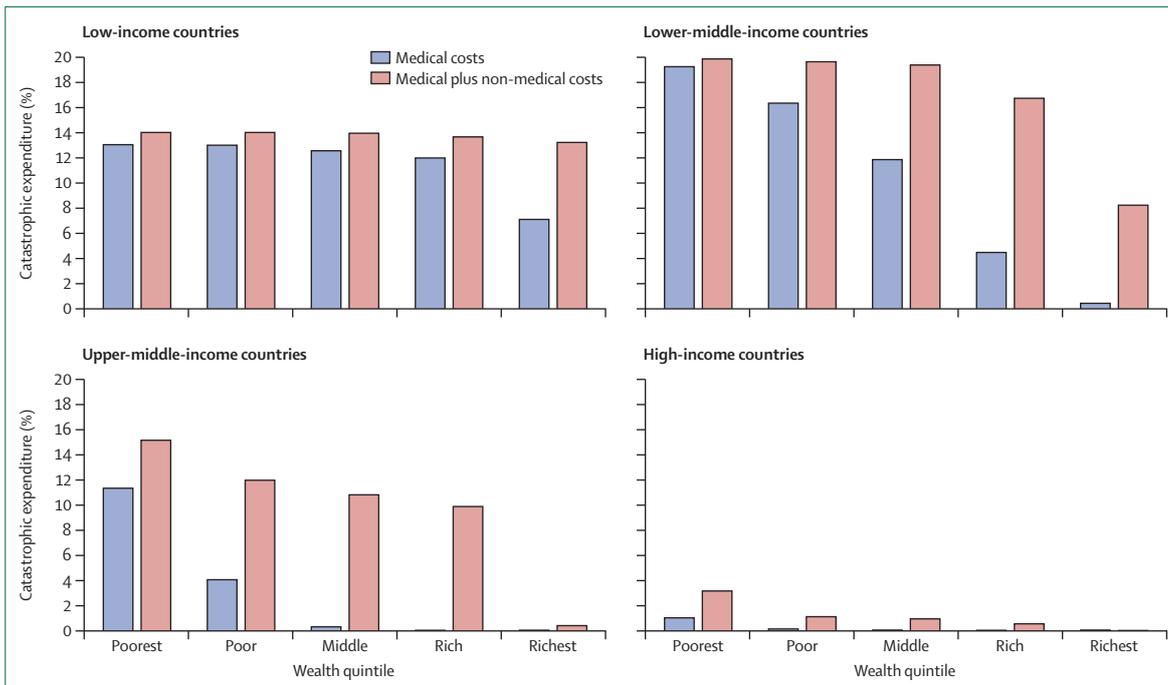


Figure 3: Risk of catastrophic expenditure due to costs of seeking surgery, by wealth quintile and income of country²⁸
Data with and without non-medical costs (eg, transportation, lodging, and food) are shown.

Key message 4

Investment in surgical and anaesthesia services is affordable, saves lives, and promotes economic growth

Scaling up basic surgical and anaesthesia care is a necessary step in the improvement of global health. The third edition of Disease Control Priorities reports that scaling up surgical services to treat three sets of conditions could prevent 3·2% of annual deaths and 3·5% of DALYs in LMICs.⁴ However, the financial cost of broad surgical scale-up has not been previously recorded. To assess the financial feasibility and economic effect of surgical expansion, we assessed the scale-up and development of surgical and anaesthesia services from 2012 to 2030 using one historical rate and two aspirational rates of increase.⁴⁸

A complete discussion of methodology can be found in the accompanying paper.⁴⁸ Briefly, we assumed that high-income countries have the capacity to undertake an adequate number of procedures to meet essential surgical needs of their populations and therefore restricted our analysis to LMICs. The historical scale-up rate (5·1% per year) was established using surgical volume data and a GNI per-person time series to estimate the level of surgical and anaesthesia care countries would be expected to achieve by 2030 in view of their income. The two rates of aspirational scale-up were surgical volume growth rates of 8·9% per year achieved in Mongolia,⁴⁹ and 22·5% per year achieved in Mexico (based on data from the Mexican Ministry of Health). We then calculated the year by which each of 103 LMICs would achieve a target surgical rate of 5000 cases per

100 000 population using these three rates of expansion, and the costs associated with achieving such a scale-up. Costs were divided into a unit cost for surgical procedures and construction costs for facilities and operating theatres (table 3).

Although any proposed surgical rate is arbitrary, we chose 5000 procedures per 100 000 population as a minimum threshold target on the basis of a surprisingly narrow range of recorded rates of surgery associated with desirable health outcomes: a life expectancy of 74–75 years, a maternal mortality ratio of 100 women per 100 000 live births or less, and the estimated minimum need for surgery described in key message 2.⁵⁰

15 (15%) of the 103 countries had already achieved the target volume in 2012. Therefore, these countries were removed from subsequent analysis. The 88 countries remaining, which include China, India, and South Africa, represent more than 70% of the world's population. Using historical rates of increase, 39 (44%) of the 88 countries could achieve the target by 2030. Using aspirational Mongolian rates of increase, 59 (67%) of the 88 countries would achieve the target by 2030, whereas all countries would achieve the target by 2030 using aspirational Mexican rates of increase.

Total costs were calculated for historical, Mongolian, and Mexican rates of increase for each country income group. Costs to expand surgical services between 2012 and 2030 for the 88 LMICs are about US\$300 billion (\$16 billion annually) with historic rates of increase, \$420 billion (\$23 billion annually) with Mongolian

	Low-income countries	Lower-middle-income countries	Upper-middle-income countries
Unit cost for surgical procedures	179	219	332
Surgical theatre construction cost	319 002	412 488	1 906 064
Historical rates of increase (5·1% per year)			
Cost of surgical procedures	14	115	86
Costs of operating rooms	6	37	40
Total cost	20	152	126
Annual cost (% of total annual health expenditure)	1 billion (4%)	8 billion (4%)	7 billion (1%)
Mongolian rates of increase (8·9% per year)			
Cost of surgical procedures	31	197	91
Costs of operating rooms	13	50	40
Total cost	44	247	131
Annual cost (% of total annual health expenditure)	2 billion (8%)	14 billion (6%)	7 billion (1%)
Mexican rates of increase (22·5% per year)			
Cost of surgical procedures	76	274	95
Costs of operating rooms	17	50	40
Total cost	93	324	135
Annual cost (% of total annual health expenditure)	5 billion (17%)	18 billion (8%)	8 billion (1%)

Costs are presented per billion 2012 US\$. Estimates are from Verguet and colleagues⁴⁸ created specifically for this Commission.

Table 3: Total and annual costs of scaling up basic surgical services from 2012 to 2030 using historical, Mongolian, and Mexican rates of increase for 33 low-income countries, 33 lower-middle-income countries, and 22 upper-middle-income countries

rates of increase, and \$550 billion (\$31 billion annually) with Mexican rates of increase.

Although Mexican rates of increase are too ambitious to use as a realistic global target, reaching historical and Mongolian rates is feasible if scaling up of surgical services was prioritised. The historical and Mongolian rates of increase are similar to rates of decline seen in LMICs for under-5 mortality and maternal mortality, two areas of prominent global health focus.^{51,52} Although the total costs of scale-up are substantial, research suggests that surgery is a highly cost-effective intervention,^{53,54} and the percentage of annual health expenditure is proportionate to the percentage of the total burden of disease that needs surgical intervention in these countries.

Expansion of surgical and anaesthesia care might result in substantial economic returns on investment. Macroeconomic assessment of other global health foci have shown that health improvements lead to both improved life expectancy and improved national income,^{55,56} but similar work has not been done for a comprehensive subset of surgical conditions. To assess the economic consequences of untreated surgical conditions, we examined five major disease categories needing essential surgery: neoplasms, injuries, maternal disorders, neonatal disorders, and digestive disorders. Full details of this methodology can be found in the accompanying paper.⁵⁷ Briefly, we estimated the

total value of lost economic output secondary to these surgical conditions between 2015 and 2030 using the WHO Projecting the Economic Cost of Ill-Health (EPIC) model. The EPIC model projects how disease affects a country's labour supply and capital stock, which in turn are related to aggregate economic output (ie, GDP) over time, thereby linking disease to economic growth.⁵⁵ The counterfactual is assumed to be no disease.

The value of lost output secondary to surgical conditions was estimated for 128 countries with a combined population of 6·4 billion people (in 2013), or 90% of the world population. We noted that between 2015 and 2030, surgical conditions will be responsible for a cumulative loss to the global economy of \$20·7 trillion or 1·3% of projected economic output. Neoplasms and injuries needing surgical care will have the greatest effect on economic output, followed by digestive diseases. More than half of all losses between 2015 and 2030 will occur in LMICs (\$12·3 trillion), particularly in LMIC super-regions of southeast Asia, east Asia, and Oceania (\$6·1 trillion; figure 4).

LMICs will bear the brunt of these losses: by 2030 we calculated that surgical conditions in middle-income countries could consume as much as 2% of these countries' projected annual GDP growth. These numbers make the roughly \$420 billion investment needed to scale-up services to treat these conditions pale in comparison.

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Key message 5

Surgery is an indivisible, indispensable part of health care

Universal access to safe, affordable surgical and anaesthesia care is essential for widespread and equitable improvements in global health, welfare, and development. Surgical conditions consist of a large and diverse collection of human ailments. More than 100 000 maternal deaths might be averted by timely intervention, and increased access to caesarean delivery reduces neonatal mortality by 30–70%.⁵⁸ Similarly, non-communicable diseases and injuries are already the largest subset of the global disease burden and are set to rise exponentially in coming years.⁵⁹ Prevention and treatment of surgical conditions are necessary to improve the health of populations,¹⁰ are fundamental parts of resilient health systems, and are crucial for the achievement of global health goals. Whether to reach unmet targets of Millennium Development Goals (MDGs) 4 and 5, or to combat the rising tide of malignancies, diabetes, and road traffic injuries, the need for integration of surgical services into comprehensive platforms of health-care delivery is clear.

In 1980, the then director-general of WHO Halfdan Mahler referred to surgery's "proper role in bringing the people of the world nearer to the goal of health for all".⁶⁰ Nearly 30 years later, improvement of surgical capacity at the district hospital level was identified as one of the 30 top mechanisms for advancement of global welfare,

or CME courses, or other professional discourse to stay up to date with evolving standards of care.^{190,215} Licensing and CPD, CME, and MOC should be required for all graduates of training programmes. CME and CPD should be provided by internet or telephone, or enabled with an educational stipend, to decrease professional isolation and increase the confidence and competence of the rural provider.

Recommendations for workforce, training, and education National

- Ministries of health should record the density and distribution of all surgical, anaesthetic, and obstetric providers including specialist providers, GPs, and associate clinicians.
- Ministries of health should develop surgical workforce plans to achieve surgical workforce densities of 20–40 per 100 000 population with adequate rural and urban distribution by 2030 as an interim goal; this goal can be reset then based on local evidence and community needs.
- All surgical workforce training programmes should have a required rural training component that is sufficiently mentored and supervised.
- All graduate and postgraduate training programmes should be accredited.
- All actively practising providers should be licensed or relicensed through available and affordable competency-based examinations, CPD and MOC.
- Access to reliable internet, information, and mentoring is needed at all training sites and first-level hospitals.

International

- Ministries of health, finance, and education and regional professional bodies should collaborate to support regional training and education opportunities.

International funding agents

- In low-income countries, multiyear funding should be directed toward large-scale health system strengthening programmes that include education of the entire surgical workforce.
- In middle-income countries, funding should be directed toward rural service incentives to improve surgical workforce distribution.

WHO

- Partner with ministries of health to record and publish surgical workforce density and distribution in all UN-member countries annually.

NGOs, professional organisations, high-income country academic institutions

- Work in partnership with local institutions to improve surgical capacity through longitudinal educational programmes that do not drain human resources away from the public system.

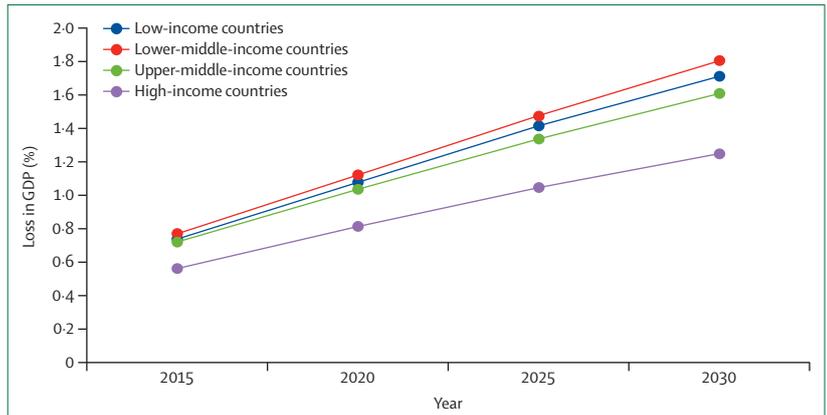


Figure 12: Annual value of lost economic output due to surgical conditions⁵⁸
Data are percentage loss of GDP by World Bank income class, based on the WHO Projecting the Economic Cost of Ill-Health (EPIC) model (2010 US\$, purchasing power parity). GDP=gross domestic product.

Start here.

Economics and financing

The present situation

The case for investment in surgical and anaesthesia care in LMICs
To appreciate the full effects of untreated disease on populations and the benefits that treatment can provide, it is crucial to understand the economic impact of surgical conditions. However, although economic evidence has become a core research area in many parts of health care, evidence for the economic effects of surgical conditions in LMICs is scarce.^{216–219}

Earlier in the report we presented the Commission's work that estimated the economic impact of surgical conditions in LMICs between 2015 and 2030 using a value of lost output approach, which describes the economic impact of disease in terms of losses in GDP as a result of depletion of the labour supply and capital stock.²²⁰ We showed that without urgent and accelerated investment in surgical scale-up, LMICs will have projected losses in economic productivity estimated cumulatively at \$12·3 trillion (2010 US\$, purchasing power parity [PPP], lower bound estimate \$6·9 trillion, upper bound estimate \$20·6 trillion) between 2015 and 2030. The annual value of lost economic output secondary to surgical conditions will have a profound effect on GDP (figure 12). Lower-middle-income countries will have the greatest losses: by 2030, our estimates suggest that surgical conditions in lower-middle-income countries could reduce annual GDP growth by almost 2%.

However, GDP alone cannot capture the full value of better health. We therefore assessed the impact of surgical conditions worldwide and at the country level using a broader economic measure: the value of a statistical life (VSL).⁵⁷ VSL estimates are derived from economic studies that assess the monetary value individuals place on small changes in mortality risk, and therefore captures non-market welfare losses, including the value of good health itself, that go beyond market valuations such as national income.^{221,222}

For key findings from the economics and financing working group see appendix p 129

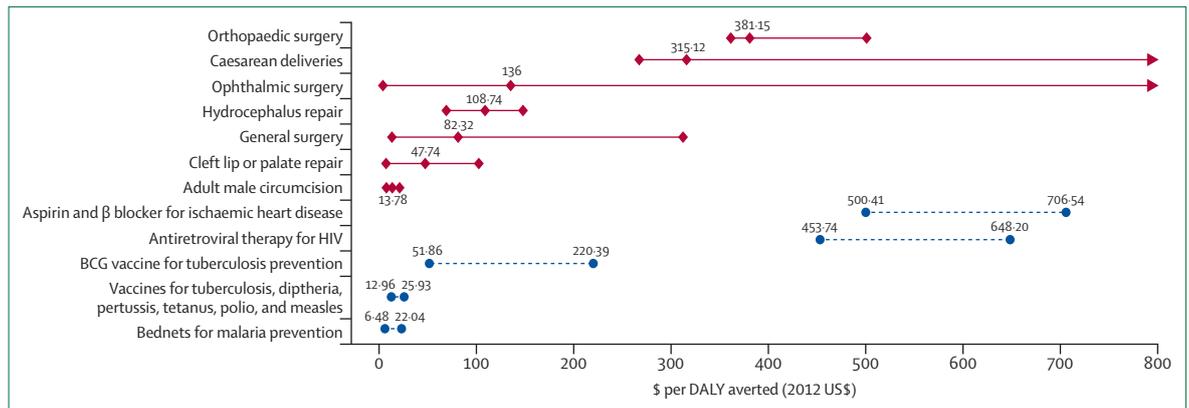


Figure 13: Cost-effectiveness of surgery in low-income and middle-income countries compared with other public health interventions
 Data points are medians, error bars show range. Surgical interventions are denoted by the diamonds and solid lines, public health interventions by the circles and dashed lines. Reproduced from Chao and colleagues,⁵³ by permission of Elsevier. DALY=disability-adjusted life-year.

Using the VSL approach, we show that at least \$14.5 trillion (2010 US\$, PPP; lower bound estimate \$9.9 trillion, upper bound estimate \$22.4 trillion) in total economic welfare was lost annually secondary to mortality and morbidity from surgical conditions in 2010. In LMICs, \$4.0 trillion in total economic welfare losses occur predominantly in the LMIC super-region of southeast Asia, east Asia, and Oceania. Most of the economic welfare losses were in high-income countries, which is in part a result of the VSL methods. Intuitively, an individual's willingness to pay to reduce their risk of mortality positively correlates with income, and therefore it is not surprising that VSL varies across countries of different income. VSL methods, including their strengths and weaknesses, are explored in an accompanying study.⁵⁷

Surgical and anaesthesia care in LMICs has been perceived as too expensive and too complex to be a public health priority in resource-poor settings. However, many examples exist in which safe, quality surgical and anaesthesia care is provided to such communities, at low cost, in both the public and the private sectors—notably in India and Pakistan.^{223–225} Cost-effectiveness analysis, using the WHO cost-effectiveness ratio,²²⁶ suggests that surgical and anaesthesia care in LMICs is a good health investment, even when accounting for capital investments.⁵³ The cost-effectiveness ratios of many surgical interventions compare favourably with those of other widely used public health strategies in low-resource settings (figure 13).

Typically, surgical and anaesthesia care are not delivered as single isolated interventions, rather a series of interventions delivered within a platform of clinical care. Similarly, policy makers are usually faced with decisions about funding platforms, rather than individual procedures. Most cost-effectiveness analyses of surgical interventions in LMICs have focused on just one surgical procedure, and therefore do not capture the full value of provision of a surgical service. Nevertheless, a small number have assessed the cost-effectiveness of an overall surgical service. Debas

and colleagues⁵ showed that a platform of surgical and anaesthesia care delivered within a first-level hospital could provide surgical services that were cost effective under a series of different assumptions in six LMIC super-regions. First-level hospitals were substantially more cost effective than were community health centres as platforms for delivering surgical and anaesthesia care in all LMIC super-regions, and cost as low as \$33 per surgical DALY averted in sub-Saharan Africa.

Although surgical and anaesthesia care can be highly cost effective as a health intervention, they can still be catastrophically expensive for individuals if they are not financially protected by publicly financed insurance. Household catastrophic expenditure and impoverishment as a result of accessing health care in LMICs has emerged as a major global health challenge.^{41,44,56} Before the work of this Commission, little was known about the amount of catastrophic expenditure attributable to surgical and anaesthesia care in LMICs outside of emergency obstetric care.^{227–230}

This Commission has estimated that about 33 million individuals face catastrophic expenditure from accessing surgical and anaesthesia care each year on the basis of OOP costs of surgery alone. A further 48 million people have catastrophic expenditure as a result of the direct non-medical costs of seeking care, including transport and food costs.²⁸ On the basis of earlier estimates of total catastrophic health expenditure worldwide,⁴⁴ catastrophic expenditure related to the direct medical costs of surgical and anaesthesia care would account for about 20% of all cases of catastrophic health expenditure worldwide. Importantly, many other people do not seek surgical and anaesthesia care at all, or decide not to pursue surgical treatment as advised, because they cannot afford the costs of such care.^{231–233}

A new prospective, multicentre cohort study assessing the socioeconomic outcomes of surgery for cancer in eight countries in southeast Asia, reports the impact on patients of the OOP costs of surgical care. Of the

4584 patients designated for surgery as part of their cancer care at baseline, 25% incurred financial catastrophe, defined in their study as costs of hospital admission exceeding 30% of annual household income, and 18% had discontinued treatment (no hospital admission) at 3 months after diagnosis. Women were reported to have greater risk of financial catastrophe than were men; low socioeconomic status was generally associated with an increased risk of death, treatment discontinuation (including failure to undergo the initial planned operative procedure), and financial catastrophe.⁴⁷

Household financial shocks from accessing surgical treatment might be particularly large because the need for surgical and anaesthesia care is often time critical, unpredictable, and resource intensive, making it difficult to pre-plan or save for. A study in rural Bangladesh assessing disease-specific impoverishment from annual OOP payments for health care showed the poverty effect on households of time-critical surgical conditions. Of the households undergoing acute cholecystectomy, appendectomy, and emergency hysterectomy, 22·2%, 12·5%, and 9·8%, respectively, were pushed into poverty. This compared with an overall annual impoverishment average of 3·4% for all health care.⁴⁸

Sources of health financing

Health financing plays a key role in the development of equitable, efficient health systems and optimal health outcomes.²³⁴ National health financing has three major sources: the public sector (general revenues [ie, raised from taxation] and social insurance contributions [ie, contributions from the insured, the insured's employer, or the state into a public insurance scheme]), the private sector (OOP payments and private insurance), and external sources (eg, grants from international funding agencies or concessional loans from development banks). Most LMICs use a combination of all three sources, but poor coordination and alignment of activities between different financing sources might have contributed to the development of fragmented health systems and surgical services.

An understanding of domestic and international financial flows to surgical and anaesthesia care is crucial to quantify the financing gap in LMICs. Yet, just how much of domestic and international health financial flows are directed towards surgical and anaesthesia care in LMICs is unknown. Most of the global development assistance for health (DAH) databases (eg, the Organisation for Economic Co-operation and Development [OECD] Development Assistance Committee [DAC] database and the OECD Creditor Reporting System [CRS] database) do not specifically collect data for surgical services, and national health accounts rarely track domestic spending on surgery. Tracking of surgical financing flows is important because it helps to identify funding gaps, ensure that resources materialise from promises, and encourages accountability and transparency.

We reviewed 958 country-generated national health accounts from 1996 to 2010 in an attempt to track domestic spending on surgical and anaesthesia care. Only Georgia and Kyrgyzstan, both lower-middle-income countries, routinely reported expenditure on surgery within their national health accounts.²³⁵ The difficulties with the tracking of domestic spending for surgical and anaesthesia care is in part a result of the accounting framework for national health accounts, which does not disaggregate health expenditure by intervention or clinical service.

By searching annual tax information for non-profit organisations, US Agency for International Development (USAID) annual reports, and the National Institutes of Health (NIH) Research Portfolio Online Reporting Tools (RePORT) database, we sought to estimate contributions to surgical and anaesthesia care in LMICs from the USA, a major international donor in global health. Although limited by incomplete datasets, several patterns emerged. Most of the US-based non-governmental support directed towards surgical and anaesthesia care in LMICs has focused on elective ophthalmology and cleft lip and palate repair and typically on support of short-term surgical delivery by international teams, rather than on long-term capacity building. Governmental support from USAID has focused on obstetric fistula care and research funding from the NIH has focused on trauma research. By comparison with other global health areas, surgical and anaesthesia care has received a very small proportion of funding from US non-governmental and governmental sources²³⁶ (appendix p 130).

Payment mechanisms

Payments for health services can be direct or indirect. Direct payments, or user fees (fee-for-service payments without the benefit of insurance), are paid OOP, usually at the point of care. Indirect financing or insurance mechanisms are based on pooling risk. Here, target groups pay a regular contribution, either through general taxation or insurance models (involving premiums and copayments), from which the expenses of treatment are financed when a member of the pool becomes unwell.²³⁷ Generally, as countries develop, their health financing profiles change, moving from a heavy reliance on direct OOP payments towards indirect financing mechanisms that pool risk (general tax revenue, social insurance, or private insurance models).²³⁴

Little has been reported about how surgical and anaesthesia care is financed within health systems in LMICs. Interviews with key informants during the process of the Commission suggest that in several low-income countries in Africa and south Asia user fees make up the bulk of financing mechanisms for surgical and anaesthesia care provided within the public sector and within private for-profit facilities, even when the stated means of health financing in a country is general taxation.⁹⁶ Informants reported that user fees acted as a

For the NIH RePORT database
see <http://report.nih.gov/>

substantial barrier for patients accessing surgical and anaesthesia care in their countries. User fees contribute to the high levels of catastrophic expenditure attributable to the use of surgical and anaesthesia care in people from low-income countries. Two previous studies^{231,237} support the notion that financial barriers substantially affect use of surgical services in LMICs.

User fees at the point of care tend to be regressive, placing a proportionately increased burden on people with a low income.²³⁸ Conversely, use of health services increases when they are made free at the point of care. For example, removal of user fees for caesarean delivery in Sudan and Senegal was associated with a significant increase in the use of emergency obstetric facilities.^{239,240} Similarly, uptake of paediatric surgical services increased by five-fold in Sierra Leone after the introduction of a free health-care policy for children younger than 5 years.²⁴¹ The removal of user fees for cataract surgery in rural China doubled uptake of services²⁴² and contributed to poverty alleviation, especially in the poorest of the study population.²¹⁶

In addition to official user fees for surgical services, two other types of OOP expenses are often encountered by households when accessing surgical and anaesthesia care in many LMICs. These costs are other medical charges such as the costs of surgical supplies (including the surgical provider's gloves, sutures, dressings, intravenous fluids, and antibiotics), which are often met by patients themselves owing to a shortage of supplies in public facilities, and non-medical costs such as the cost of transport and food. These expenses contribute substantially to the overall payments made by households. Non-medical costs can act as a financial barrier to care and a source of medical impoverishment, even when surgical and anaesthesia care itself are free.²⁴³ Very few insurance schemes or general taxation financing mechanisms for health make provision for non-medical costs.²⁴⁴

In contrast with user fees, indirect financing with either general taxation or insurance contributions spreads out payments for health services, which minimises costs to users when they become unwell.²³⁸ When general taxation is used, the tax structure of the country contributes substantially to how equitable payment contributions are. In LMICs, taxation is not always progressive; several countries still fund health and other public services using proportional or regressive tax structures²⁴⁵ that disproportionately affect people with a low income. Government spending on health also varies widely, as do the areas within the health budget that receive priority. Generally, however, government health expenditure per person correlates with operative volumes (appendix p 132). General tax revenue funds coverage of a basic package of maternal and child health services in several LMICs (eg, Afghanistan and Sierra Leone),²⁴⁶ but this package does not usually extend to all health services. Surgical services are often one of the last services to be covered despite the high financial risks

associated with use of surgical and anaesthesia care.⁴⁶ Even when public spending does cover surgical and anaesthesia care, the allocation of funding might not benefit those most in need if coverage of services is poor or if other barriers impede service uptake.

Most LMICs have found that government funding is necessary for achievement of good health coverage. A contribution-based risk-pooling mechanism, such as national social insurance, often does not work in LMICs because most of the population usually subsist on low incomes, a large informal sector exists, and populations are often geographically dispersed, all of which makes collection of premiums very difficult. Because of these restrictions, contribution-based risk-pooling mechanisms have usually struggled to provide good coverage for people with a low income, even for the most basic health services. Rwanda, a notable exception, has successfully implemented a national community-based health insurance model with more than 90% population coverage.²⁴⁷

Private insurance used in isolation is not a solution for surgical coverage, generally only insuring the healthiest and most often wealthiest people, thereby leaving sick and poor people uninsured.²³⁴ Likewise, a dual system with government insurance for poor people and informal sector workers and private insurance for formal sector workers and wealthy people can also lead to inequalities and is unsustainable.

While risk pooling is important for equity and financial risk protection, strategic purchasing drives quality and efficiency. In many LMICs, the government directly funds government-run or government-owned health facilities (including those providing surgical and anaesthesia care) by paying for their inputs, such as personnel, medicines, supplies, and equipment, through line-item budgets. Little attention is given to how financial incentives or other mechanisms can motivate surgical providers to improve quality and efficiency, or to respond to patient demand. As a result, productivity is often low, quality of service is highly variable, and physician or surgeon absenteeism in the public sector is frequent. Such input-based funding also has negative equity effects. When wealthy individuals are dissatisfied with poor-quality surgical services in the public sector, they seek care in the more expensive private sector, an option that is financially out of reach for people with a low income.²⁴⁸

In contrast, strategic purchasing includes proactive and explicit decision making on the basis of predefined outputs and outcomes. This method links payment to information provided about the delivery of these predefined products and selects the most qualified and efficient provider. In doing so, the purchaser seeks to improve efficient allocation of resources and effective service delivery to maximise population health and reduce financial risk.²⁵¹ A key policy instrument that improves the effectiveness of purchasing is provider

payment method, a mechanism through which funds are transferred from the purchaser to the provider of health services. So far, no research has been done to characterise how different purchasing strategies affect surgical providers' behaviour in treatment decisions in LMICs, and thus the quality and efficiency of service provision.

In the past few years, pay for performance (P4P) programmes (or results-based financing) have gained support above traditional provider payment methods to drive improvements in quality of care. P4P programmes link payment of individual providers or institutions to predefined outcome or output and activities that have established evidence of being cost effective in terms of health outcome improvement. However, the evidence for the effectiveness of P4P in the improvement of outcomes in LMICs is mixed. Financial incentives aimed at individual providers, or at patients, have been shown to have short-term benefits for simple and distinct, well defined behavioural goals,²⁵⁰ particularly for health facility deliveries and health care for children younger than 5 years.²⁵¹ To the best of our knowledge, no studies have examined the effectiveness of P4P in the context of surgical-care provision in LMICs. P4P has some potential risks if financial incentives are tied to the wrong health indicators or outputs, or when they encourage gaming the system (providers who only do low-risk surgical procedures so that they have better outcomes and better financial compensation) at the expense of other areas of health-care provision.

The way forward

Scale-up of surgical and anaesthesia care as an investment

Financing and financial mechanisms for surgical and anaesthesia care in LMICs are inadequate, do not meet current health needs, and will not in the near future. Two key aspects should be addressed. First, substantial surgical scale-up is needed in most LMICs to meet clinical demand, improve health and welfare, and fully realise associated economic gains. The costs of scale-up will need to be met through both domestic and international financing mechanisms in many LMICs, especially low-income countries. Second, the large, catastrophic costs borne by patients for surgical and anaesthesia care should be addressed through improved deployment of equitable health financing mechanisms. Several possibilities for scaling up surgical and anaesthesia care while assuring financial risk protection exist for countries.

In the Commission we examined different scenarios for scale-up of surgical and anaesthesia care from 2012 to 2030 in LMICs. To achieve rates of surgical growth similar to a best-performing LMIC (eg, Mongolia), the total scale-up costs for 88 LMICs during this time (2012–30) would be about \$420 billion. This number represents 1% of total annual health expenditures in upper-middle-income countries currently, and

approximately 8% and 6% for low-income and lower-middle-income countries, respectively. In countries with little surgical infrastructure (most low-income countries and many lower-middle-income countries) the costs of scale-up are largely related to the size of capital investment needed. Additional costs for training consultant surgeons, surgical officers, and associated personnel were not included in the model presented in the Commission and will need to be met through investment in human resources for health programmes. Although the scale-up costs are large, the costs of inaction are higher, and will accumulate progressively with delay (figure 4). Scale-up of surgical and anaesthesia care should therefore be viewed as an investment, not a cost.

Expansion of sources of health financing

The capital and operating investments in scaling up surgical and anaesthesia care in LMICs can be met through various sources.⁵⁶ The 2013 *Lancet* Commission on Investing in Health⁵⁶ recommended three main ways by which countries could increase their health financing: increased mobilisation of domestic resources (eg, general taxation; taxation of tobacco, alcohol, and sugar; and taxation of multinational corporations), intersectoral reallocations and efficiency gains (eg, reduction or elimination of fuel subsidies), and contributions from external resources (eg, both traditional DAH and innovative financing mechanisms, such as airline ticket solidarity taxes).

The *Lancet* Commission on Investing in Health also identified five key enabling advances of the past two decades of global health that can be further leveraged to increase health gains by mobilisation of resources and reduction of inefficiencies in the coming two decades. In table 4 we consider how these gains can be used specifically to mobilise resources to advance surgical and anaesthesia care in LMICs.

Although consensus exists that the main responsibility for financing of health services rests with governments through domestic revenue generation, in the short-to-medium term, finance of surgical scale-up in many low-income countries and in some middle-income countries is not possible through national health expenditure alone. To attempt to do so would require countries to apportion an unrealistically large amount of the health budget towards surgical and anaesthesia care. Therefore, to accelerate the scale-up of surgical services in many LMICs, external sources of financing will also be needed. Because surgical care spans many services and health delivery platforms, surgical scale-up costs often overlap with the broader costs of health systems strengthening and other priority health areas. To avoid further so-called verticalisation of global health financing around individual interventions, as occurred during the MDG era, surgical and anaesthesia care might be best supported by DAH aimed at health systems

	Effect on global health and surgical and anaesthesia care, 2000–15	Opportunities for surgical and anaesthesia care, 2015–30
Focused domestic attention to health	Many LMICs instituted important health systems reforms, often accompanied by increased domestic health financing. However, these reforms were focused on infectious diseases and child and maternal health, and in most countries did not benefit (and in some cases harmed) surgical services. Notable exceptions are Mexico, Mongolia, Papua New Guinea, and Rwanda	Domestic recognition of the effect of non-communicable disease and injuries in LMICs is increasing. Realignment of health priorities and financing to show changing disease patterns should increase funding of health systems development, hospital care, and primary care and allow for increased domestic funding to flow to the development of surgical services needed to manage these challenges
Growing effect of MICs	Economic growth of some large MICs led them to become financially self-sufficient in health; some are now aid donors and international suppliers of key health technologies themselves (eg, drugs, vaccines, and surgical instruments)	Economic growth in many countries will create fiscal space for increased domestic spending on health, including surgical services. MICs can increasingly participate in and lead the transfer of cost-effective solutions to surgical and anaesthesia care that they have developed through so-called South-South collaboration and exchange
Increased funding and institutional innovations for health research and development	Funding for research and development into infectious diseases, neglected tropical diseases, and child and maternal health increased facilitation of development of new drugs, vaccines, and diagnostics. Product development, public-private partnerships, and institutional capacity in MICs led to a healthy product pipeline.	Surgical and anaesthesia care in LMICs would benefit from a greater share of research and development funds. The development of high-quality, low-cost surgical innovations represents a viable focus point for research and development and product development by public-private partnerships, especially given the potential for reverse innovation to high-income countries, which are also increasingly focused on cost constraint
Mobilisation of development assistance for health	Global health architecture was transformed by new actors (private foundations and global funds and alliances). An explosive rise in development assistance for health occurred. However, this rise was mainly channelled into the health-related MDGs, and surgical and anaesthesia care did not benefit from these new resources	The core functions of global health and the development of robust, responsive, and efficient health systems have been underfunded, which should be reversed. Surgical and anaesthesia care will benefit from increased development assistance for health systems, as well as greater aid efficiency. Mobilisation of development assistance for health will be needed to meet many of the capital costs of scaling up surgical and anaesthesia care, especially in low-income countries
New technologies	Scale-up of new methods was associated with major reductions in mortality, especially for the health-related MDGs. There was some focus in MICs (eg, India) on improvement of surgical technology, instruments, and manufacturing during this time	Successful product development in global health, especially in diagnostics and devices and technology, suggests substantial potential for surgical and anaesthesia care to benefit from the development and deployment of new technologies designed for LMIC environments (eg, durable, high quality, low cost, and easily repaired). This development could also permit LMICs to progress above high-income countries in terms of surgical technology

Modified from the 2013 Lancet Commission on Investment in Health.³⁶ LMICs=low-income and middle-income countries. MICs=middle-income countries. MDG=Millennium Development Goal.

Table 4: Key enabling advances in global health as they relate to surgical and anaesthesia care: past challenges and new opportunities

strengthening. Explicit provision for surgery within these budgets is needed, however, to ensure surgical and anaesthesia care is not overlooked, as occurs at present, and to track financing flows adequately.

Interest in use of donor money to finance country-defined programme-based approaches, rather than individual health projects, has increased.²⁵² Such approaches are characterised by country ownership and the coordination and harmonisation of donor activities around a comprehensive health programme that the country itself defines.²⁵³ One popular type of programme-based approach is the sector-wide approach (SWAP), defined as an approach in which all substantial donor funding supports one comprehensive sector policy.²⁵² SWAPs have been applied to the health sector, including to fund surgical services,^{254,255} but the results so far have been mixed.²⁵⁶ For example, results of a 2012 review²⁵⁷ of the evidence showed that the outcome and effect benefits of health SWAPs are inconclusive. Further assessment of the most effective mechanisms of support for comprehensive health services, including surgical services that align with country priorities, is needed.

Irrespective of the financing mechanism, to mobilise the necessary financial resources for scale-up, surgery should provide a better case for its inclusion within domestic health and external financing budgets than it has done so far. This proposition needs presentation of a clear argument for the health value of scale-up and the return on investment, and generation of political will at a national and international level, and should hold people,

governments, and organisations accountable for promises made to improve surgical care (table 4).

Tracking of financing flows

To improve the effectiveness of both DAH and domestic health spending, funding flow clarity and transparency is needed. In the case of surgical and anaesthesia care, reliable estimates of how much financing is needed to provide safe, accessible, and affordable surgical services at the national level, present spending on surgical and anaesthesia care, and the so-called funding gap (ie, the difference between how much financing is needed and present spending) are crucial preconditions for sound policy and decision making.

National health accounts and databases tracking overseas DAH should be redesigned to allow for comparative analyses of health systems spending by clinical intervention or service. Without the ability to track spending commitments and disbursements on surgical and anaesthesia care, countries and the international community will be unable to develop robust and transparent policy and investment strategies for scaling up surgical and anaesthesia care.

Improvements in payment methods for surgical and anaesthesia care

The present scenario in LMICs, in which most of the population has to pay for surgical and anaesthesia care through user fees must be improved. Although no perfect financing system exists, three features of

surgical and anaesthesia care make prepayment mechanisms preferable to direct user fees. First, a substantial proportion of surgical disease in LMICs is time-critical and life-threatening or limb-threatening.^{258,259} Second, user fees for surgical and anaesthesia care are often high, and direct payments can result in large rates of catastrophic expenditure.²⁴³ For this reason, surgical conditions are associated with a high household poverty effect relative to other health problems.⁴⁶ Finally, emergency surgical conditions (eg, trauma and acute abdominal disorders) are not predictable, making it difficult for households to foresee or to plan for the financial outcomes.

We support the use of risk pooling to achieve financial risk protection for surgical and anaesthesia care. Risk-pooling mechanisms protect against unexpected financial shocks as a result of surgical illness and ensure that delays in care do not occur while families rally to raise funds. Options for pooling mechanisms include a supply-side approach (direct public subsidies to public facilities or zero or highly subsidised fees at the point of service for patients who need surgery or patients with a household income less than a specific amount), and a demand-side approach (the government subsidises people with a low income and those who work in the informal sector to enrol in a mandatory insurance scheme with benefit packages that include surgical and anaesthesia care). Because both social insurance models and private insurance have their drawbacks in LMICs, a desirable system might be a public insurance scheme (ideally single payer) with identical benefits for the whole population. Another option is that the government pays for people with the lowest income and those who work in informal sectors, and formal-sector workers and those with means pay their own premium.

Strategic purchasing and the role of the private sector

Strategic purchasing can improve health service productivity and the quality of care in some contexts,²⁶⁰ although no direct evidence exists to support its use in surgical and anaesthesia care in LMICs. In strategic purchasing, the purchaser (who can be the government or an insurance fund) selectively enters into a contract with efficient and high-quality providers with whom choices exist, irrespective of whether the providers are public or private. Payments can be complemented by an element of pay for performance, with a proportion of the fixed payment withheld and paid according to performance assessment done on a periodic basis. Performance indicators should be closely linked to process and outcome quality measures. As systems become more mature, clinical outcome metrics are preferable. Non-financial approaches to achievement of quality and efficiency improvements might also work—eg, changing of professional behaviour⁶⁶—but virtually no studies in LMICs have compared financial and

non-financial strategies, and none for surgical and anaesthesia care.²⁵⁰

The engagement of the private sector, and especially the private for-profit sector, in the delivery of health services in LMICs is controversial. Several successful examples exist in which the private not-for-profit sector has been contracted to manage hospital facilities, including surgical services, on behalf of the public sector, to increase service delivery and improve geographic coverage to a greater extent than would have been possible with government resources alone.²⁶¹ Little evidence has been reported about situations in which the contracting of private for-profit hospital services has been beneficial in LMICs. Regulatory mechanisms for all private providers, including the not-for-profit sector are often weak, making it a challenge to assure quality service delivery and to coordinate with other state actors on both short-term and long-term goals.

However, in countries with a large private for-profit sector already engaged in delivery of the bulk of surgical services, and where the public sector capacity to do so is restricted, some commentators, such as Rosemary Morgan and Tim Ensor, have proposed that a mix of public and private provision of surgical services might be a more pragmatic solution, provided its regulation is appropriate.⁶⁷ In this situation, the focus should be on development of regulatory mechanisms that promote quality and efficiency, assure equity and pro-poor financial risk protection through risk pooling, and protect against corrupt or monopolistic relationships developing between state and private actors.⁶⁷

Surgery and UHC

UHC has emerged as a leading post-2015 policy goal, supported by WHO,²⁶² the World Bank,⁴¹ the UN,⁴² and many governments in LMICs.^{263,264} We endorse a path to UHC emphasising pro-poor progressive universalism, as laid out by the *Lancet* Commission on Investment in Health.⁵⁶ We do so on the basis that a need exists to recognise cost constraints in decisions around health coverage in LMICs, and because pro-poor pathways help promote health coverage and typically result in the greatest magnitude of health gains in LMICs.^{56,264} Mexico's pathway towards UHC adopted such a pro-poor approach.²⁶⁵ Assessments of the Mexican health reform suggest that it has improved access, equity, and uptake of services, and was associated with an unprecedented increase in surgical volume in the country, at an average rate of 23% per year. Whether pro-poor progressive universalism is best achieved through the targeting of poor people by the choice of surgical interventions covered or through fee exemptions for surgical and anaesthesia care is unclear. Results of research in Mexico and Thailand suggest both methods can work and both have advantages and disadvantages.^{56,265,266}

Panel 5: Multicriteria decision analysis for funding surgical procedures, packages, and platforms within progressive universalism schemes

Thought should be given to the following factors, using country-specific data and contexts:

- Size of the population affected by the disease
- Severity of the disease, including chance of death or permanent disability if untreated and including level of impairment
- Effectiveness of the surgical intervention, including chance of cure with the intervention and ability to be done successfully within the skill and resource level of the country
- Economic effect of the condition on the household, including catastrophic expenditure and effect on productivity
- Welfare effect of the condition on the household, including effects on primary caregiver and on schooling and welfare of dependants
- Equity and social implications and the extent to which it is a pro-poor policy
- Cost-effectiveness of the particular procedure and the platform needed for delivery
- Budget implications of coverage, including necessary expenditure to provide the intervention to all those who need it

Panel 6: Core packages for surgical and anaesthesia care

The packages listed here would be appropriate to provide within the initial coverage and benefits package under universal health coverage, with examples of procedures each package might cover. Individual countries should perform their own decision analyses to tailor the procedures, packages, and platforms according to their individual needs. The multicriteria decision analysis framework, outlined in panel 4, was applied to a series of surgical procedures and packages to generate this list.

Common conditions: emergency procedures

Basic trauma surgery package

- Open and closed fracture repair, chest tube placement, amputation, trauma laparotomy, burr hole, wound care, debridement.

Basic emergency obstetric surgical package

- Caesarean section, hysterectomy, salpingectomy, dilatation and curettage.

Basic emergency general surgical package

- Laparotomy, appendectomy, hernia repair with or without bowel resection, incision and drainage of soft tissue infections.

Common conditions: planned care packages

General surgical package

- Hernia repair (non-obstructed or incarcerated), hydrocelectomy, cholecystectomy, ureteric or kidney stone removal, prostatectomy, thyroidectomy (goitre-endemic regions), excision biopsy, lumpectomy or mastectomy, resection of early-stage oral cavity tumours, bowel resection.

Obstetric and gynaecological package

- Treatment of cervical pre-cancerous lesions, hysterectomy for invasive cervical cancer.

Specialist surgical package

- Cataract repair, trachoma surgery (where endemic), cleft palate and lip repair, clubfoot correction, surgical repair of congenital heart anomalies, obstetric fistula repair.

Palliative surgical care package

- Mastectomy, diversion colostomy; palliative surgical care packages should be delivered alongside access to appropriate palliative analgesics, including opioids.

Irrespective of the mechanisms by which an individual country moves towards UHC, we believe a basic level of surgical and anaesthesia care should be included as part of the initial coverage package within a country's UHC

expansion pathway. As we have shown in this report, although surgical and anaesthesia care can improve health and fight poverty in LMICs, use of surgical and anaesthesia care can also be impoverishing for households in the absence of effective coverage and financial risk protection.

Four levels of surgical coverage exist, conveniently denoted as the 4Ps: the procedures that are covered; the packages of surgical and anaesthesia care in which different procedures are grouped, funded, and purchased; the platforms on which packages of surgical and anaesthesia care are delivered (community health centre, first-level hospital, second-level hospital, etc); and the national and international policies that assure universal coverage and that inform how this coverage is organised and delivered.

Under the scenario of progressive universalism, by definition, not everything can be funded immediately. The most cost-effective interventions and those that are associated with the highest levels of impoverishment in the absence of financial risk protection are typically given priority in the initial benefits package. Other factors can also be included in decisions about what to cover, according to a country's specific context, values, and political environment. In panel 5 we outline factors that are important for countries to consider when deciding which surgical procedures, packages, and platforms to include within their coverage policies. These factors are not exhaustive, but can be used as a guide to assist policy makers, health planners, and ministries of health and finance in their decision making.

By applying these criteria to a typical LMIC and with emphasis on targeting people of low income through the choice of interventions that will benefit them most, we present one potential set of core surgical procedures, packages, and platforms that might form the first step in a surgical coverage policy under a progressive universalism path (panel 6; appendix p 133).

Recommendations for economics and financing

National (governments, ministries of health, ministries of finance)

- UHC policies should include surgery and cover basic packages of surgical and anaesthesia care from early within the expansion pathway.
- Health financing mechanisms for surgical and anaesthesia care that are based on risk pooling should be used instead of user fees at the point of care. Risk pooling with one pool and payer (eg, a public national health insurance) can improve equity, access, and financial risk protection.
- Increased mobilisation of domestic health financing sources towards surgical and anaesthesia care is needed to meet the costs of scaling up surgical and anaesthesia services to a minimally acceptable level. Early investments will pay the greatest dividends in terms of health benefits and economic and welfare gains.

- Improved tracking of financing flows to surgical services through national health accounts is needed. Disaggregated accounting and improved transparency will assist with improved tracking of financial flows. Strategic purchasing—ie, risk-pooled funds for surgical services that pay providers on the basis of quality output and outcomes—should be further explored as a means of improving quality and efficiency.

International (World Bank, WHO, USAID, OECD, Eurostat)

- Surgical and anaesthesia care should be included within UHC policies and goals.
- Increased international health financing (eg, traditional DAH and innovative global health financing) is needed to finance the scale-up of surgical services in many LMICs, particularly for capital costs. Financing of health systems strengthening in LMICs should explicitly include surgical services.
- Tracking of financing flows to surgery within global DAH or Overseas Development Assistance databases is needed. Increased transparency and disaggregation of spending within DAH accounts will assist with tracking efforts.
- The international System of Health Accounts (which outlines statistical reporting rules for financial data provided by national health accounts, allowing for international comparisons of health-care spending between countries) should include and collect surgical data to allow for standardised reporting of expenditure on surgical and anaesthesia care and its financing. Surgical and anaesthesia care should be included within the International Classification for Health Accounts health care, health providers, and health financing tables.
- Increased attention should be given to the use of innovation and technology to reduce costs and optimise the use of resources in the delivery of surgical and anaesthesia care in low-resource environments.

End here.

Information management

Data for monitoring and generating progress

Data collection, analysis, and reporting of findings are crucial for a responsive and effective health-care system. Consistent monitoring of data through a limited set of indicators, such as those used for the MDGs, can focus attention and galvanise support about a particular topic. Here, we examine what global health information is collected and used for surgery. We then use these findings to develop and propose a core set of surgical indicators to be used at national and international levels to monitor progress towards universal access to safe, affordable surgical and anaesthesia care when needed.

The present situation

Data collection

Mechanisms for acquisition of health-specific data vary depending on the level of collection, desired use, and

resource availability. These approaches have been broadly grouped into population-based and facility-based methods. Additional sources are administrative data, such as from accreditation and licensing bodies and modelling.

Population-based mechanisms for health monitoring include civil registration systems, censuses, demographic surveillance systems, verbal autopsies, and household surveys or questionnaires. Country-wide documentation of medically certified cause of death and births through civil registration and vital statistics systems is the gold standard for mortality statistics and subsequent knowledge of many health issues. However, to develop the infrastructure necessary to collect these data is time and resource intensive. Few countries maintain complete civil registration and vital statistics systems;¹⁸ only 1% of deaths are reported by cause in low-income countries.¹⁷ Notwithstanding a host of moral, legal, and policy implications, this so-called scandal of invisibility greatly hinders true understanding of (let alone ability to affect) cause, magnitude, and effect of deaths from any condition, including those of a surgical nature.¹⁹ As discussed earlier, most of what is known about the burden of surgical conditions is therefore based on modelling methods, or limited data samples generated through the methods we describe in this section.

Household surveys are one method to generate epidemiological data. Such surveys frequently include various demographic, socioeconomic, health, and financial states.²⁷ Household surveys are typically funded externally in the lowest-resource settings and are expensive to undertake,^{268–270} and have been used for years to examine health factors on subnational, national, and multinational scales. Different surveys are used in different countries with varying frequencies. To assess inclusion of surgical conditions within household surveys, we reviewed four of the most widely used multinational surveys: Multiple Indicator Cluster Surveys (MICS), Demographic and Health Surveys (DHS), Living Standards Measurement Study (LSMS), and the World Health Survey (WHS). Full methods are reported in the appendix (p 136) and results in table 5.

Briefly, MICS were originally created by UNICEF as monitoring methods for various indicators of child welfare after the 1990 World Summit for Children.²⁷¹ Since inception, the surveys have been completed in more than 100 countries and are in the fifth iteration, MICS5.²⁷² The only MICS5 indicator identified that pertains directly to surgery is indicator 5.9, which assesses birth by caesarean delivery.

The DHS Program, funded by USAID, institutes country-wide data collection pertaining to population, health, and nutrition. Introduced in 1984, the DHS Program has overseen completion of surveys in more than 90 countries.²⁷³ The present version, DHS6, has a strong maternal child health focus and basic surgical inclusion: birth by caesarean delivery and OOP expenditures for accidents or injuries and births.

For key findings from the information management working group see appendix p 135

The Opinion Pages | OP-ED CONTRIBUTORS

How Surgery Can Fight Global Poverty

By MARK G. SHRIME and JOHN G. MEARA SEPT. 25, 2015

EARLIER this year in Madagascar, a man in his 60s named Sambany made international news after volunteer surgeons from Mercy Ships removed a 16-pound tumor from his face. For decades, he had sought treatment at 10 hospitals, most of which lacked surgeons. He was ostracized, then physically unable to work. His family had to sell a rice field just to pay for the cost of getting to the hospital (the surgery itself was provided free).

Earlier this week, the United Nations adopted 17 proposed sustainable development goals, which reflect the resolve of world leaders to “end poverty and hunger everywhere; to combat inequalities within and among countries; to build peaceful, just and inclusive societies.”

Although admirable, these goals cannot be achieved without explicitly addressing one of the most crucial needs facing the world: a lack of access to surgery. The aim of universal access to “health care and social protection, where physical, mental and social well-being are assured,” will come to nothing without it.

Most of the world lacks access to safe, affordable and timely surgical care.

Every year over 80 million people worldwide face financial catastrophe if they get surgery. And while the individual cost of getting surgery is great, the societal cost of inaction is staggering. If nothing is done to increase surgical access, developing nations are projected to lose \$12.3 trillion from their gross domestic products between now and 2030.

Currently, infectious disease interventions are the main focus of global health policies, because many countries lack the personnel and infrastructure to carry out surgical interventions successfully.

Despite the fact that nearly one-third of human disease is amenable to surgery, it remains overlooked in much of the world.

This is shortsighted. After all, the treatment of solid tumors in the United States began with surgeons: William Stewart Halsted described the surgical removal of breast cancer in 1894, well ahead of chemotherapy. Surgery and early detection alone drove substantial drops in breast cancer mortality. Today over 60 percent of cancer diagnoses benefit from surgical intervention.

Surgery is more than just facial tumors, breast cancer and trauma; it is a crosscutting intervention, involved in every disease category from infections to blindness, from congenital abnormalities to maternal conditions, from the neurological to the cardiac to the neoplastic. To put this in perspective, H.I.V., tuberculosis and malaria — which have captured the global conversation — currently make up less than one-tenth of the global disease burden, combined.

Why, then, has surgery been ignored? In part, because expanding surgery seems daunting and expensive. Why not just focus global energy on vaccines, for example, which can be mass-produced and delivered to the population, rather than scaling up an entire health infrastructure? After all, providing surgery requires reliable electricity, water, suction, sterilization, oxygen — as well as surgeons, anesthesiologists, nurses and biomedical technicians.

But this is exactly what makes improving surgery ideal. Improve a surgical system, and you improve the very things that are necessary for the delivery of health care in general. Doing so is less costly than it might initially seem. The cost of scaling up a surgical system in resource-poor countries — about \$300 billion over 18 years — represents only about 5 percent of the total combined expenses that governments in low- and lower-middle-income countries spend on health annually, and pales in comparison with the \$12.3 trillion cost of inaction. And spending that money now will not only lower the current surgical disease burden and allow patients to return

to economic productivity, but it will also make the health system itself more resilient when shocks like Ebola hit.

Moreover, reliable surgical infrastructure strengthens entire health systems. It is not enough to prevent maternal deaths during childbirth if a health care system cannot care for the children after birth. It is not enough to treat tuberculosis successfully if the patient then dies from a perforated appendix. Surgical scale-up is not and has never been envisioned to exclude other global health priorities — surgery is necessary to meet all global health priorities.

It is this inherent synergy that makes surgical delivery a **cost-effective intervention**. Researchers from Harvard and Stanford Universities, including one of us, recently compared the cost-effectiveness of surgical care with that of multiple accepted global health interventions. They found that general surgeries, ophthalmic surgeries and cleft palate repairs, among others, had a similar cost effectiveness to some vaccinations, and that cesarean sections and orthopedic surgeries were potentially more cost effective than medical treatments for heart disease and H.I.V.

For Sambany, surgery was a personal issue. For developing nations, it is an economic issue. For the world, it is a moral issue, a question of equity. Surgery has been called the “neglected stepchild of global public health.” To achieve the recently approved global development goals, world leaders must explicitly develop systems to bring access to safe, affordable and timely surgery to those who need it.

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Investing in surgery: a value proposition for African leaders



Globally, poor access to high-quality surgical, obstetric, and anaesthesia care remains a main contributor to global disease burden accounting for about a third of deaths worldwide.¹ The need for strengthening surgical care systems is especially urgent in sub-Saharan Africa, where access is strikingly limited, leading to the highest mortality and morbidity from surgically preventable and treatable conditions in the world.^{2,3} Approximately 93% of the population of sub-Saharan Africa lacks access to safe, affordable, and timely surgical care, compared with less than 10% in high-income countries.² Despite the immense and growing need for surgical services in sub-Saharan Africa, investments by African public sector leaders to improve surgical systems on the subcontinent have been inadequate. The current COVID-19 pandemic has disrupted health care globally, with an estimation by the CovidSurg Collaborative showing that more than 28 million surgeries will be postponed or cancelled worldwide during the 12 weeks of peak disruption.⁴ There is a basic ethical responsibility to provide surgical care as a fundamental human right, in keeping with the principles espoused in the Universal Declaration of Human Rights. Additionally, improved access to high-quality surgical care is an essential component of universal health coverage and will contribute to good health and wellbeing, leading to improved human capital—all of which are vital for poverty reduction and economic growth on the continent.

Human capital—the knowledge, skills, and health that people accumulate over their lifespan—is a primary driver of economic development.⁵ Investing in people by developing their skills, knowledge, and health allows them to be more productive, adaptable, and innovative, enabling meaningful participation in social, political, and economic life. The benefits of better health as human capital are visible at the individual, societal, and

national levels. Healthy children thrive physically and mentally, which enables them to acquire knowledge and skills needed for the labour market. People with greater human capital earn higher wages and further invest in the education and health of family members and their community. This relation is especially visible in women's health, where poor maternal health can lead to long-term health consequences in women and children, negatively affecting the wellbeing and economic productivity of future generations.^{6,7} Ultimately, educated, skilled, and healthier individuals are better placed to productively contribute to national socioeconomic development, while maximising available human capital.

In 2015, an estimated 47% of all productivity losses in the WHO African region—approximately Int\$1.4 trillion—were due to non-communicable diseases and injuries, which often require surgical systems for proper diagnosis, treatment, and management.⁸ In the past, substantial investments targeting infectious diseases and nutrition



Thomas Mukoya/Reuters Pictures

have led to improvements in health outcomes in sub-Saharan Africa.⁹ However, in view of changing disease epidemiology, it is likely that returns on these investments will only be partly realised unless substantial resources are invested in robust surgical systems to address the increasing burden of surgical conditions, which disproportionately affect the working-age population and children.^{3,10} The demographic dividend in Africa will only be harnessed by reducing the dependency ratio and increasing the capacity of the working population to perform efficiently and effectively.

Studies suggest that investment in surgical care will contribute substantially to human capital in sub-Saharan Africa.^{2,11,12} Caesarean delivery is the most widely performed surgical operation globally and is a critical intervention to reduce maternal mortality.¹³ However, in sub-Saharan Africa, maternal mortality after caesarean delivery is estimated to be as high as 543 per 100 000 operations—50 times higher than in high-income countries.¹⁴ Other conditions that require surgical care and severely affect human capital in sub-Saharan Africa are road traffic injuries. In 2016, the rate of these injuries in the WHO African region, at 26.6 road traffic deaths per 100 000 population, was the highest in the world—up from 26.1 per 100 000 population in 2013.¹⁵ Addressing trauma resulting from the rise in road traffic injuries and other sources of injuries, as well as mortality and morbidity from surgical conditions such as obstructed labour during pregnancy, will require investments in surgical systems.

The 2015 *Lancet* Commission on global surgery estimated that up to \$12.3 trillion in low-and-middle-income countries, or 2% of gross domestic product growth in middle-income countries, could be lost by 2030 without improved surgical systems.² Improving surgical care should be considered an urgent matter, as conditions amenable to surgical care account for more annual deaths than HIV/AIDS, malaria, and tuberculosis combined.¹² The delivery of surgical care can be complex, requiring all components of the health system and the governance and organisation of diverse actors within that system. Nonetheless, programmes such as Narayana Hrudayalaya in India show that complex cardiovascular surgical interventions can be safely delivered in resource-limited settings at affordable costs.¹⁶ Using a combination of innovative processes and technologies, with a focus on efficiency and leveraging economies of scale, Narayana

Hrudayalaya has been able to provide access to cardiac and other surgical care at low cost to thousands of Indians.¹⁷ Similar models could be adapted and scaled up in Africa to deliver a wide range of essential and emergency surgical care. Progress is already underway in several African countries. For example, six African countries have adopted national surgical, obstetric, and anaesthesia plans as roadmaps to systematically scale up surgical systems as a component of their national health strategic plans. The Southern African Development Community passed a regional resolution in 2018 specifically to improve surgical care.¹⁸ Several innovative affordable efforts to improve access to quality surgical care regionally, such as the East, Central and Southern Africa (ECSA) Collegiate training of surgeons, obstetricians, and anaesthesiologists, are showing early success.¹⁹ Such efforts should be supported politically and financially by African leaders.

In 2015, the World Bank launched its Human Capital Project, which includes a human capital index that primarily aims to incentivise and support countries to invest in people for economic development and poverty reduction.⁵ In view of the high burden of surgical conditions in sub-Saharan Africa, investment in health systems capacity to deliver surgical care must be included in all efforts to increase human capital necessary for technological innovation and long-term economic growth in this region.

Africa's most valuable resource is its people. Increased investment in the health of Africans will lead to economic growth in Africa. Millions of Africans who do not have access to surgical care, especially women and young adults, are prevented from achieving their maximum human capital, which is needed to compete in an increasingly technological and digital world. Therefore, African leaders have an ethical, social, and economic responsibility to invest in surgical care to increase the individual, societal, and national human capital needed to reap its demographic dividend.

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RESEARCH

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Financial contributions to global surgery: an analysis of 160 international charitable organizations

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Abstract

Background: The non-profit and volunteer sector has made notable contributions to delivering surgical services in low-and middle-income countries (LMICs). As an estimated 55 % of surgical care delivered in some LMICs is via charitable organizations; the financial contributions of this sector provides valuable insight into understanding financing priorities in global surgery.

Methods: Databases of registered charitable organizations in five high-income nations (United States, United Kingdom, Canada, Australia, and New Zealand) were searched to identify organizations committed exclusively to surgery in LMICs and their financial data. For each organization, we categorized the surgical specialty and calculated revenues and expenditures. All foreign currency was converted to U.S. dollars based on historical yearly average conversion rates. All dollars were adjusted for inflation by converting to 2014 U.S. dollars.

Results: One hundred sixty organizations representing 15 specialties were identified. Adjusting for inflation, in 2014 U.S. dollars (US\$), total aggregated revenue over the years 2008–2013 was \$3.4 billion and total aggregated expenses were \$3.1 billion. Twenty-eight ophthalmology organizations accounted for 45 % of revenue and 49 % of expenses. Fifteen cleft lip/palate organizations totaled 26 % of both revenue and expenses. The remaining 117 organizations, representing a variety of specialties, accounted for 29 % of revenue and 25 % of expenses. In comparison, from 2008 to 2013, charitable organizations provided nearly \$27 billion for global health, meaning an estimated 11.5 % went towards surgery.

Conclusion: Charitable organizations that exclusively provide surgery in LMICs primarily focus on elective surgeries, which cover many subspecialties, and often fill deep gaps in care. The largest funding flows are directed at ophthalmology, followed by cleft lip and palate surgery. Despite the number of contributing organizations, there is a clear need for improvement and increased transparency in tracking of funds to global surgery via charitable organizations.

Keywords: Surgery, Global health, Finance, Economics

Background

For the past three decades there has been an expanding number of organizations and activity in the non-profit and volunteer sector (Salamon 2010). These sectors account for significant economic contributions to global health and mobilization of thousands of volunteers. Even in the face of the global financial crisis—when levels of

overall development assistance for health (DAH) were stagnant, non-governmental organizations (NGOs) increased their spending on DAH by 10 % (2010–2011) (Leach-Kemon et al. 2012; Institute for Health Metrics and Evaluation 2012). Furthermore, surgeons—in conjunction with non-profit and volunteer organizations—have played a prominent role in providing service in low and middle-income countries (LMICs) where access to surgical care remains limited (Casey 2007; McQueen et al. 2010; Shrime et al. 2014; Ozgediz 2009; Kingham et al. 2011).

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Surgical diseases account for 11–30 % of the global burden of disease, with LMICs bearing largest majority of the burden, despite having the least capacity to manage these conditions (Shrime et al. 2014; Shrime et al. 2015; Debas et al. 2015). Approximately 5 billion people worldwide are without access to timely, affordable, and safe surgery (Alkire et al. 2015).

International charitable organizations providing surgical care in LMICs often work in regions with the highest burden of surgical disease and the least amount of human and financial resources (McQueen et al. 2010; Nguyen et al. 2014). Additionally, while these organizations provide a broad range of surgical specialties, the cases, counterintuitively, are mainly elective in nature (McQueen et al. 2010). As a result, these organizations mainly adhere to short-term mission models and provide clinical service as well as training opportunities (Nguyen et al. 2014).

Besides delivering needed care, charitable organizations account for significant funding flows to global health. Conservative estimates suggest that total expenditures on short-term medical missions, including surgical missions, are about \$250 million per year (Maki et al. 2008). One study found that twenty of the largest U.S. NGOs that have health as a top priority spent \$11.8 billion on global health from 2002 to 2006 (Ravishankar et al. 2009). Furthermore, health NGOs as a whole accounted for 15.7 % of the \$31.3 billion total sum of DAH in 2013 (Dieleman et al. 2014). Little, however, is known about the finances provided towards surgery in LMICs because DAH databases do not specifically collect data on surgical services.

To this point, there have been no studies dedicated to aggregating the revenue and expenditure of exclusively surgical charitable organizations. As an estimated 55 % of surgical care delivered in some LMICs is via charitable organizations; understanding the financials of the charitable sector would be helpful in estimating funding flows to global surgery (Bolkan et al. 2015). Furthermore, the dual nature of charitable organizations—as both funding channels and implementation agents—make them a particularly unique topic to study (Dieleman et al. 2014). In this study, we examined financial contributions made to global surgery exclusively by surgical charitable organizations in five high-income nations (United States, United Kingdom, Canada, Australia, and New Zealand).

Methods

We define charitable organizations as non-profit, non-governmental organizations that serve the public interest. These organizations may receive funding from a variety of sources including private donations, grants, government contracts, and user fees. Charitable organizations

with available financial information described here represent the spectrum of platforms for the delivery of surgical care by charitable organizations described by Shrime et al. (2014) short-term surgical trips, specialized hospitals, and self-contained surgical platforms.

Charitable organizations providing exclusively surgical care were identified using the surgical volunteerism listings on the websites of the American College of Surgeons Operation Giving Back, the Society of Pediatric Anesthesiologists, OmniMed, and the U.S. State Department Private Volunteer Organizations registry ([American College of Surgeons Operation Giving Back](#); [Private Voluntary Organizations](#); [Omni Med Database of Global Health Service Opportunities](#); [Society for Pediatric Anesthesia Volunteer Medical Services Abroad](#)). Additional searches were performed on the Foundation Center Online Directory, idealist.org, UK Charity Commission, Australia Charity Commission, New Zealand Charity Commission, and Canada Revenue Agency Charity Search. Key words used in these searches are described in Table 1. The website of each organization was then reviewed to ensure it met our inclusion criteria of providing exclusively surgical care, and not other services, in LMICs. Charitable organizations were selected solely based on the location and type of services provided; financial thresholds were not considered. Organizations that solely provided surgical care—not other types of medical care or development aid—were selected to be the study's primary focus, as groups that provide several varieties of care often, in their accounting, do not disaggregate funds, making identifying surgical allocations nearly impossible.

Any non-profit organization that is registered in the United States can qualify for federal tax exemptions. In order to apply for these exemptions, most of these groups are required to file a version of the tax form 990. The 990 forms provide information on the organization's revenue and expenses and are required to be publically available. The 990s for each organization used in this study were obtained from the organization's own website or from other public sources listed in Table 1.

For organizations registered in the UK, Canada, Australia, and New Zealand, annual financial reporting is compiled by the respective country's national charity commission and is made available on the commission's website and/or on the individual organization's website. Both websites were searched to obtain the data.

Based on availability, up to five of the most recent annual financial documents were collected for each organization. These five reports encompassed the most recent available years, which were not uniform across the study sample. For example, one organization had available documents for the years 2009–2013, while another organization only had the years 2008–2012 available.

Table 1 Summary of study methods

Country	Organization identification	Sources of financial documents
United States of America	American College of Surgeons Operation Giving Back, the Society of Pediatric Anesthesiologists, OmniMed, and the US State Department Private Volunteer Organizations registry, Foundation Center Online Directory,	Organization's website, Guidestar, ProPublica, Economics Research Institute (ERI), Citizenaudit.org, National Center for Charitable Statistics at the Urban Institute, and the Foundation Center Online Directory
United Kingdom	UK Charity Commission	Organization's website, UK Charity Commission
Canada	Canada Revenue Agency Charity	Organization's website, Canada Revenue Agency Charity
Australia	Australia Charity Commission	Organization's website, Australia Charity Commission
New Zealand	New Zealand Charity Commission	Organization's website, New Zealand Charity Commission

Keywords used in search: "global," "international," "low resource," "developing countries/nations" and "surgery," "obstetrics and gynecology," "obstetric fistula," "trauma," "injury," "congenital birth defects," "cleft lip/palate," "cataract," "ophthalmology," "burn," "reconstructive," "urology," "orthopedics," "club foot," "neurosurgery," "hydrocephalus," "anesthesia," "hernia," "cardiac," and "ENT"

Both organizations had 5 years of financial data to review, but not the same 5 years. The data set included a total of 651 financial documents from 160 different organizations. Five documents were available for about 80 % (128) of the organizations. Some organizations had anywhere from 1 to 4 available reports. Specifically, 17 out of the 160 organizations (10 %) included in this study had only one document available. Similarly, 16 (10 %) organizations had four documents available. Each organization was categorized by surgical specialty.

The total revenue and expenditure (broken down further into the categories of program service, management and administration, fundraising, and other) were recorded per organization per year. The expenditure breakdown was not available on every financial document. All foreign currency was converted to U.S. dollars using historical yearly average conversion rates. All nominal dollars were adjusted for inflation by converting to 2014 U.S. dollars using the International Monetary Fund World Economic Outlook database (downloaded April 2014). Data was managed and analyzed in JMP Pro 11 and Microsoft Excel. Ethics approval was not obtained; only public financial data was used and none of the data analyzed was linked to any human subjects or personal private health information.

Results

One hundred sixty organizations representing 15 different surgical specialties (including anesthesia), were included in the study. 651 documents of financial data ranging from 2007 to 2013 were analyzed. Table 2 analyzes the total revenues and expenses of all organizations, divided by type of surgical specialty, then further divided by the number of organizations identified per specialty. The aggregated total revenue was \$3.4 billion. The total expenditure was \$3.1 billion. Table 3 delineates expenditure breakdown. Service expense/total expense represents the average percentage of total funds spent

on actual program services. The median range is 0.71–1. In other words, on an average aggregated level these organizations spend anywhere from 71 to 100 % of their funding on actual program execution. However, data on expenditure breakdown were very limited, so the range of these figures may not truly reflect reality. Nearly all of these organizations focus on elective surgical procedures.

Ophthalmology ($n = 28$) is the top revenue-generating surgical specialty, generating about \$1.5 billion over the studied time frame. Ophthalmology accounted for 45 % of total revenue and 49 % of total expenditure. Cleft/lip palate ($n = 15$) was the specialty with the second highest revenues (\$912 million), generating \$912 million and accounting for 26 % of total revenue and 25 % of expenditure. With \$462 million, the "mixed" grouping ($n = 19$)—which includes organizations that do not focus on a single surgical specialty but enlist multidisciplinary surgical teams—had the third largest revenues, accounting for 14 % of total revenue and 16 % of total expenditure. The remaining 15 % of funds are attributed to 98 organizations that represent 12 specialties. Trauma and burn organizations were the least financially supported, although data for these types of organizations was very limited.

Discussion

The study identified 160 surgical charitable organizations. Between 2007 and 2013, this group generated around \$3.4 billion in revenue and spent nearly \$3.1 billion. On an annual basis from 2007 to 2013, the organizations collectively generated an average of \$573 million. In 2013, charitable organizations providing DAH as a whole generated about \$5 billion (Dieleman et al. 2014), which can be extrapolated that in 2013, about 11.5 % of charitable revenue generation (\$0.573 billion out of \$5 billion) can be accredited to surgical charities.

There are several limitations to this study. First, only charitable organizations that provided surgical care

Table 2 Total revenue and expenditure for 160 international charitable organizations 2007–2013 in 2014 U.S. dollars

Type of surgery	Number of organizations	Total revenue (sum)	% of total	Total expenses (sum)	% of total
Ophthalmology	28	\$1,556,711,013.71	45.22	\$1,516,012,160.15	48.36
Cleft Lip/Palate	15	\$912,757,996.82	26.52	\$809,238,269.93	25.82
Mix	19	\$462,030,763.76	13.42	\$478,313,096.97	15.26
Reconstructive	25	\$230,820,438.28	6.71	\$72,786,337.43	2.32
Cardiac	22	\$87,152,341.35	2.53	\$82,542,871.03	2.63
Orthopedics	18	\$86,650,015.57	2.52	\$81,162,974.39	2.59
Pediatric	11	\$56,377,801.33	1.64	\$49,837,202.80	1.59
Obstetric Fistula	10	\$24,953,680.80	0.72	\$23,488,194.25	0.75
Neurosurgery	2	\$11,273,228.00	0.33	\$10,601,253.93	0.34
Urology	1	\$4,657,374.00	0.14	\$4,191,093.97	0.13
ENT	1	\$3,354,510.00	0.10	\$566,978.10	0.02
Craniofacial	1	\$2,906,726.00	0.08	\$3,844,568.83	0.12
General	3	\$897,863.21	0.03	\$805,652.52	0.03
Anesthesia	1	\$817,932.45	0.02	\$465,826.27	0.01
Burn	2	\$733,727.84	0.02	\$657,707.13	0.02
Trauma	1	\$59,476.55	0.00	\$14,663.53	0.00
All	160	\$3,442,154,889.65	100.00	\$3,134,528,851.22	100.00

Table 3 Breakdown of expenditures for 160 international charitable organizations 2007–2013 in 2014 USD

Type of surgery	Total program service expenses (sum)	% of total	Total management expenses (sum)	% of total	Service expense/total expense (median)
Ophthalmology	\$1,146,905,574.00	54.30	\$25,232,021.67	27.72	0.904
Cleft Lip/Palate	\$501,356,549.10	23.40	\$27,124,232.84	29.91	0.782
Mix	\$253,328,682.50	11.93	\$18,558,637.91	20.37	0.890
Orthopedics	\$74,106,734.52	2.65	\$2,988,617.99	5.66	0.8528
Cardiac	\$59,824,911.09	2.83	\$5,198,179.02	5.74	0.858
Pediatric	\$38,866,267.74	1.84	\$1,852,283.99	4.87	0.838
Reconstructive	\$39,263,691.25	1.84	\$4,459,333.64	2.05	0.782
Obstetric Fistula	\$18,275,700.71	0.87	\$1,935,357.54	2.14	0.818
Neurosurgery	\$116,048.07	0.01	\$11,283.36	0.01	0.885
Urology	\$2,944,251.58	0.14	\$843,406.30	0.94	0.715
ENT	\$460,631.72	0.02	\$106,003.33	0.12	0.996
Craniofacial	\$3,361,305.62	0.16	\$384,823.62	0.42	0.871
Burn	\$279,259.59	0.01	\$22,984.77	0.03	0.968
General	\$236,554.13	0.01	\$0.00	0.03	1
All	\$2,139,326,162.00	100.00	\$88,717,165.99	100.00	

exclusively (i.e. no other service) were included. There are many other charitable organizations that provide significant amount of surgery in addition to many other forms of medical care and overall developmental aid. These organizations were excluded because it is impossible to ascertain from their financial documents precisely what portion of funds are allocated to surgery as opposed to other activities. Nonetheless, it is important to acknowledge that many such organizations exist and make invaluable contributions to global surgery. To illustrate,

Medicine Sans Frontiers International had a net income of €1,008,535,702 and net expenditure of €953,000,000 (of which €615,000,000 was on program expenses) in 2013 (MSF 2013). The organization's financial report includes a very general breakdown of expenditures, with such categories such as personnel, administration, travel and transportation, medical and nutrition, logistics, and several more. An MSF surgical mission would likely span across all these categories, but the organization does not disclose the exact proportions from each that might be

attributed to a mission. To further contextualize, in 2013, 77,350 major surgical interventions were performed, but in that same year 2,497,250 measles vaccinations delivered, there were 9,029,100 outpatient consultations, and 341,600 patients were enrolled in HIV care (MSF2013). Additionally, independent studies have shown that MSF also provides surgical care in various specialties and among different age groups (Groen et al. 2015; Wong et al. 2015a, b; Alvarado et al. 2015). Even within one of the world's major medical charitable organization, MSF, surgery has been among the least provided services. Another study searched to identify all charitable organizations providing surgical care in LMICs regardless of other services rendered. They identified 313 organizations, including the 160 analyzed here (Ng-Kamstra et al. 2015).

A second limitation to this study is that only included organizations that had publicly-available data, thus not taking into account the work done and money spent by charitable surgical organizations that don't disclose data to the public. Perhaps some organizations were not officially registered as a charitable organizations, thus they were not legally required to publically provide financial documents. Therefore, their finances are unknown and could not be included in this study.

A third, related limitation is only organizations that had financial data available in English (we were unable to read reports in other languages). Therefore, many charitable organizations that are registered in the European Union, Asia, Africa, and South America were not included.

Despite these limitations, the countries and organizations included in this study are among the worlds leading contributors to global health. Consequently, while the data aggregated in this study may be an underestimate of the comprehensive amount of money generated and spent for surgery in LMICs, it is representative of the funding flows from charitable organizations in the top donor countries.

A well functioning surgical system is an integral part of any strong health system. Surgical care is required for the treatment of many diseases, across almost all medical disciplines (Rose et al. 2014; Bickler 2015). Unfortunately, it is often beyond the local health system capacity to provide adequate surgical care, leaving a gap that charitable organizations from high-income countries ultimately fill. In certain countries, charitable organizations may be the de facto option for affordable surgical care (Farmer and Kim 2008). Therefore, until health systems of LMICs are strengthened, charitable organizations remain critical to the delivery of surgical care. Thus, understanding these organizational finances will provide some insight to financing flows to surgery in LMICs.

Likewise, charitable organizations are a critical stakeholder as the field of global surgery evolves. This study

offers up some evidence that surgical charitable organizations are, at the very least, financially underrepresented, earning just 11.5 % of charitable organization revenue in 2013. While this statistic is striking, it's difficult to definitively support, which is illustrates another pressing problem. There is an overall lack of financial data on global surgery. Databases that report DAH, such as the Creditor Reporting System (CRS) database, provide detailed information on aid for specific disease categories, such as malaria, but they contain very little information on funds dedicated to global surgery ([Technical Guide to terms and data in the Creditor Reporting System \(CRS\) Aid Activities database](#)). When donors publicly report their DAH in the CRS, they must assign a "purpose code" (i.e. HIV control) to each of the projects that they fund ([DAC and CRS code lists](#)). While several of the codes might potentially include surgery—for example, the "medical services" code includes "laboratories, specialized clinics and hospitals (including equipment and supplies)"—the lack of a dedicated code for surgery makes it extremely difficult for researchers to ascertain how much DAH is dedicated to surgical care. Furthermore, with the passing of resolution A 68/31 on Strengthening Emergency and Essential Surgical Care and Anesthesia as a Component of Universal Health Coverage at the 68th World Health Assembly, there will potentially be greater World Health Organization funding towards surgical care in LMIC making the need for robust financial tracking systems of surgery-oriented funds is imperative.

More detailed purpose codes would significantly improve tracking all external financing sources in global health. Additionally, better classification of expenditures would help elucidate exactly how charitable organizations are utilizing their funds, promoting transparency and accountability. It became clear that there is an overall lack of standardized measurement metrics, and in some cases, a complete lack of reporting on what defined a program service expense. Organizations adhering to the short-term mission model best illustrate this point. In this model, surgical teams from high resource settings come to a LMIC for short period of time, often with their own supplies and equipment, and perform a very specific surgery on a group of patients in a defined period of time. While their own time is often voluntary, the cost of their travel (airfare, accommodations, and meals) is often paid for by the organization. If these indirect costs are being counted as, for example, a service expense or administrative expense, it will not be clear from the financial data that these expenses were actually relating to a short-term mission, making it challenging to track funding flows to all elements of charitable surgical care. Consequently, this makes it difficult to fully analyze the allocation of resources and make corresponding recommendations for their most efficient use.

There is a large unmet need of access to even basic, life-saving surgical care in low resource settings (Rose et al. 2015). Moreover, there are significant economic losses in form of country GDP when surgical services are not rendered to those in need (almost 2.5 % GDP by 2030 in LMIC) (Alkire et al. 2015). The cost of scaling up surgical care in LMIC over the years 2012–2030 is estimated at \$300–420 billion–4–8 % of annual total health spending in LMICS (Verguet et al. 2015). In order to achieve this goal, the current financial state and funding flows towards surgery in LMIC need to be better elucidated, documented, and disseminated so that national governments, donors, charitable organizations, and any other stakeholders can better plan and allocate funds. Charitable organizations are a particularly crucial stakeholder as they are both a funder and implementer of surgical care. Thus, we urge all organizations to have detailed and transparent accounting practices to clarify current investments and understand funding gaps for future investment and scale up of surgical care.

Authors' contributions

LG, MS, AD, JM all contributed to the design of the study. LG did the analysis. LG wrote the manuscript with input and numerous revisions from all authors. All authors read and approved the final manuscript.

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How much does it cost to scale up surgical systems in low-income and middle-income countries?

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Poor access to safe, affordable and timely surgical, obstetric and anaesthesia (SOA) care remains a major cause of global morbidity and mortality, impacting low-income and middle-income countries (LMICs) most severely. Globally, approximately five billion people lack access to safe, affordable and timely SOA care. This accounts for about a third of the global burden of disease and drives close to 81 million people into catastrophic expenditure each year.¹ In 2010, an estimated 16.9 million deaths worldwide, a third of all deaths, were attributable to surgical conditions.^{1 2} Annually, about 77.2 million disability-adjusted life years in LMICs could be averted with investments in basic, life-saving high quality SOA care.³

A major impediment to scaling surgical systems in resource-limited settings has been the notion that the cost is too high and the planning and orchestration too complex. SOA care systems require a functioning operating theatre along with specialised workforce, nurses, biomedical engineers, reliable supply chain systems for consumables and medicines, dependable blood banks, diagnostics, strong prehospital and referral systems and postoperative care. As Farmer and Kim succinctly put it, “there is no surgical equivalent to a vaccination campaign or a mosquito net”.⁴ This apparent complexity and the associated costs have made policy-makers reticent to invest in surgical systems, despite the need for these services to achieve the Sustainable Development Goals (SDG) and Universal Health Coverage (UHC).⁵

Since 2015, notable progress has been made at both global and national levels. At the global level, surgical and anaesthesia care has been explicitly acknowledged as an essential component of UHC by all Member States of the World Health Assembly through Resolution 68.15.⁶ This commitment was recently re-emphasised in a recent address by

Dr Tedros Adhanom Ghebreyesus, Director General of the WHO, who stated that “no country can achieve universal health coverage unless its people have access to safe, timely and affordable surgical services”.⁷ At the national level, countries around the world recognise that UHC and eight of the SDGs will not be achieved without intentional and systematic strengthening of health systems capacity to deliver SOA services.⁵ Countries are addressing these surgical inequity gaps through the development of National Surgical, Obstetric and Anaesthesia Plans (NSOAPs). These strategic plans recommended by The *Lancet* Commission on Global Surgery (LCoGS) in 2015 are created to systematically scale up SOA services within each country's national health strategic plan to improve health system outcomes while ensuring accountability and sustainability.

As part of the LCoGS, Verguet and colleagues estimated that scaling up surgical systems in LMICs to meet the target of 5000 surgical procedures per 100 000 population would cost between US\$300 and 420 billion between 2012 and 2030.⁸ Their costs were modelled based on both historical and aspirational rates of scale-up, given the baseline estimates of annual surgical volume in each country and number of operating theatres.

Since 2015, several countries have created and begun implementing NSOAPs, with over a dozen more NSOAPs in development (figure 1). Countries with fully-developed NSOAPs include Senegal, Zambia, Tanzania, Ethiopia, Rwanda and Nigeria. All of these plans have been fully costed, except Ethiopia and Senegal, which were developed before LCoGS. A review of the cost estimates associated with these NSOAPs reveal important insights into the scale of additional financial investments needed to strengthen surgical systems in LMICs.

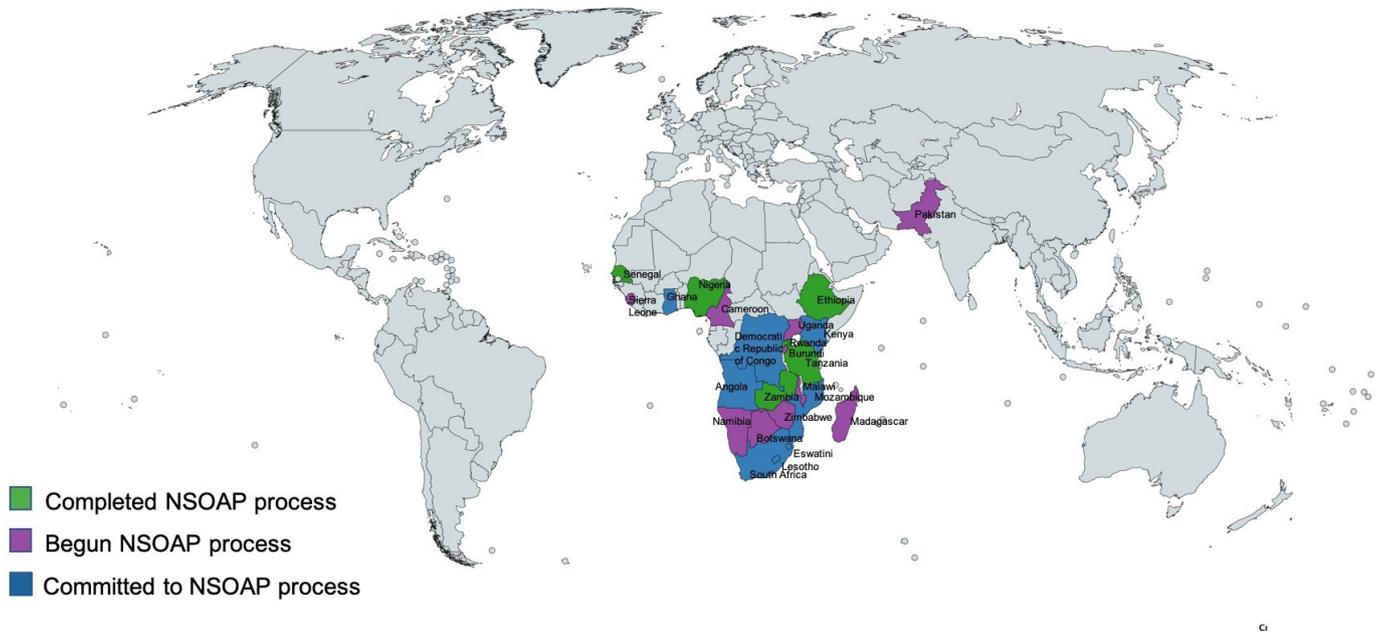


Figure 1 Map of countries at different stages of the National Surgical, Obstetric and Anaesthesia Plan (NSOAP) process.

Table 1 summarises the investments in US dollars anticipated in the four countries with fully costed NSOAPs. The cumulative cost of implementation ranges from US\$69.7million in Rwanda for a population of 12.3million people to US\$16.8billion in Nigeria for a population of 195.9million people. Tanzania and Zambia fall in the middle with a cost of US\$597.0million for 56.3million people and US\$314.2million for 17.3million people, respectively. On a per capita basis, this represents US\$0.94 per person per year in Rwanda, US\$1.51 per person per year in Tanzania, US\$3.62 per person per year in Zambia and Nigeria estimated \$17.12 per person per year. Variations in costs between countries appear to be due to differences in NSOAP priorities set by each country. For example, in Nigeria, healthcare financing, which includes increasing health insurance coverage from 5% to 50% by 2023, accounts for 56% of their NSOAP cost while the finance domain only accounts for 0.14% of Rwanda’s NSOAP cost. Significant differences in NSOAP costs between countries could also be due to differences in costs of interventions between countries as well as the costing methodology used.

In terms of gross domestic product (GDP) per capita, Rwanda and Tanzania would need to invest approximately 0.13% and 0.16% of their current GDP per capita, respectively, to fully implement their NSOAPs. The Zambian NSOAP accounts for about 0.24% of their GDP per capita while Nigeria’s account for about 0.87% of their GDP per capita. Countries considering investing in SOA care should take into account the cost of scale-up and should equally consider the economic consequences of failing to do so. As highlighted by Alkire and colleagues, LMICs stand to lose up to US\$12.3trillion or 2% of projected annual GDP growth in middle-income countries by 2030 if they fail to invest in SOA.⁹ The economic consequences

of surgically-avertable mortality and morbidity, especially as countries seek to increase human capital, cannot be overlooked, particularly with the epidemiological and demographic shifts in LMICs. For example, in the WHO Africa Region, non-communicable diseases and injuries account for about 47% of productivity losses as of 2015.¹⁰ Modest investments between 0.13% and 0.87% of GDP per capita to fund NSOAPs could prevent these large economic losses, in addition to the benefits of decreased morbidity and mortality from surgical conditions. Improvement of SOA care will lead to economic growth and should be considered a worthwhile investment for LMICs.

Systematically scaling up surgical systems appears to be affordable for the countries with NSOAPs. Fiscal space expansion for NSOAPs may in fact be possible from a variety of sources including increasing government health spending to reach national and regional health budget commitments such as the Abuja declaration. Currently, none of the countries with NSOAPs have met the target of the 2001 Abuja declaration, in which African heads of state pledged to set a target of allocating 15% of their annual budget to the health sector.¹¹ Increasing the annual health budget to meet this commitment will provide significant resources to implement NSOAPs and improve SOA outcomes.

Health spending is expected to increase over the next decade as a result of GDP growth, government spending and government health spending.¹² In lower-middle-income and upper-middle-income countries, health spending is expected to grow at an annual rate of 4.2% and 5.3%, respectively.¹² Growth in health spending will be much slower in low-income countries at a rate of 1.8%. While it is possible that many LMICs have enough fiscal space in their annual budgets to increase allocations to

Table 1 Cost of implementing National Surgical, Obstetric and Anaesthesia Plans in four countries

Country	World Bank Income Group	GDP per capita (World Bank, 2017) (US\$)	Population (World Bank, 2018)	Current health expenditure per capita (World Bank, 2016) (US\$)	Current health expenditure (% of GDP)	Current health expenditure (% of annual government budget) ¹⁸	Number of years for NSOAP implementation	Total NSOAP cost (US\$)	NSOAP cost/year per capita (US\$)	NSOAP cost/year per cap (% of THE/ cap)	NSOAP cost/year of annual government budget)	NSOAP cost/year per cap (% of GDP/ cap)
Zambia	Lower-middle	1509.80	17 351 822	56.54	1.90	9.60	5	314 160 747	3.62	6.49	0.96	0.24
Tanzania	Low	936.33	56 318 348	35.50	2.10	12.10	7	597 042 037	1.51	4.20	0.62	0.16
Rwanda	Low	748.39	12 301 939	48.08	1.90	9.30	6	697 350 72	0.94	1.98	0.57	0.13
Nigeria	Lower-middle	1968.56	195 874 740	79.34	0.60	6.40	5	16 768 118 788	17.12	22.18	13.22	0.87

GDP, gross domestic product; NSOAP, National Surgical, Obstetric and Anaesthesia Plan; THE, total health expenditure.

health, it is also likely that even with increased domestic funding for health, many LMICs, particularly low-income countries, may not be able to meet their health financing needs. Therefore, other means of fiscal space expansion, such as development assistance for health and innovative financing mechanisms, will still be needed.^{13–16}

NSOAPs include a comprehensive set of interventions such as creating a specialised workforce which requires several years of training. For example, Tanzania's NSOAP aims to increase the physician surgeon, obstetrician and anaesthesiologist provider density from 0.46 per 100 000 people to 2.27 per 100 000 people by 2025.¹⁷ It should be noted that when Verguet and colleagues modelled costs for scaling up SOA care based on 2000–2013 data, they did not include training of surgical and anaesthesia providers and associated personnel.⁸ Hence, current NSOAPs provide updated and comprehensive cost estimates for scaling surgical systems addressing all pillars of the health system.

Scaling up surgical systems through NSOAPs is invariably an exercise in health systems strengthening. It is worth noting that the components of an NSOAP are cross-cutting and span all six pillars of the health system: service delivery, workforce, infrastructure and supplies, finance, governance and information management. SOA care delivery requires surgical and anaesthesia providers, and also requires qualified ancillary staff, a reliable blood bank, effective referral systems, a responsive supply chain system, functioning laboratory, radiotherapy and pathology and reliable information systems. Expanding fiscal space for NSOAPs will likely strengthen the entire health system to improve the diagnosis, treatment and management of non-communicable and communicable diseases. SOA care is not a competitor for scarce resources; it is a synergistic partner in healthcare delivery that will allow countries achieve the SDGs and UHC.

Cost estimates from the first countries to develop NSOAPs suggest that scaling up surgical systems may not be as expensive as previously suggested.⁸ A moderate expansion of fiscal space for health by governments with support from development partners could achieve surgical system goals, strengthen the entire health system and promote economic growth.

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Images are pulled from the [Evolution and patterns of global health financing 1995-2014](#), by the Global Burden of Disease Health Financing Collaborator Network. In addition to reviewing the below images, please review the [IHME Flows of Global Health Financing Visualization Tool](#) (or learn more [here](#)).

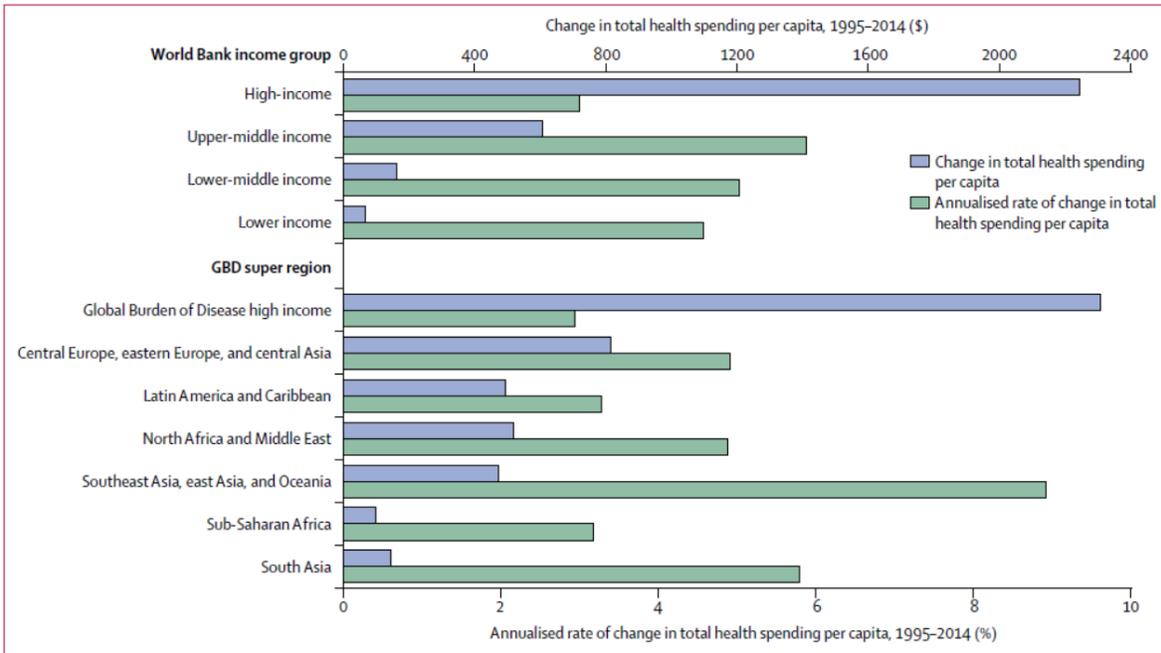


Figure 1: Changes in health spending by income group and Global Burden of Disease (GBD) super region, 1995–2014
 Currency reported in 2015 purchasing power parity adjusted \$.

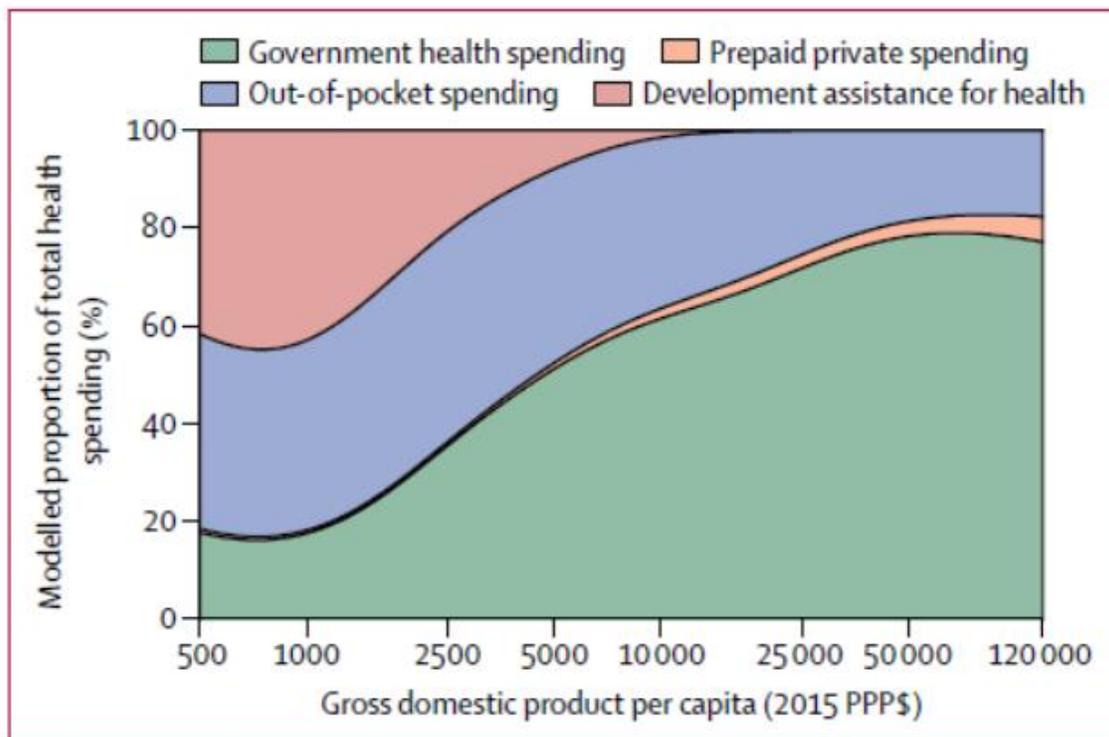


Figure 3: Composition of health-care spending by source, 2014
 PPP=purchasing-power-parity.

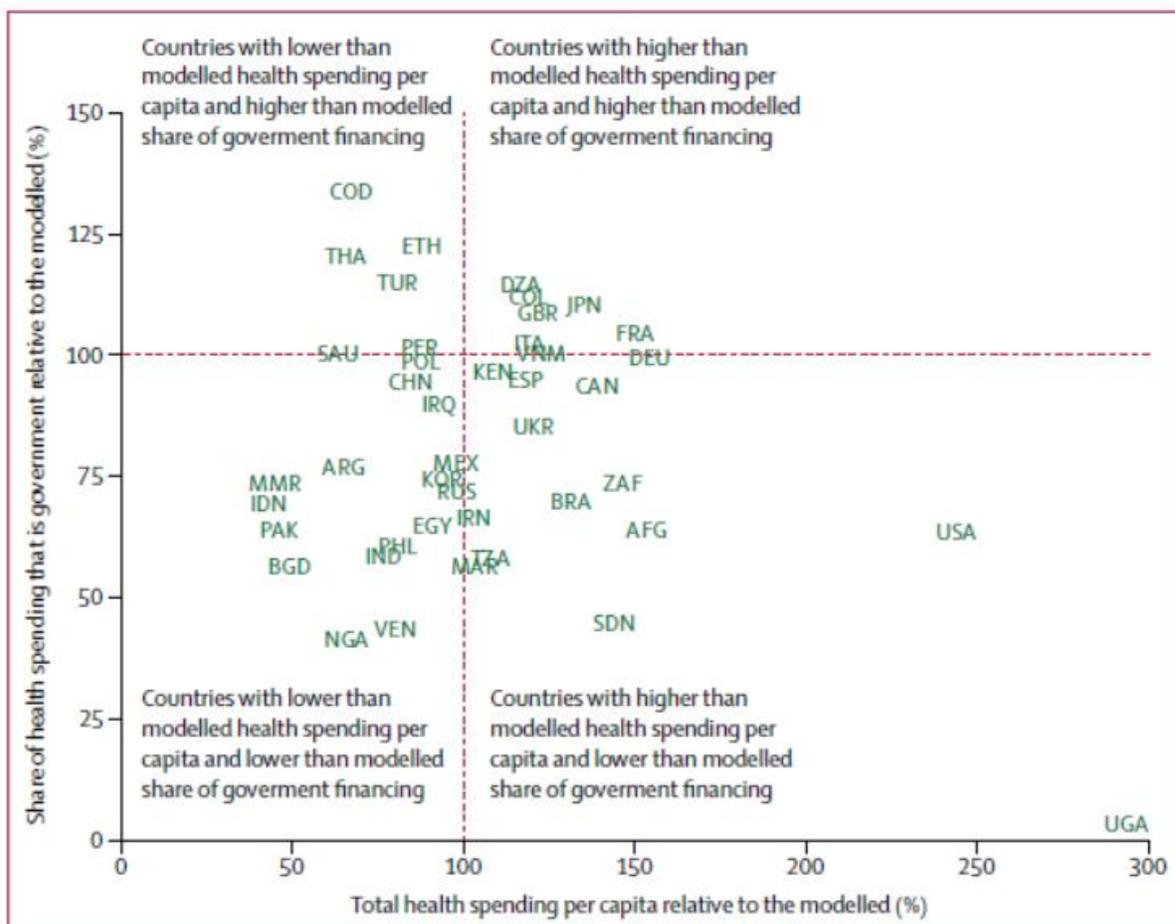


Figure 4: Observed government and total health spending relative to modelled spending, 2014

The figure shows the total health spending relative to modelled spending, and the share of health spending that is from the government relative to the modelled share. The vertical and horizontal red lines indicate where the observed spending is equal to the modelled spending (100%). Although all countries and years of data were used for this analysis, the deviations reflect the 2014 model fit. Only countries with a population higher than 30 million and 2014 data are included as points to avoid too many markers. A version with all countries included a dots is included in the appendix (p 68). AFG=Afghanistan. ARG=Argentina. BGD=Bangladesh. BRA=Brazil. CAN=Canada. CHN=China. COD=Democratic Republic of the Congo. COL=Colombia. DEU=Germany. DZA=Algeria. EGY=Egypt. ESP=Spain. ETH=Ethiopia. FRA=France. GBR=UK. IDN=Indonesia. IND=India. IRN=Iran. IRQ=Iraq. ITA=Italy. JPN=Japan. KEN=Kenya. KOR=South Korea. MAR=Morocco. MEX=Mexico. MMR=Myanmar. NGA=Nigeria. PAK=Pakistan. PER=Peru. PHL=Philippines. POL=Poland. RUS=Russia. SAU=Saudi Arabia. SDN=Sudan. THA=Thailand. TUR=Turkey. TZA=Tanzania. UGA=Uganda. UKR=Ukraine. USA=USA. VEN=Venezuela. VNM=Vietnam. ZAF=South Africa.

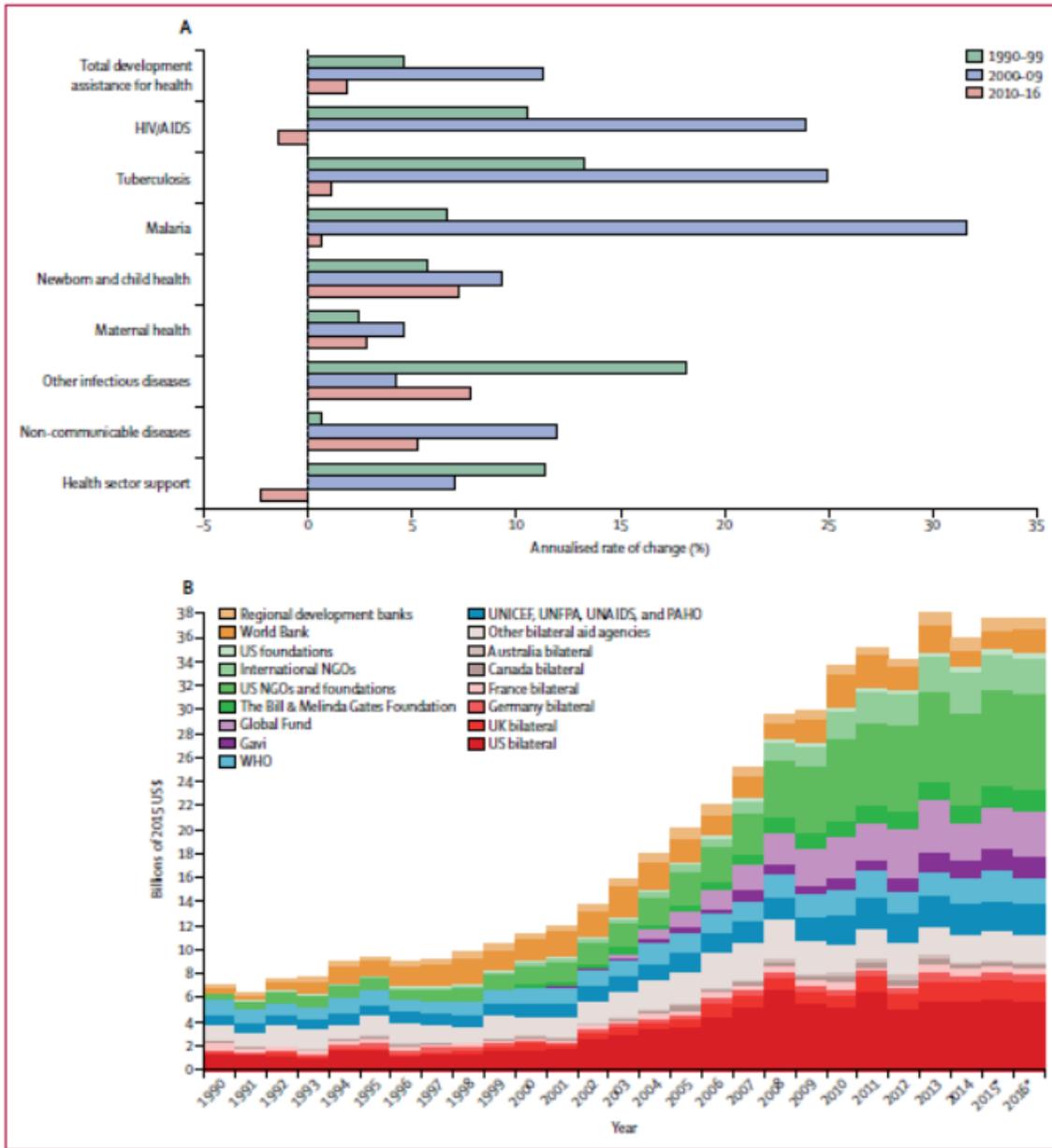


Figure 5: Changes in development assistance for health disbursements, 1990-2016

Development assistance for health as annualised growth rates (A) and disaggregated by channel (B). (A) Growth rates are shown for 1990-99, 2000-09, and 2010-16. (B) Estimates are shown from 1990 to 2016, all in billions of 2015 US\$. World Bank includes the International Development Association and the International Bank for Reconstruction and Development; and regional development banks include the Inter-American Development Bank, the African Development Bank, and the Asian Development Bank. NGOs=non-governmental organisations. Global Fund=The Global Fund to Fight AIDS, Tuberculosis and Malaria. Gavi=Gavi, the Vaccine Alliance. UNICEF=United Nations Children's Fund. UNFPA=United Nations Population Fund. UNAIDS=Joint United Nations Programme on HIV/AIDS. PAHO=Pan American Health Organization. *Data for 2015 and 2016 are preliminary estimates based on budget data and estimation.

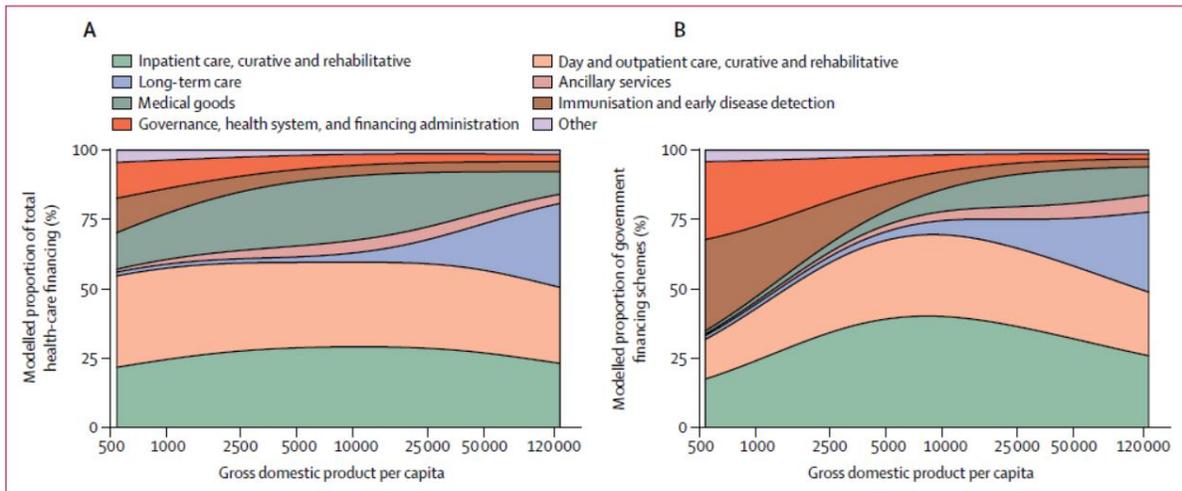


Figure 7: Composition of health spending by type of goods and services, 2014

The modelled proportion of total (A) and government (B) health spending across gross domestic product per capita by types of goods and services. Other health spending includes all other health spending that is not otherwise classified in this taxonomy. Spending on education and counselling programs, epidemiological surveillance, and disaster preparedness was excluded.