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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.

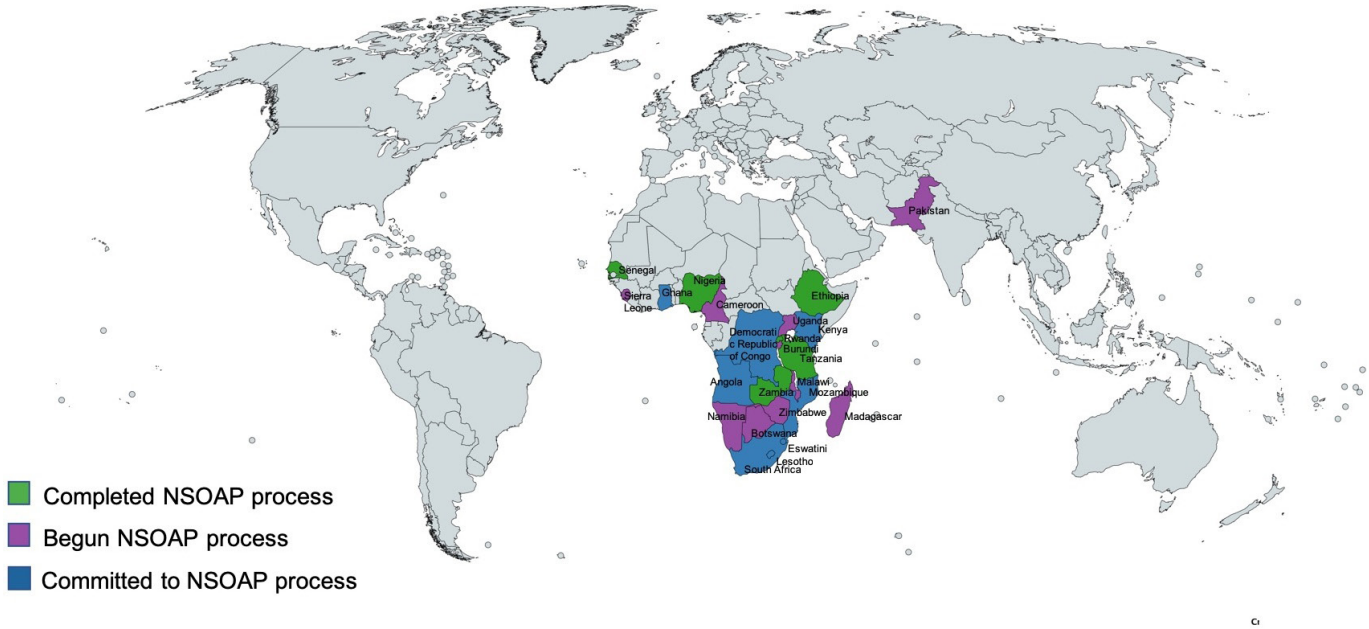

Figure 1 Map of countries at different stages of the National Surgical, Obstetric and Anaesthesia Plan (NSOAP) process.

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$69.7 million in Rwanda for a population of 12.3 million people to US$16.8 billion in Nigeria for a population of 195.9 million people. Tanzania and Zambia fall in the middle with a cost of US$597.0 million for 56.3 million people and US$314.2 million for 17.3 million 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$12.3 trillion 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)[18]	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	314160747	3.62	6.49	0.96	0.24
Tanzania	Low	936.33	56 318 348	35.50	2.10	12.10	7	597042037	1.51	4.20	0.62	0.16
Rwanda	Low	748.39	12 301 939	48.08	1.90	9.30	6	69735072	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 100000 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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