

GSB Module 3 – Access to and Quality of Care

Learning Objectives

1. Explain how the quality of care is an important consideration in discussions of access and availability
2. Describe the barriers to care framework (i.e. seeking, reaching, and receiving care)
3. Be able to name the variety of factors that can affect a person’s decision to seek care
4. Explain the impact of poor-quality healthcare on people’s lives
5. Be able to explain the LCoGS key messages 1 and 2

Materials

Watch

1. International Collaboration for Essential Surgery (ICES), [“The Right to Heal”](#)
2. Lifebox, [“The Checklist Effect”](#)

Read

1. Meara, “Global Surgery 2030”, read **Key Messages 1 and 2** and the **Health Care Delivery and Management** section. (pages 2-13)
2. Farmer, “Who Lives and Who Dies” (pages 14-27)
3. Knowlton, “A Geospatial evaluation of timely access to surgical care in seven countries”(pages 28-35)
4. Grimes, “Systematic Review of Barriers to Surgical Care” (pages 36-45)
5. Gulliford, “What does Access to Health Care Mean”(pages 46-48)
6. Kruk, “Mortality Due to Low-Quality Health Systems in the Universal Health Coverage Era”(pages 49-58)
7. For a deeper dive, please check out the supplemental readings.

**Please watch the Access to and Quality of Care Module summary video after working through the above materials.

Things to Think About

- What prevents people from accessing care when needed?
 - Operation Smile talks a lot about barriers to care. What are they? Why do they matter? Who is affected? What are social determinants of health? How do they factor in?
- Does the existence of health care automatically mean it is accessible? How are these two concepts (availability of care vs. accessibility of care) distinct? In what ways do they overlap?
- How does accessibility affect Operation Smile’s work?

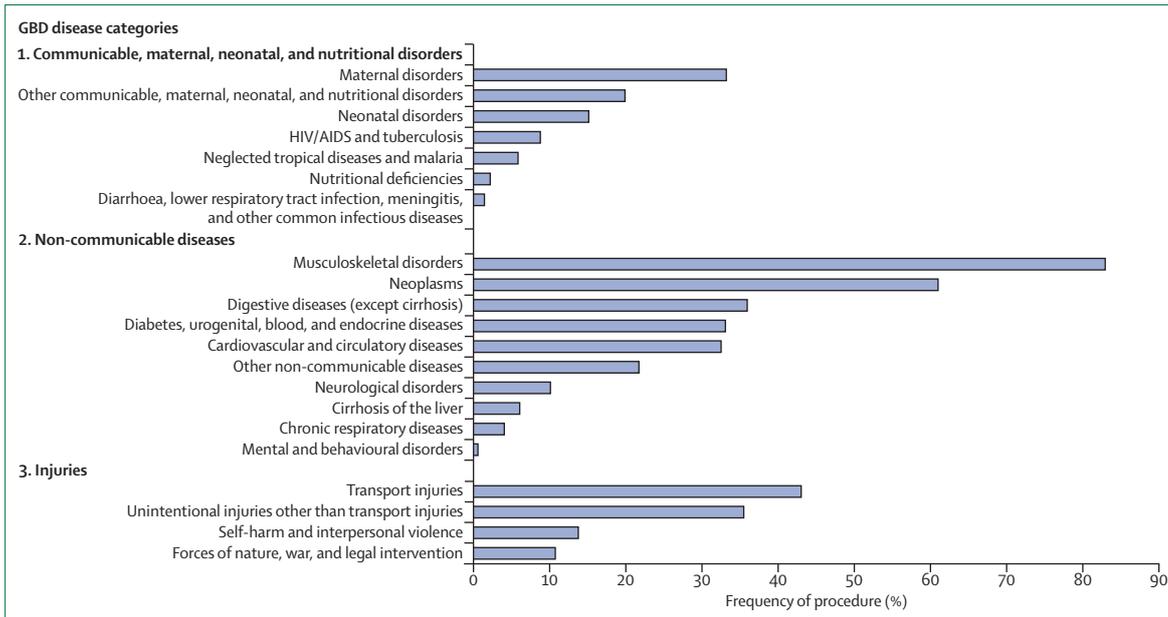


Figure 1: Frequency of operations done per GBD 2010 disease category for patients admitted to hospitals in a well-resourced health system
Data from Rose and colleagues.⁹ GBD=Global Burden of Disease.

first and most widely cited estimate was generated after 18 surgeons from around the world provided estimates for “the proportion of each condition [from the 2002 World Health Report burden of disease estimates] that would require surgery” based on their professional experiences.⁵ After excluding the two highest and two lowest estimates, the investigators concluded that at least 11% of global DALYs were surgical.⁵

The second was derived in consideration of the reduction in morbidity and mortality from scaling up a basic surgical package that could be provided at first-level hospitals in LMICs. This package included treatments for four digestive disorders, four maternal–neonatal disorders, and injuries that could be treated with basic interventions.⁴ After assuming a counterfactual scenario in which mortality and morbidity were equal to the best performing regions on the basis of the Institute for Health Metrics and Evaluation (IHME) estimates, the researchers estimated that 1.4 million deaths could be prevented annually.⁴ The avertable and non-avertable mortality and morbidity from this small number of surgical conditions within the three specific categories examined accounted for 14.2% of the total burden of disease in LMICs.⁴

The third was done as part of this Commission.² Surgeons, anaesthesiologists, internists, nurses, and public health practitioners from around the world were surveyed. For each of the 21 IHME cause groups, they were asked: “What proportion of patients with the following conditions would, in an ideal world, require a surgeon for management?” 173 people returned the surveys, including six anaesthesia providers,

36 general surgeons, and 46 specialists. Depending on the method of estimation and definition of burden used (death vs DALYs), they reported that surgical conditions account for 28–32% of the overall global burden of disease.

Key message 1 **Start here.**

5 billion people lack access to safe, affordable surgical and anaesthesia care when needed

Access to surgical care is essential for reduction of mortality and morbidity from surgical conditions. Previous estimates reported that more than 2 billion people have no access to surgery and anaesthesia.⁸ This figure is probably an underestimate, because it was calculated using just one dimension: operating theatre density.⁸ The notion of access to care is multidimensional, encompassing geographic, temporal, structural, socio-cultural, financial, and political components. For a patient to access surgical and anaesthesia care, a delivery system (including trained personnel and physical resources) should first exist. The patient should then be able to reach this system in a timely manner. For the patient to benefit, the care should be safe and effective. Finally, the costs of surgical and anaesthesia services should not act as a barrier to uptake, or result in financial catastrophe for patients and their families. Consideration of these dimensions suggests a greater deficiency of access than previously estimated.

Our vision is universal access to safe, affordable surgical and anaesthesia care when needed. To quantify a more comprehensive assessment of access in terms of this vision, we created a mathematical model to show

how many people worldwide are unable to receive safe, timely surgical and anaesthesia care with financial protection. We defined access to surgery in a specific country by the following four components: existence of surgical capacity in terms of workforce and infrastructure; ability to obtain surgical and anaesthesia care in a timely way; a safe way; and an affordable way.

We constructed a chance tree to model the probability that an individual has access to surgery and anaesthesia using a binary outcome of access (1) or no access (0).²⁵ Each chance node represented the probability of an access dimension being available to an individual patient conditional on the previous dimensions. Raw data for each dimension were not widely available so proxy measures were used. We assessed timeliness (first dimension) by the proportion of serious injuries transported by ambulance,²⁶ surgical capacity (second dimension) by the number of surgical procedures undertaken in a country as a proportion of number of surgeries needed,²⁷ safety (third dimension) by the proportion of operating rooms with pulse oximetry,⁸ and affordability (fourth dimension) by the proportion of patients undergoing surgery who do not experience catastrophic expenditure.²⁸

Since access most likely varies between urban and rural populations, we did a secondary analysis²⁵ (selective

tree) in which all four dimensions were applied to rural populations, but only the third and fourth dimensions (safety and affordability) were applied to urban populations to create a lower bound estimate. The application of all four dimensions to the entire population is termed the full tree and is an upper bound estimate. A full discussion of the methods can be found in the accompanying paper.²⁵

The selective and full trees show that 4.8 billion (95% posterior credible interval [PCI] 4.5–5.0) and 5.3 billion (5.0–5.5) people, respectively, do not have access to safe, timely surgical and anaesthesia care when needed with financial protection, and most of these people reside in the poorest regions of the world. In countries designated as low-income and lower-middle-income countries by the world bank, the selective tree estimates that 94% of the population does not have access to safe surgical and anaesthesia care that is timely and affordable, compared with 14.9% of the population in high-income countries. When results from the selective tree are stratified by IHME super-region, 93% of the population in sub-Saharan Africa and 97% of the population in South Asia do not have access, compared with 3.6% in higher-income regions (figure 2). These numbers are large but not unexpected considering that

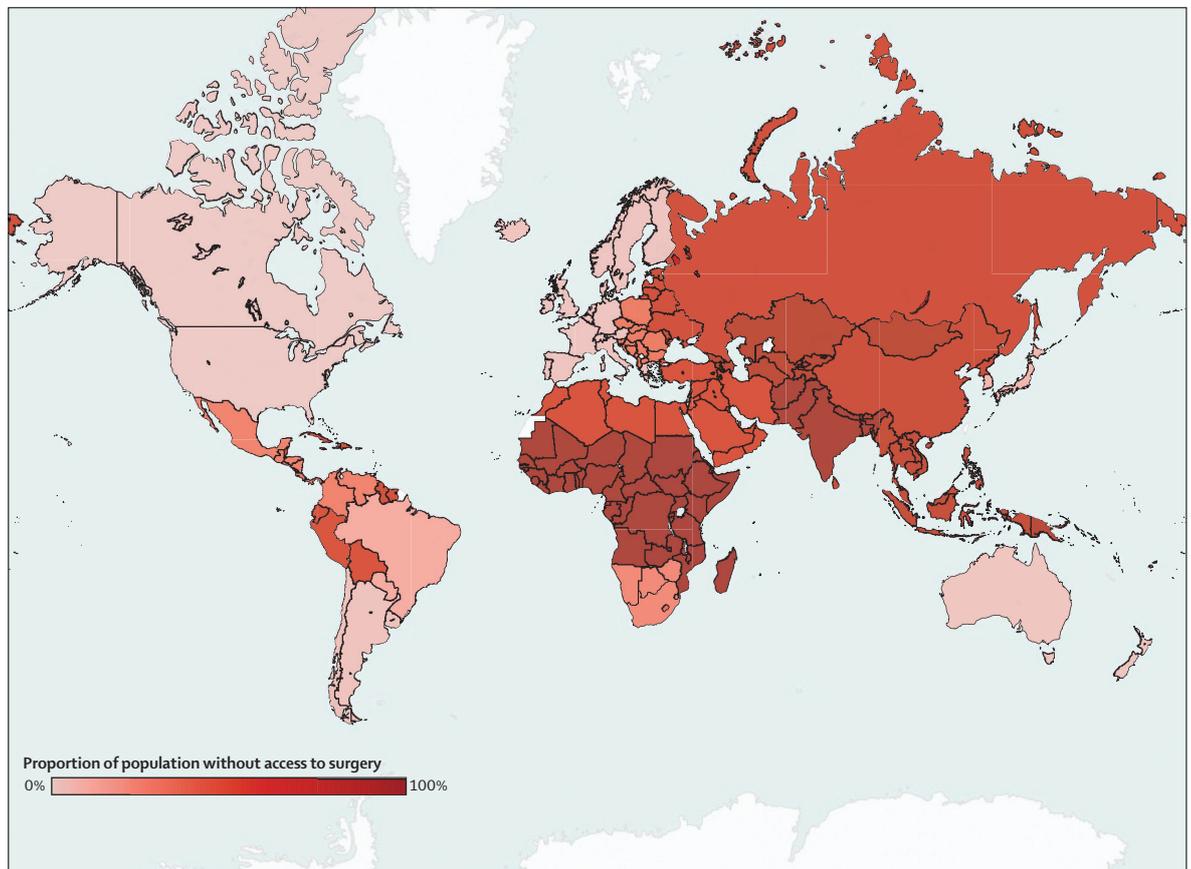


Figure 2: Proportion of the population without access to safe, affordable surgery and anaesthesia by Institute for Health Metrics and Evaluation region (selective tree)^{25,29}

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.

End here, continue to next page.

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

and particularly the welfare of developing countries, in the problem category of disease at the 2009 Copenhagen Consensus.⁶¹ The integration of surgery into district hospitals acts as an enabler, raising the ability to deliver other health-care services.⁶² Because of its complexity,⁶³ delivery of safe surgery and anaesthesia signals the presence of the “staff, stuff, space, and systems” of a responsive health care system.⁶⁴ Such a system is capable not only of delivering surgical care, but also of treating a broad range of health challenges, whether it be a child with malnutrition, a mother dying of post-partum haemorrhage, a family injured in a bus collision, or a community faced with an Ebola outbreak. As World Bank president Jim Kim stated in his address at this Commission’s inaugural meeting, “surgery is an indivisible, indispensable part of health care”.²

Surgical conditions—whether cancers, injuries, congenital anomalies, childbirth complications, or infectious disease manifestations—are ubiquitous, growing, and marginalising to those who are afflicted by them. These conditions are financially devastating for individuals and their families, economically damaging for countries, and disproportionately threaten the welfare of the poorest and most vulnerable people in our societies. The arrival of 2015 brings with it a new set of goals for the ensuing two decades, including commitments to UHC, increased investments in health, and a collection of SDGs that aim to end poverty, promote economic growth, and ensure good health for all. The one proposed health-related SDG—to ensure healthy lives and promote wellbeing for all at all ages—will need widespread and equitable delivery of surgery and anaesthesia, the treatment needed for a third of the global burden of disease.² Similarly, the World Bank and WHO have targets for UHC of at least 80% coverage of essential health services, and 100% protection from OOP payments for health services, by 2030.³⁹ In a world where 70% of the population cannot access essential surgical services, and 50% are at risk for catastrophic expenditure should they need surgical care, fulfilment of UHC will need an expansion of surgical and anaesthesia services and a pro-poor approach to the financing of surgical care. Such a scale-up will need immediate mobilisation of domestic and international health financing, and a commitment to surgical services as an integral component of health systems strengthening.

Surgical and anaesthesia care are fundamental for health-care delivery for any country at any level of development. Broad scale-up of quality surgical services will prevent deaths, limit disability, palliate suffering, promote economic growth, and help achieve maximum gains in health, welfare, and development for all.

Read this section onwards.

Health-care delivery and management

The surgical system

A common yet erroneous perception is that the surgical system consists of a surgeon and an anaesthetist in a sterile environment. However, a more accurate

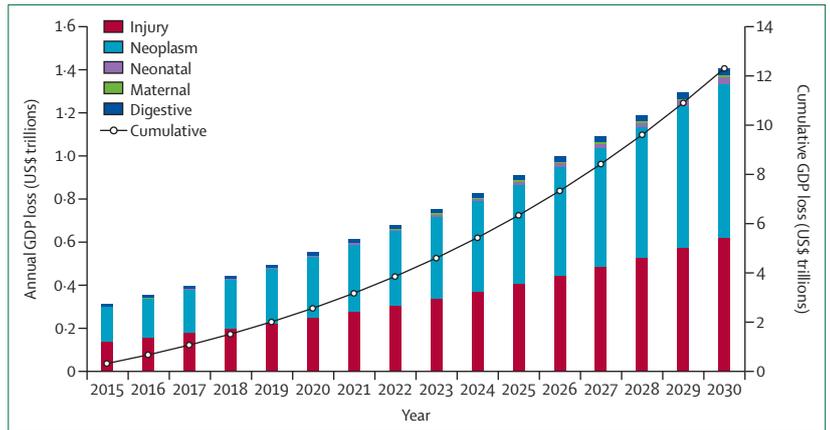


Figure 4: Annual and cumulative GDP lost in low-income and middle-income countries from five categories of surgical conditions (2010 US\$, purchasing power parity)⁵⁷

Data are based on WHO’s Projecting the Economic Cost of Ill-Health (EPIC) model (2010 US\$, purchasing power parity). GDP=gross domestic product.

perspective acknowledges an interdependent network of individuals and institutions all essential to the delivery of safe, timely, and affordable surgical and anaesthesia care (figure 5). Many of these components are not standalone requirements for a surgical system, but rather for a shared delivery infrastructure that is the basis of a functional health system.⁶⁵ A blood bank, for example, is equally important for a woman with post-partum haemorrhage as it is for a child with severe malaria. The goals of achieving a functional health system and surgical system are not separate.

Surgical care begins in the community. Community health workers connect patients in remote areas to providers. They refer surgical patients to the first-level hospital, and provide post-discharge follow-up. First-level hospitals provide the hub for surgical and anaesthesia care, and should be capable of providing most emergent and planned procedures. Tertiary centres can provide specialised care, and serve as hubs for training, research, and system-wide quality improvement.

In most areas, delivery of surgical services consists of a mix between public and private providers.^{66,67} Private providers consist of all actors outside the government and can take on many forms, including for-profit providers, not-for-profit providers (eg, non-governmental organisations [NGOs] and faith-based organisations), and informal providers (eg, traditional healers). In some countries, the private sector is responsible for most hospital-based service delivery.⁶⁷ All hospitals should connect to the community and to each other through a reliable referral system. Strong clinical leadership, professional management, and government policies should support all levels of care.

In this section we discuss surgical and anaesthesia care delivery at the first-level hospital through the lens of the Three Delays framework often used in the maternal

For key findings from the health-care delivery and management working group see appendix p 16

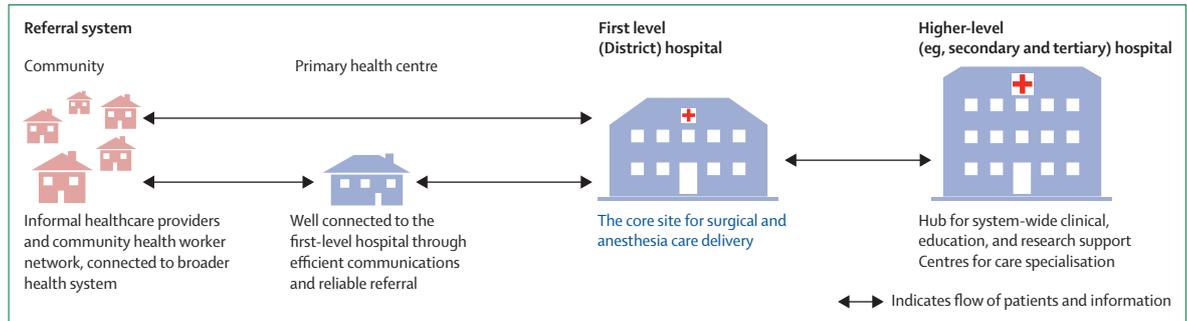


Figure 5: The surgical system
The surgical system is an interdependent network of individuals and institutions that reside within the health system.

health community.⁶⁸ We outline the role of tertiary care structures and of leadership across the surgical system, focusing on the instruments and systems needed for the workforce to deliver care. We have queried hundreds of providers in resource-poor settings through in-person interviews and telephone conversations, a survey, and electronic correspondence (appendix pp 47–49). We also used the WHO Emergency and Essential Surgical Care Situational Analysis Tool (SAT) database, a collection of 1357 facility surveys (as of April, 2014) from 54 countries collected since 2007 (appendix p 30). This section presents published work and previously unpublished data on present challenges and potential solutions for care provision in low-resource settings.

The present situation

The Three Delays framework

The ability to receive surgical care when needed depends both on the accessibility of surgical facilities and the availability of surgical and anaesthetic providers to deliver that care. A woman who lives hours away from the nearest hospital probably does not have access to timely surgery and anaesthesia. A woman who lives just minutes away from a hospital that does not have enough surgeons and anaesthetists available to offer care also does not have access to surgery and anaesthesia. Accessibility and availability, then, are crucial concepts in low-resource settings and can be further interrogated under the lens of the Three Delays framework to explain the delay between symptom onset and receipt of appropriate care.⁶⁸

The First Delay—the delay in seeking care—occurs when patients often wait to seek health care because of financial and geographic restrictions, cultural beliefs, poor education, a history of being disconnected from formal health systems, and low awareness of available services or low confidence in those services.⁶⁹ Patients turn to informal providers (traditional healers) because they are accessible, trusted, and inexpensive.⁷⁰ WHO reports that up to 80% of the population in low-resource settings relies on informal providers who are often poorly connected to the broader health system.⁷¹ This option can lead to further delay in surgical referral.

The Second Delay—the delay in reaching care—occurs when hospitals with surgical capacity are scarce, meaning the nearest facility can be hours to days away, depending on mode of transportation. Few patients have access to private vehicles, ambulance systems are rare, and public transportation is variable in availability.⁷² Poverty also plays a strong part, reducing the affordability of public transportation if any is available. We have analysed the distance to surgical and anaesthesia care using the WHO SAT database, and present the median distances patients travel to their nearest surgical facility in various income settings (figure 6).

The Third Delay—the delay in receiving care—occurs when attendance at a hospital does not guarantee treatment, since few first-level hospitals can provide comprehensive emergent operative care. Data from the WHO SAT database show the proportion of first-level hospitals that could provide a caesarean delivery (64%), laparotomy (58%), and treatment for an open fracture (40%). Country-specific studies had similar findings (appendix p 50).

Reasons for delays in receiving care

Structural deficits trouble hospitals in low-resource settings. The WHO SAT database surveyed almost 800 facilities in low-income countries to discover what proportion of them did not have reliable electricity (31%), running water (22%), oxygen (24%), a dedicated area for emergency care (31%), and provisions for postoperative care (47%; appendix p 30). Few facilities, especially rural ones, have access to a computer or the internet; this restriction furthers a sense of isolation and prevents access to up-to-date clinical and research resources.⁷³ 55% of district hospitals surveyed across eight African countries did not have an anaesthesia machine.⁷⁴ About 70% of operating rooms in parts of sub-Saharan Africa had no pulse oximeter.⁸ Of 28 district hospitals in Zambia, 35% did not have a laryngoscope.⁷⁵ A study in Nigeria reported that only 42% of district and 24% of regional hospitals had supplies to maintain a paediatric airway.⁷⁶

Essential medications, supplies, and personal protective equipment are frequently out of stock.^{74,77} Stock-outs are often the result of insufficient funding and poor

administrative management of inventory.^{78,79} Disposables are often reused (appendix p 47).

In low-resource hospitals, equipment often does not work and is difficult to repair (appendix p 49).⁸⁰ Most equipment is foreign—WHO once estimated that up to 80% is donated—so local serviceability is unusual, and manufacturers seldom extend maintenance contracts for old equipment.⁸¹ Assessments show that almost 40% of donated equipment is out of service.⁸² Hospitals often feel obligated to accept donations even when the equipment or supplies are not useful.⁸¹

WHO estimates that more than half of the world does not have access to radiology services.⁸³ Only 41% of first-level hospitals studied in Nigeria and 63% of hospitals studied in Botswana had a radiograph machine (appendix p 36).⁸⁴ Pathology services are essential for surgical treatment, yet few first-level hospitals have the ability to preserve a sample or obtain a pathological diagnosis.⁸⁵ Basic blood laboratory and microbiology services are also variable in availability.⁸⁶

The absence of a safe blood supply is a crucial problem worldwide. Blood donation rates are low because of a high prevalence of anaemia and transfusion transmissible illnesses (TTIs), and poor blood collection infrastructure.^{87,88} Only 27% of hospitals in low-income countries reported an on-site blood bank (appendix p 51). The few facilities that have an on-site blood bank are concentrated in urban areas. Safety is also a concern: despite high rates of TTIs, 39 countries report that donated blood is not routinely tested and a third of 98 reporting countries had stock-outs of test kits.⁸⁹

Many providers resort to unbanked direct blood transfusion, in which a family member or community member donates on the spot, blood is tested with a rapid test kit that includes cross-match, and the patient is immediately transfused (appendix p 51). This process carries increased risk of TTI, and both paid and unpaid donors can face coercion.⁹⁰

In the face of minimally functional first-level hospitals, the burden of care falls on functional non-governmental and tertiary hospitals. Tertiary hospitals are overcrowded; some exceed capacity by 200–300% (appendix p 47). In high-income settings, the association between overcrowding and adverse events is well documented.⁹¹ Tertiary centres, burdened with acute surgical volume from first-level hospitals, lose the ability to offer more complex, planned surgery.⁹² Planned surgery, often referred to as elective in the high-income setting, is seldom elective in LMICs. These non-elective chronic, debilitating surgical conditions, left untreated for years, have generated a tremendous backlog.⁹³

Insufficient managerial support leads to little focus on processes and protocols in all areas.⁹⁴ Poor surgical functionality is often attributed to an absence of resources, but once resources are obtained, the hospital's functionality depends on organisation to bring those resources together successfully.⁹⁵ Too often,

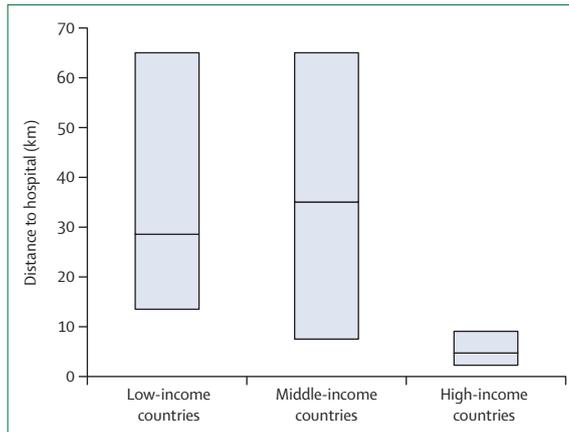


Figure 6: Median distance to a hospital according to country income level
Data are medians and IQRs of the estimated distances patients travel to reach a hospital in low-income, middle-income, and high-income countries. Low-income and middle-income country data are from the WHO Emergency and Essential Surgical Care Situational Analysis Tool database, 2007–14 (appendix p 30). Due to paucity of data for high-income countries, we substituted the data from the WHO Situational Analysis Tool database with US data from the Centers for Disease Control and Prevention's National Center for Health Statistics Research Data Center, 1999–2009.

For more on the CDC's Research Data Center see www.cdc.gov/rdc/

managerial tasks are left to clinicians with substantial clinical responsibilities and little training in professional management.⁹⁶

Leadership is often diffuse and goals are unclear or set by an external agency, restricting autonomy at the local level.^{94,97} Poor structural hierarchies make it difficult to reprimand the habitually late surgeon or identify the root cause of an improperly cleaned instrument making it into the operating room. Insufficient administrative support further hinders mundane tasks such as filing paperwork to replace a broken ultrasound machine (appendix).

Additionally, referrals are a source of consternation for both the referring and accepting parties, not to mention the patient who bears the cost of transportation. Patients are transferred because of inadequate capabilities at the local level, but capability at the next level is not guaranteed, which reinforces the adage that referral is a myth.⁹⁸

Furthermore, more than 80% of people in low-income countries might have been subject to some type of corruption related to health care.⁹⁹ Corruption can manifest as bribes for necessary health-care tasks or more subtly in priority setting by ministries of health, infrastructure allocations, and hiring decisions.¹⁰⁰ People in authority positions often have the means to leave the country for care, lowering their incentive to invest in strong health systems for people with the lowest income. Restricted freedom of the press to report present circumstances without retribution exacerbates existing deficits.⁹⁹

More than 300 international NGOs provide surgical services in LMICs.¹⁰¹ Although most of these NGOs

provide excellent care, owing to uneven power dynamics, a discord often exists between the services most needed and the services that can be provided.^{102,103} When more than one NGO delivers similar services, mistrust and direct competition occurs. All combined, this discord can lead to dysfunction and poor integration with the health system. Short-term visiting teams can draw away resources from the local providers who deliver continuous care, create a perception within the community that visiting teams provide higher-quality care, and introduce uncertainty as to the availability of a service.¹⁰⁴ Nonetheless, an offer for a clinical service not usually provided is difficult for low-resource institutions to refuse.

The way forward

Reduce the First and Second Delays

A strong prehospital network, which includes primary care centres and rapid-response ambulances, could partly overcome delays that patients can incur while seeking and reaching care.¹⁰⁵ However, a comprehensive and more immediate approach needs context-specific interventions that engage the community and existing providers.¹⁰⁶

Surgical teams should engage all members of the surgical ecosystem, including informal providers and community health workers, particularly in areas without formal health-care facilities. A comparative model is the integration of traditional birth attendants into the maternal health system to refer critical cases to first-level hospitals.¹⁰⁷ Community health workers have already been effectively used in many large-scale programmes, from Haiti to Ethiopia, with documented improvements in health outcomes.^{103,108} BRAC, a Bangladeshi NGO, has devised a low-cost referral system for obstetric care that uses community health workers and traditional birth attendants with mobile technology to systematically reduce First and Second Delays (appendix p 21). This partnership enables BRAC community health workers to identify complicated deliveries, and coordinate reliable, timely transportation to a hospital.

Community participation is already the default for emergency transportation in many low-resource settings, and these ties should be strengthened while more formal systems develop.¹⁰⁹ So-called Good Samaritan laws that protect first-response volunteers from legal prosecution can ease barriers to trauma-victim response.¹¹⁰ In Ghana, truck drivers who brought trauma victims to the hospital were compensated through a fund established for this reason.¹¹¹ In Uganda, community-based trauma response programmes have trained individuals most likely to be near accident scenes (eg, taxi-drivers and city police) in basic first-response techniques.¹¹² Similar programmes have shown promise in Ghana, Cambodia, Madagascar, Israel, India, Iraq, and Iran (appendix p 22).

Lastly, when geographic challenges are immense, an alternative approach is to bring care to the patient. Cinterandes Foundation, an Ecuadorian NGO founded

in 1990, uses a 7 m truck with a mounted operating room to take surgical and anaesthesia care to patients in the country's mountainous regions (appendix p 22). Similar approaches have been used effectively in other specialities—eg, in radiology screening.⁸³

The risk of being left destitute as a result of medical care, however, is a real possibility for most people with a low income, and will continue to hinder efforts to reduce the First and Second Delays.²⁸ OOP expenses combined with transportation and food costs drive millions who seek care further into poverty each year and would do so to billions more if they tried (discussed in detail in the Economics and financing section).

Reduce the Third Delay

On reaching the first-level hospital, the patient should have a reasonable guarantee of treatment. The first-level hospital is closest to its catchment population and should serve as the core delivery site for surgical care.⁵⁴ In fact, sufficiently equipped and staffed, it should be able to provide about 80–90% of surgical procedures, including treatments for acute abdomen, obstetric complications, and open fractures (appendix p 77). We believe that provision of laparotomy, caesarean delivery, and treatment of open fracture are bellwethers of a system functioning at a level of complexity advanced enough to do most other surgical procedures. Hence, we refer to them as the Bellwether Procedures. The WHO SAT database was used to interrogate this notion, and these three procedures proved to be indicators for completion of most other elective and emergency procedures in WHO's primary surgery package (appendix p 30). Further, the completion of each individual Bellwether Procedure correlated with the completion of related, less complex procedures from the SAT database (figure 7).

The Third Delay will shorten when first-level hospitals can efficiently deliver a broad range of surgical and anaesthesia services. Borrowing from the quality-improvement literature, we will use a structure, processes, and outcomes framework to discuss needed improvements in care delivery.¹¹³

Structural and resource needs

Although surgeons from across the world have derived ingenious workarounds to infrastructure deficits (eg, rainwater collection reservoirs and use of solar power), the need for creativity in basic infrastructure is an additional burden to the heroic clinicians committed to low-resource populations.¹¹⁴ Official investments should be directed towards all of the basic needs of the health system, from electricity and water to radiograph machines and drugs, aiming for a well distributed shared-delivery infrastructure.⁶⁵

Many organisations have attempted to characterise specific methods, equipment, and drug needs for surgical and anaesthesia care, and these are summarised in the appendix (p 27). We are reluctant to endorse any specific

list, as needs change with time and between contexts. Further, although all agree that safety in surgical and anaesthesia care is important, fewer agree on what actually constitutes safe or quality surgery. Adverse events exist even in the world's highest-resource systems, and what constitutes 'quality' is challenging to define.¹¹⁷ To blindly pursue the perceived high-income country (HIC) safer option without an evidence base to support it can be a dangerous endeavour; many practices that make life-saving care possible in low-resource settings might be mischaracterised as unsafe. The pressure-cooker used for sterilisation in a rural Indian first-level hospital might be just as effective as the industrial-grade autoclave in the tertiary centre. In fact, these cost-conscious adaptations from the low-resource environment might be important cost-saving innovations in the high-resource setting. Without further research, uncertainty will persist. With this in mind, we came to consensus on general needs for safe surgery on the basis of a review of the existing academic and grey literature and expert panel deliberation, avoiding an overly prescriptive set of recommendations based on scant evidence (panel 2).¹¹⁷

The Bellwether Procedures need skills that span general and orthopaedic surgery, obstetrics, and anaesthesia. Workforce shortages, however, make it unlikely to have a general surgeon, orthopaedist, obstetrician, and anaesthetist available in all first-level hospitals, all the time.¹¹⁸ As such, providers who practice in these environments are forced to transcend contextually irrelevant professional constructs and command a broad skillset. These true generalists are actually multispecialists, and allow care provision for many rural communities that would otherwise go without. However, to work as a multispecialist in a rural setting is taxing, both personally and professionally. Away from friends and family, working in remote areas in poorly equipped hospitals, treating high-acuity patients with minimal resources, with few opportunities for professional development, restricted interactions with peers, and little recognition of their sacrifice can lead to a sense of isolation and futility.

Maintenance of a motivated workforce in low-resource environments, however, is essential for service provision, and ministries of health and professional societies should take active steps to ensure these clinicians are celebrated instead of neglected.¹¹⁹ To ensure that providers have the necessary instruments to practise is imperative,

as are opportunities for continuing education and professional development. These resources include access to the internet, online clinical management

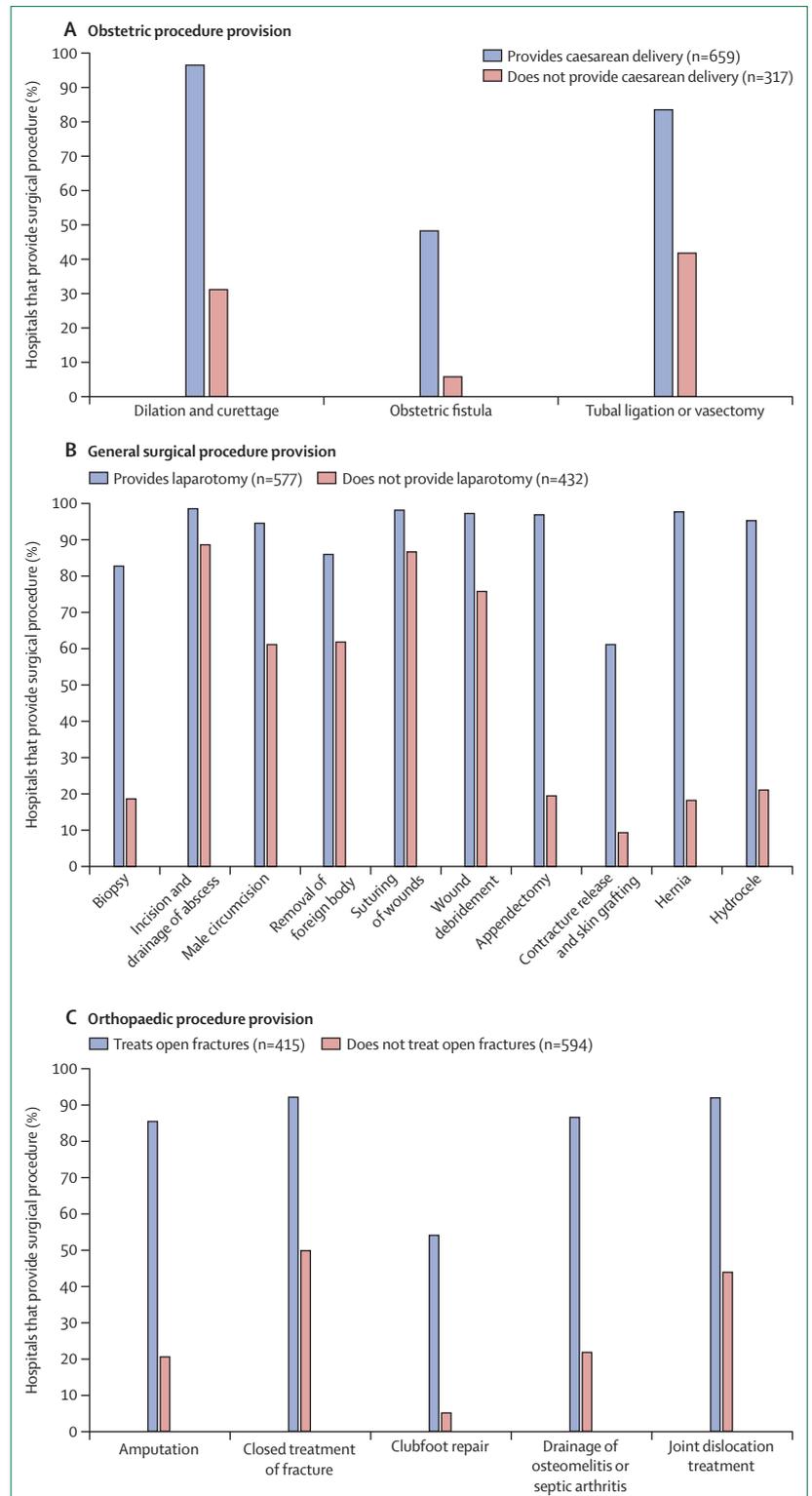


Figure 7: Proportion of surgical facilities that provide listed surgical procedure according to provision of related Bellwether Procedure

(A) Proportion of surgical facilities in LMICs that provide the listed obstetric procedures according to whether or not they also provide caesarean delivery. (B) Proportion of surgical facilities that provide the listed general surgical procedures according to whether or not they also provide laparotomy. Data are from the WHO Emergency and Essential Surgical Care Situational Analysis Tool database, 2007–14 (appendix p 30). (C) Proportion of surgical facilities that provide the listed orthopaedic procedures according to whether or not they also treat open fractures. LMICs=low-income and middle-income countries.

Panel 2: Ten needs for the provision of safe surgical and anaesthesia care

1. Trained surgical provider
2. Trained anaesthesia provider
3. Infrastructure, equipment and supplies necessary to perform safe general anaesthesia, loco-regional anaesthesia, laparotomy, caesarean delivery, and treatment of open fracture (including, for example, electricity, water, personal protective equipment for staff, basic laboratories, and HIV-testing capabilities)
4. Decontamination and sterilisation capacity
5. Blood supply that is safe and affordable (screened and cross-matched blood)
6. Drugs, including antibiotics, pain medicines, and anaesthetics (from the WHO Model List of Essential Medicines)¹³⁶
7. Nursing care, which includes a record of appropriate physiological observations
8. 24 h surgical cover with the ability to review and respond to a deteriorating patient
9. Quality-improvement processes, including audit of perioperative mortality
10. Risk assessment and operation planning for planned procedures

resources, textbooks, and research literature.¹²⁰ Pathways for the training of supporting staff, such as task-shared providers, might provide hope for a more reasonable workload. Establishment of rotations for surgical residents through first-level and other low-resource hospitals not only recognises the crucial role that multispecialists can serve in resident training, but also connects them to tertiary centres.

Augmentation and equitable distribution of the blood supply is essential. Blood donation rates can vary substantially, and although no gold standard exists, most high-functioning health systems with high life expectancy achieve a rate of at least 15 donations per 1000 population (appendix p 51). In the long term, the reduction of chronic anaemia and TTIs will be important to ensure a robust donor pool.⁸⁹ In the short term, workarounds like unbanked direct blood transfusion should be optimised for safety with provider training and delivery of rapid testing kits. Tranexamic acid effectively reduces the need for blood transfusion and its supply and use should be encouraged.¹²¹ Finally, the blood banking infrastructure should be well distributed for collection, storage, and delivery.

Ultrasound is important to the first-level surgical hospital. It provides the capacity for a broad range of rapid diagnoses, including those for fractures, ectopic pregnancies, and ruptured solid organs.^{122,123} Low-cost innovation will be important to make imaging technology such as ultrasound and CT scan, which are so crucial to clinical decision making, available to more of the global population (panel 3). Strategies to leverage connectivity to compensate for the shortfall of radiologists and minimise maintenance costs will be important. The global radiology community continues to make strides towards technologies that allow remote image interpretation despite restricted bandwidth, network disruption, and electrical grid restrictions.⁸⁴

The greatest gains in spreading the reach of pathology might be realised by improvement of services at regional

and tertiary centres, and improvement of connectivity between the tertiary and first-level centres. Professional collaborations consisting of training support between areas with an excess of pathologists to areas with a deficit will be crucial to improving services at higher-level centres.^{85,133}

Maintenance is imperative to address the common concerns of equipment failure. The availability of local service contracts should be a guiding principle during the procurement process. Corporate responsibility among manufacturers who sell to low-resource areas should include contracts that transcend the traditional, high-income standards of obsolescence. Reliable maintenance, however, cannot be sustained without programmes to increase capacity of biomedical equipment training (BMET).^{124,125} Corporate partnerships with academic institutions and local collaborators to establish BMET-certification programmes, like the General Electric Foundation's programme described in the appendix (p 24), can be valuable to develop this cadre of workers.

WHO has outlined some general guidelines for the donation of equipment and supplies.⁸¹ Three points should be emphasised. First, donations should be demand-driven, directly related to the specific needs of the receiving institution. Second, donated equipment should be matched with a plan for long-term maintenance.¹²⁵ If partners cannot provide the specified equipment with maintenance, they should instead consider contribution to infrastructural investments, maintenance contracts, or training. Finally, donation of consumables should be discouraged, as they complicate supply chain information flow and rarely provide long-lasting benefit to the receiving institution.¹³⁴

Processes to improve care delivery

Management practices and capacity are strong drivers of volume and quality in the high-income environment. Management might be even more important in settings in which maximal use of the few resources available is a practical necessity. Professional health-care management, consisting of either clinicians or non-clinicians with management training, is needed to focus on hospital performance, process optimisation, cost savings, and quality, and to provide administrative support.¹³⁵ Hospital leadership should consist of clinical leaders and professional managers. These leaders should be enabled to develop autonomous strategies to meet performance and financial targets, create employee buy-in, and cultivate a shared sense of purpose in staff. Accountability is necessary and leadership should be enabled to define its own organisational structure, complete with the ability to recruit, promote, demote, or terminate employees on the basis of transparent criteria.

Health-care managers do not add value merely by reducing costs; hospital efficiency should not be mistaken as a singular aim. The greatest health and

economic gains will be realised with true, meaningful reductions in the burden of disease. As such, true value is added only when cost reductions are linked inextricably to the goal of providing necessary care to more patients, at low cost to the health system and to the patient. Discharging a patient early might save the hospital in the short-run, but if early discharges incur high indirect follow-up costs for patients, they have not served their aim. Similarly, investment in personnel to assist patients, often illiterate, to navigate a complex medical institution might cost the hospital in the short term, but can ensure patients actually receive care.¹²⁹ Ministries of health should ensure that incentives for hospital management and clinical leadership align with the goal of efficient, system-wide reductions in the burden of disease.

Process standardisation can be a low-cost driver of efficiency, quality, and safety.¹³⁶ One example is WHO's Safe Surgery Checklist, which showed that adverse events in low-resource settings could be reduced through a simple method for communication, if a minimally functional surgical system is in place.^{137,138} Most hospitals can benefit from process standardisation, and organisations with relevant guidelines for low-resource settings should make them publicly available, perhaps through a registry hosted by WHO or other international collaborators. Health-care managers can work with clinicians to identify relevant protocols and help adoption according to local context.

Reliable supply chains are crucial. Consumable shortages are often due to inadequate information and poor management. These issues can be countered with the standards of supply chain management, but application of these standards would need upfront investments to ensure future savings.¹³⁹ Too many surgical units run as close to or below the minimum necessary units of resources, making them ultimately unreliable. With investments in warehousing and information management, health-care managers can focus on optimisation of efficient, bidirectional information flow, on the basis of usage patterns with built-in redundancy (eg, at least 3 months of buffer at the site of delivery).¹³⁹

Streamlining of procurement decisions might also be prudent. For example, restriction of suture orders to a standardised set according to clinical consensus instead of ordering on the basis of individual surgeon preference might yield cost savings (appendix p 47).

Centralised negotiation of framework purchasing agreements with decentralised ordering is an efficient way to procure consumables at the lowest price while allowing flexibility in shifting demands during service scale-up.¹⁴⁰ Chile, Mexico, and the various UN programmes are good examples of the use of strong framework agreements to drive purchasing.¹⁴⁰

Improved referral between facilities depends on many factors already discussed, including financial resources, transportation infrastructure, and staffing.

Panel 3: Opportunities for innovation

Surgical device consortium

Transplantation of equipment designed for high-income settings into low-income ones is insufficient. Similar to other industries, however, medical equipment manufacturers find it challenging to develop profitable products for low-resource settings. Equipment in low-resource countries needs to be affordable and yet durable to withstand erratic electricity, infrequent maintenance, and harsh environments.¹²⁴

However, encouraging examples of surgical innovations developed for low-resource settings exist. Lifebox is an organisation that has sourced low-cost pulse oximeters to hospitals in more than 90 low-income and middle-income countries. Durable pulse oximeters specifically designed for low-income operating rooms are manufactured in Taiwan (for US\$250) and supplied with training materials, the WHO Surgical Safety Checklist, and accompanied by training courses for providers in countries with large distribution programmes. The Universal Anaesthesia Machine (Gradian Health Systems, New York, NY, USA) and Glostavent (Diamedica, Barnstaple, UK, are examples of anaesthesia machines that are low-cost, designed to operate despite abrupt power outages, easy to maintain, and accompanied by long-term service contracts and commitments to train local biomedical equipment technicians.¹²⁵

An international device consortium could have a strong effect in driving forward innovation for low-resource areas. It would include a partnership between the private and public sector, and would follow the Drugs for Neglected Disease Initiative, a similar collaborative that has had success with the development of pharmaceuticals for disorders that largely effect the world's poorest people. Ideally, such a consortium would also be able to bring to scale the vast amount of low-cost innovation that takes place everyday in hospitals worldwide. When providers are forced to improvise due to resource restrictions, the results can be impressive; the work of rural surgeons from Nigeria and India are just a couple of examples.^{114,126}

Surgical mobile health consortium

Mobile health (m-Health) tools have been implemented in various global health contexts.^{127,128} These technologies have also been used in surgical care. In Haiti, photographs taken by a community health worker's smartphone have been used to assess postoperative surgical wounds.¹²⁹ In Kenya, Tanzania, and elsewhere, mobile money services have been used to reimburse transportation costs for patients who need surgery but do not have bank accounts.¹³⁰

Unfortunately, too many valuable applications do not last beyond the initial pilot project because of poor planning for scale-up, poor local buy-in, and minimum budgeting for monitoring and assessment.¹³¹ As such, resources are wasted in reinventing a product from the bottom up in other settings rather than building on previous efforts, and local buy-in is squandered on cumbersome projects with little follow-up.

Botswana is a country where the Ministry of Health has invested in systematic scale-up of promising m-Health applications, from cervical cancer screening to radiology.¹³² We propose a similar, but international effort, led by a consortium on surgical m-Health, to bring together the public and private sectors, funders, developers, and NGOs to promote development of value-additive applications and coordinate well designed assessments of effect. Applications that clearly show value and scalability to other contexts can be supported on an internationally visible platform; lessons learned from unsuccessful projects can be catalogued.

Communication can be improved, though, through development of protocols that establish clear transfer criteria and an understanding of what can be done for the patient at both ends.¹⁴¹ Ministries of health can help develop these protocols through committees that include clinicians and health-care managers from all

For more on Lifebox see <http://www.lifebox.org/about-lifebox/>
For more on the Drugs for Neglected Disease Initiative see www.dndi.org

levels of care, including public, private, and NGO stakeholders.¹⁴² These committees should work to minimise or eliminate the cost of transfer to the patient.

Equipped with basic infrastructure and administrative and managerial support, first-level hospitals should aim to offer a broad range of surgical procedures. Consistent provision of planned surgery needs only a marginal increase in resources above those already in place for emergency care. In fact, provision of planned surgery can confer valuable benefits to the function of the surgical team, including morale, confidence, and efficiency; patients can be preselected, health status optimised, and teams can focus on timely starts and process checks.¹⁴³

Ministries of health should ensure that planned surgical care is available at first-level hospitals, consistent with population needs. Ideally, these procedures can be stratified by volume and risk, and the initial focus can be on provision of high-volume, low-risk planned procedures at first-level hospitals, referring the rest to tertiary centres. In many instances, owing to resource constraints of the health system and of the patient, first-level providers do not have the option of referral to a higher-level centre, and should do their best to provide the necessary medical attention. Nonetheless, figure 8 outlines some common procedures stratified in a must do, should do, and can do framework for first-level care. The framework serves as an example, is not comprehensive, and should be adapted to different contexts according to relevant disease burden. NGOs and volunteer teams can be particularly useful in the provision of support for planned surgical care.

Outcomes and other opportunities

The ultimate goal is to build a strong, resilient surgical system that can provide consistent, high-quality care. Armed with adequate structures and improved

processes, a great opportunity to improve outcomes in low-resource settings exists. As structural and functional capacity at first-level hospitals improves, higher-level hospitals can serve as hubs for education, research, and clinical support. Improved network connectivity between the tertiary hospital and its health system partners will allow for novel collaborations. As discussed, providers at first-level hospitals often feel isolated, and have few opportunities for interprofessional interaction. A system-wide morbidity and mortality conference, hosted by the tertiary centre over mobile link, for example, could connect staff at remote first-level hospitals into a forum for multilateral learning. A collaborative approach between a tertiary centre and rural hospitals has been fostered by the Christian Medical College in Vellore, India, which has a longstanding practice of encouraging its surgical graduates to practise in rural communities.¹⁴⁴ These surgeons are paired with colleagues at the tertiary centre, who are available by phone to provide support for challenging cases or discuss the need for referral.

Higher-level centres can also serve as the clinical support hub for complex radiology, pathology, and services with needs unavailable at the first-level hospital. A reliable system to transfer films and pathology specimens and return diagnostic reports should be established.

Research is important to improve outcomes; adherence to protocols should be measured, metrics tracked, and adverse events openly reviewed.⁹⁴ Much of this activity will hinge on having the staff and the tools for research, and although excellent clinical care can be provided in the absence of electronic medical records, context-appropriate information systems can enhance both data collection and process monitoring. Research collaborations between well resourced academic institutions with research skills and clinicians in low-resource settings with high clinical loads and important research questions can be a powerful aspect of global health partnerships.

Clinical conditions with management guidelines based on the high-income context present a challenge to clinicians in low-resource settings, who might feel vulnerable when resource constraints force clinical decisions that are different from contextually irrelevant, but published, protocols. Academic and professional entities within low-resource settings should take the lead in research and establishment of relevant clinical practice guidelines. The appendix lists some examples of protocols developed for use in low-resource settings (appendix p 24).

While surgical capacity is developed, local and international NGOs can play an important part in care delivery. When using a measured approach consistent with the local needs, culture, and context, NGOs can strengthen the system by assisting local clinicians to tackle the backlog of unmet need, integrating with local training programmes, and enhancing local

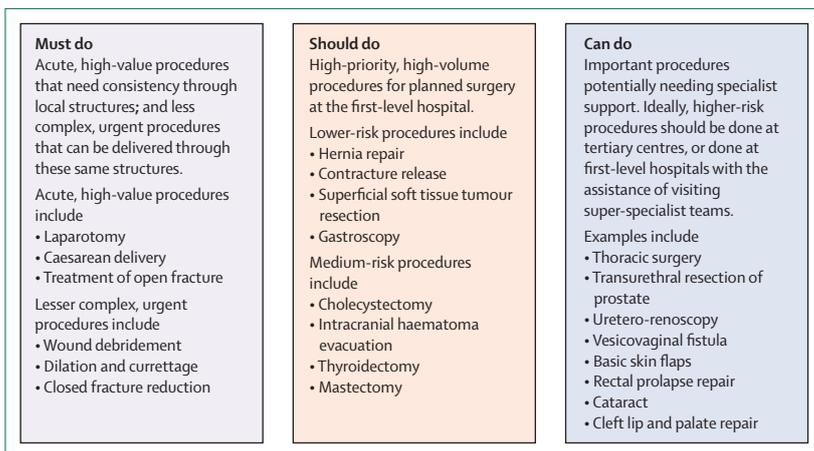


Figure 8: Common surgical procedures stratified in a must do, should do, and can do framework for first-level care

This chart should be adapted to local context.

infrastructure.¹⁴⁵ We propose an expansion of coordinated, demand-driven international surgical support aimed to address the unmet burden of surgical disease. This support could consist of long-term postings of surgical staff to high-need areas, like Operation Smile's Comprehensive Cleft Care Centres (appendix p 25), or many sequential short-term commitments that add up to a consistent, predictable presence. Academic and professional societies can help coordinate global surgical volunteerism with a centralised registry to help uninterrupted service. The Royal Australasian College of Surgeons' Pacific Islands Program is an example of one such enterprise (appendix p 25).¹⁴⁶

Corruption at the point-of-care is a challenging problem with no easy solutions. Establishment of community-based monitoring boards, consisting of community leaders and hospital officials, is a practical measure directed towards the point of care. These boards can provide the community with a formalised grievance process with transparent feedback loops that report to hospital leadership and government bodies. This process has been effective in rural India, and can help promote community trust and confidence in the health system.¹⁴⁷ Elimination of corruption on a national level might also help. Rwanda and Georgia are examples of countries previously labelled as corrupt that have made impressive strides through an independent media, legal frameworks with protections for whistle-blowers, aggressive prosecution of corrupt activities, and improved documentation through electronic records.¹⁴⁸

Recommendations for health-care delivery and management

National (hospitals, ministries of health)

- Culturally appropriate outreach to the community and existing health networks is essential to promote health system use.
- Comprehensive prehospital referral systems can be developed at low cost, leveraging community health workers and mobile connectivity.
- All first-level hospitals should aim to provide the Bellwether Procedures (which we define as laparotomy, caesarean delivery, and treatment of open fracture) because these are acute, high-value procedures and because their consistent provision is suggestive of functional surgical systems with broad service delivery.
- Professional health-care managers, both clinicians and non-clinicians with management training, should be prioritised and empowered to improve access, efficiency, and safety.
- Tertiary hospitals should have a key role as the system's education, clinical support, and research hub.
- A national blood donation strategy should be developed to achieve blood donations of at least 15 donations per 1000 population and equitable distribution of blood bank infrastructure.

- Centralised framework purchasing agreements with decentralised ordering and supply chain management should be used to allow hospital facilities to order per local needs.

International (WHO, NGOs, professional societies, industry)

- Clinical guidelines and protocols relevant to the low-resource setting should be established and shared publicly by institutions in developing countries.
- All donated equipment should be accompanied by long-term maintenance contracts or should be replaced with funds for other local investments.
- International professional societies, high-income academic medical centres, and NGOs play an important part in the coordination of short-term interventions and support; this participation should be within the framework of long-term, demand-driven commitments focused on system strengthening.
- International consortiums consisting of public-private partnerships can drive forward innovation and scale-up in the areas of medical devices, biomedical equipment training, and mobile health applications.

End here.

Workforce, training, and education

Human resources for health in surgery and anaesthesia

Human resources are the backbone of health-care delivery systems. At present, major shortages worldwide in the surgical workforce compounded by maldistribution of the existing workforce both within and between countries result in gross inequity.

LMICs are disproportionately affected by low surgical workforce density. Within these countries, people living in rural areas, those with a low income, and those who are marginalised are the most affected by these shortages (appendix p 13).³⁴ Despite these challenges, surgical and anaesthetic providers endeavour to provide care for people who need it.

The present situation

The surgical workforce

The health workforce involved in the delivery of surgical and anaesthesia care consists of an interdependent network of clinical and non-clinical professionals involved in health-care delivery, management, training, and monitoring.¹⁴⁹ This network includes, but is not restricted to, community health workers, hospital managers, theatre technicians, surgeons, anaesthesiologists and obstetricians (all of whom might be trained or still be in training), generalist physicians and associate clinicians providing surgical and anaesthesia care, educators, rehabilitation specialists, and diagnosticians in laboratory, pathology, and radiology science (appendix p 108). We acknowledge the interdependency of members of the surgical workforce, but for the purpose of the Commission, our report will focus on a narrow yet crucial element of the workforce: surgical, anaesthetic, and obstetric providers.

For key findings from the workforce, training, and education working group see appendix p 107

London Review of Books

Who Lives and Who Dies

Paul Farmer on the iniquities of healthcare funding

What is it like to be a passenger on a bus, or standing in a cheering crowd at the finishing line of a marathon, in the seconds after a bomb goes off, when you know you're hurt but not where or how badly? What's it like to be a child who finds a discarded toy and picks up what turns out to be a landmine? What's it like to be giving birth at home, and see blood pooling between your legs, and look up at the ashen faces of a birth attendant, a midwife, a spouse? What's it like to feel the earth tremble and see the roof and walls of your home or school fall towards you? More to the point, in terms of survival: what happens next? It depends. Not just on the severity of the injury, but on who and where you are. Death in childbirth, once the leading killer of young women across the world, is now registered almost exclusively among women living in extreme poverty, many of them in rural areas. Trauma is now the leading cause of death for children and young adults in much of the world. Who lives and who dies depends on what sort of healthcare system is available. And who recovers, if recovery is possible, depends on the way emergency care and hospitals are financed.

In the thirty years since I began my medical training in Boston, Massachusetts, I've cared for critically ill patients in Harvard's teaching hospitals, as well as in Haiti, Peru, Rwanda and elsewhere in Africa. Study of healthcare financing was almost wholly absent from the curriculum at Harvard Medical School. But after working in rural Haiti I felt it was a necessary topic. I have seen patients grievously injured, often at the point of death, from a weapon or neglect or a weak health system or carelessness. Some died; those who had rapid access to a well-equipped hospital had a better chance of survival. I convinced myself, at first, that the differences in outcome must have been due to worse injuries, greater impact, more blood loss. But with time and broader experience, I was tempted to record the cause of death as 'weak health system for poor people', 'uninsured', 'fell through gaping hole in safety net' or 'too poor to survive catastrophic illness'.

The people I lived with in the hills of central Haiti had a concise way of putting it: these were 'stupid deaths'. It was to prevent such deaths that Partners In Health was founded in the mid-1980s, with the aim of providing care for the ailments, trivial or catastrophic, that afflicted the poorest, who were doing most of the stupid dying. PIH would also recruit and train others, whether as community health workers or nurses or doctors or managers, and

generate knowledge about 'healthcare delivery': what's the best way to treat Aids or cancer or drug-resistant tuberculosis in a squatter settlement in rural Haiti or a slum in Peru? How might we introduce trauma care, much of it surgical, where none exists? How might we prevent and treat malnutrition, which complicated most of the illnesses we diagnosed in children, without importing cheap food from subsidised US farms (which would further decrease the paltry incomes of local farmers, the parents of the malnourished)? How would we help the people who lived in these places, and had the most at stake, to get trained and qualified?

Our grandiose 1987 mission statement – most of us were still students – even promised to serve as 'an antidote to despair'. Much of the despair we'd seen was generated by the 'OOPS approach' to sickness. 'Out Of Pocket Spending', a leading cause of destitution in countries rich, poor and in-between, was largely responsible for the stupid deaths we witnessed, since the care people paid for was expensive and mostly bad. PIH committed itself to the fight for healthcare as a human right. Such a right was in principle guaranteed by governments, even if they were unable, alone, to provide both healthcare and protection from destitution caused by a lack of health insurance. That meant PIH would try to help public health authorities to do their jobs, an aspiration dismissed as silly or worse by most other NGOs. We knew little about (and had nothing against) private health insurance, but we'd seen what it meant to be poor and sick or injured. The vast majority of Haitians had no insurance, public or private; they paid for their poor-quality healthcare, and inadequate education, with their own scarce cash.

*

One afternoon in October 1988, I was leaving a friend's house in Cambridge, Massachusetts in a self-important rush: a medical student also getting a degree in anthropology, I was headed back to Haiti, then experiencing a great political upheaval. My friend was one of the founders of Partners In Health, which we believed, even then, might make a difference in rural Haiti and beyond. But that's not the reason I was in a rush: I was eager to correct the proofs of an academic paper (my first) before boarding an early flight to Port-au-Prince, where electricity and postal services were uncertain. The paper was on the political economy of health and illness in Haiti. I was also distracted (distressed, really) because three of the Haitian founders of PIH, all in their twenties, had recently died stupid deaths. The first of puerperal sepsis shortly after childbirth; the second of cerebral malaria in a psychiatrist's waiting room after being misdiagnosed as psychotic; the third of typhoid fever, a rare infection where there is modern sanitation; it had eaten through his small intestine and he died as he was being rolled into one of the operating rooms of Haiti's large, dysfunctional university hospital. My three co-workers, seriously ill, found themselves at the door of the House of No, even as they were working to dismantle it.

Unlike my Haitian co-workers, in 1988 I escaped a stupid death. Outside my friend's house in Cambridge, I ran to catch a bus. A car in the first lane slowed and waved me across Huron Avenue. I turned back to my friend and, referring to my paper, said: 'You're not paying attention.' A car in the second lane hit me, knocking me in front of the bus, which swerved just in time. I tried to get up and out of the way of the traffic, but failed: my left leg was broken. But lying in the road, I was already grateful for two things: that the bus I'd missed had missed me, and that I would soon be in a proper hospital. The doors to the House of Yes would swing open. But there was more than a touch of the OOPS plan evident here, too, and a dysfunction I could see even before I reached the emergency room. 'We're taking you to Sancta Maria Hospital,' one of the ambulance crew said. I'd never heard of Sancta Maria; the ambulance service, a private and for-profit concern, must have had some sort of contract with it. I asked instead to be taken to the Mount Auburn, a Harvard teaching hospital less than half a mile away. From the Mount Auburn I was transferred, again by ambulance, to the emergency room of Massachusetts General Hospital, which I'd just left after a long clinical rotation. My orthopaedic surgeon would be Dr Boland, the surgeon for the local professional football team.

The first dose of morphine (a cheap drug, but one largely unavailable in Haiti as in much of the poor world) made me voluble and almost cheerful. If Dr Boland could patch up the New England Patriots and return them to the field, surely he could put me to rights; I'd be back in Haiti in no time. In the second ambulance with me was another friend, an emergency physician from Colombia. We talked about Pinochet – it was the day of the plebiscite in Chile that denied him another eight years in power – whose many sins had included the dismantling of the country's public healthcare safety net.

The emergency room of MGH was, in those days, chaotic, poorly laid-out and slow, as the Colombian doctor complained to the nurse. My morphine-induced euphoria began to give way: the pain returned and my leg looked less amenable to repair. Nausea, whether from the morphine or from too little of it, was taking over. It was some time before the orthopaedic resident showed up. Knowing I was a medical student, she spoke telegraphically: 'Your knee is destroyed. You will go to the OR as his first case.' She was referring to Dr Boland. 'Anaesthesiology will come and see you tonight; not sure when; they're busy too.' In those days, doctors-in-training and students, rather than phlebotomists, drew blood at night, with varying success (this at one of the best resourced hospitals in the world, and one of the oldest in the US). The resident stuck a needle in the crook of my arm and popped a glass tube into the plastic sleeve on the bevelled surface of the other end of the needle. Instead of dark, homogenous venous blood, a raspberry-and-cream swirl of blood and fat came out of my arm. Fat in the bloodstream after an injury like mine signalled the possibility of a fat embolus, a rare but potentially fatal complication of long-bone fractures. 'I will have the anaesthesia resident come right away,' she said, more gently. 'Just in case.'

I gave myself up to illness. The next dose of morphine, long overdue, made me vomit, and by morning I was happy to be wheeled to Dr Boland's operating room. It was more than a month before I returned to Haiti, in a wheelchair, and three months before I walked without a crutch or a cane. But I knew, even as I saw – for the first time as a patient – the imperfections of our medical system, that I'd been given excellent surgical and nursing care. After five years between Harvard and Haiti, I knew I was lucky to receive it.

What did my failure to look before crossing the road cost? It's smarter to think of price, rather than cost, in the crazy and profoundly ideological arena of healthcare financing. All told, the price of my care was about twice my widowed mother's annual salary as a grocery store cashier. How was it paid, given that in 1988 she, like all but one of her six children, was a student? By the private health insurance provided to students at Harvard. It covered most of the bills, though I was hounded for more than two years by the ambulance service that had taken me to two of Harvard's teaching hospitals in one night. For some reason my student insurance didn't cover that expense, or perhaps I made a mistake filling out the stacks of forms that piled up along with the 'co-pays' for medication, crutches, renting a wheelchair and physical therapy – all obtained from different companies rather than from the hospital.

In other words, lucky as I was to receive such excellent care, I was even luckier to have insurance for 'catastrophic illness', as it's known in health economics jargon. Surgical care like mine is estimated to impoverish some thirty million households a year – and those are only the fortunate families that receive care when they need it. By some estimates, the fraction of humanity covered fully for catastrophic illness is between 5 and 10 per cent. It isn't only in the rural reaches of Haiti, Rwanda, Lesotho or Malawi that millions die at the door of the House of No. The south side of Chicago has been called a 'trauma desert' because there isn't a single fully staffed and equipped trauma centre on that side of the city, which is one of the reasons that the outcome of trauma there – much of it caused by guns – is so much deadlier than in more affluent reaches of the third largest city in the US.

*

So how do we finance emergency and trauma care? What about cancer care? Hospital care in general? How do we foot these bills as well as bills for prevention and primary care, so often pitted against the sort of hospital care I received but my Haitian colleagues did not? I would have been wise to look both ways before I crossed, but wouldn't have wanted the ambulance crew or the orthopaedic surgeons to lecture me about prevention. My Haitian friends, though, might well have heard a chorus of such opinion while they were dying of malaria ('should have had a bed net'), typhoid ('should have drunk clean water') or after childbirth: lectures about family planning and handwashing abound in places like Haiti, and most of them are directed at the poorest – typically women – rather than to those responsible for the staff, stuff, space and systems required to deliver such services.

It is vividly apparent that prevention is being pitted against care in comments about the current Ebola epidemic in West Africa. Many are surprised to learn that Ebola kills mostly by causing massive fluid and electrolyte loss through vomiting and diarrhoea. These are treated by fluid resuscitation, a fancy term for replacing what has been lost. It's hard to do this by drinking Lucozade if you're vomiting, which is why the severely dehydrated often need what physicians and nurses call 'supportive care', which doesn't mean handholding but intravenous fluids (often several litres per day), electrolytes and nutritional supplements.

In August the president of Nigeria called a Liberian-American sick with Ebola 'a madman' for seeking treatment in Lagos, even though proper care for the critically ill was unavailable in Liberia: most of its hospitals had closed and the 'Ebola centres' had thus far been more about isolation than care. The blogosphere erupted with similarly uncharitable comments about two American humanitarians who were airlifted from Liberia to Atlanta for hospital care. In September Liberian police shot dead a 15-year-old boy trying to break out of, or protest against, the quarantine of an entire neighbourhood. Sierra Leone made it a crime to shelter an Ebola patient.[1] In the US, Ebola – or, rather, the fear and anxiety it triggered – became an issue in the run-up to the midterm elections. Travellers from West Africa, including volunteer doctors and nurses, felt stigmatised.

It's possible to argue, as many politicians did, that the fuss was all about averting an expensive health crisis, but prevention is no longer the issue for those already injured, or sick with Ebola or Aids or typhoid or cancer. Finding equitable ways to finance healthcare, including the treatment of catastrophic illness, is the main challenge for both medicine and public health, along with weaving, or restitching, the safety nets that might protect families from death or disability and the financial ruin that accompanies serious illness.

There are few health economists in the rural parts of the developing world where I've worked, but there are plenty of development economists working full-time, if often from a comfortable distance, on 'poverty reduction' through economic growth. Some of them have been architects of the House of No, calling for the reduction of public expenditure, the privatisation of health services and public investment only in services deemed 'cost-effective'. In all the years of my training, moving between Harvard and Haiti (and parts of Latin America), I rarely heard calls for investment in the treatment of trauma, cancer, diabetes, Aids or drug-resistant TB. Many influential players in the 'donor community' held that such efforts simply weren't cost-effective. Even the treatment of drug-susceptible TB, which costs less than \$200 per patient and prevents airborne epidemic spread, was thought by experts in 'selective primary care' not to warrant the investment of scarce resources in poor countries. The list of pathologies deemed too costly to cover went on and on.

Despite this, a 'revolution in child survival' began in the middle of the last century, hastened by massive campaigns to end vaccine-preventable illness and diarrhoeal disease. The effect of such campaigns, along with the advent of modern contraception and the promotion of

breastfeeding, was – as anticipated – that sky-high child mortality rates began to drop in even the poorest countries, as they had in previous decades in affluent countries (and among affluent families in poor ones). A century of differing health outcomes, especially for infants and children, was at last coming to a close. In *The Great Escape: Health, Wealth and the Origins of Inequality*, the Princeton economist Angus Deaton describes ‘the reduction in global poverty since 1980’ as ‘the greatest escape in all of human history and certainly the most rapid one’.[2]

*

But economic growth doesn’t necessarily lead to a health revolution. For the past decade India has consistently ranked below only China as the world’s fastest growing economy, but it has failed to address some of the worst healthcare disparities in the world – and what may well be the highest global rates of childhood malnutrition and stunting. In *An Uncertain Glory: India and Its Contradictions*, Jean Drèze and Amartya Sen consider the plight of hundreds of millions of Indians who still live in poverty, often as a consequence of class, caste and gender inequality, without ready access to education, credit or any sort of social safety net.[3] One of the questions Drèze and Sen ask is how to finance health services ranging from prevention to primary care to catastrophic illness:

A health system based on targeted insurance subsidies is very unlikely to meet basic norms of equity in healthcare, as four different sources of inequality reinforce each other: exclusion errors associated with the targeting process; screening of potential clients by insurance companies; the obstacles (powerlessness, low education, social discrimination, among others) poor people face in using the health insurance system ... where access to healthcare is linked with the ability to pay insurance premiums.

Drèze and Sen draw on lessons from across the world, comparing China unfavourably with India in terms of democratic institutions, but noting that since it restored its rural health insurance scheme which was savaged a few decades back, China has surged ahead of India in all standard measures of health and wellbeing. So have Bangladesh, Mexico, Thailand and many other countries with radically different political systems. All have public health systems that aspire to universal coverage, though with varied success. Drèze and Sen are critical of the healthcare system in the US,

one of the most costly and ineffective in the industrialised world: per capita health expenditure is more than twice as high as in Europe, but health outcomes are poorer (with, for instance, the US ranking 50th in the world in terms of life expectancy). This system is also highly inequitable, with nearly 20 per cent of the

population excluded from health insurance, and terrible health conditions and risks among deprived groups.

And some disparities of outcome are growing. As deaths due to Aids, TB, malaria and vaccine-preventable illness are dropping, and life expectancy at birth continues rising, a greater share of deaths in the poorer parts of the world are due to trauma (or other injuries, intentional and unintentional), and to complications of heart disease and diabetes; two-thirds of all new ('incident') cases of cancer already occur in 'low and middle-income countries'. Integrating prevention and care for these pathologies requires not only community health workers and clinics, but hospitals able to care for the injured and patients with 'non-communicable disease'. An injury like mine, sustained because of a jaywalker's inattention, would probably be tossed into this broad category, but so would injuries due to gunshot wounds, especially in trauma deserts, and problems associated with diabetes and heart disease, in food deserts.

Such deserts – most of West Africa is in a public health desert, which is why Ebola spreads, as well as a supportive care desert, which is why it kills – need resources. One of the suggestions of the 2013 *Lancet* Commission on Investing in Health was 'progressive universalism', which is to say publicly financed health insurance schemes, with the rich paying more through taxation than the poor (as with the NHS since 1945, though perhaps not for very much longer). 'Throughout most of recorded history', the British epidemiologist Martin McKee and colleagues recently observed, the concept of universal healthcare 'was essentially meaningless because healthcare had so little to offer'. In much of industrialising Europe, premature mortality began its decline well before the advent of widespread vaccination. The antibiotic revolution seemed to matter less than improved sanitation and living conditions, which led some to argue that access to healthcare was far less important than meaningful improvements in work, education and other drivers of economic growth: there was not much improvement in life expectancy among the Navajo when they were given 'modern' medical care for a limited set of diseases. But such claims were made in the infancy of modern medicine, as is clear from the meagre 'package' of therapies offered to the Navajo.

In discussing settings with 'limited resources' – usually code for people living in poverty and without medical insurance – it was widely argued (in discussions about poor people rather than with them) that medical care was a luxury compared to efforts further 'upstream' to promote economic development and basic sanitation. Arguments proliferated along the lines of 'they don't need new medical technologies or medicines; they need prevention and better living conditions' – as if it were either/or. In the last decades of the 20th century, the policymakers qualified their prescriptions by drawing on rudimentary notions of 'cost-effectiveness' and 'sustainability'. In the face of rapid medical advances, and dizzying fluctuations in both the cost (to say nothing of price) and effectiveness of these advances, it

was increasingly the global poor who were asked to make do with the 'basic minimum package'.

I first heard this term in a public health course at Harvard in the mid-1980s, when it was asserted that our attentions in places like Haiti, or most of Africa, should be focused on a package called 'Gobi'. 'That's what we should be financing,' I heard. Believing Gobi to be a desert in Mongolia, but clearly in a minority (the public health students, unlike the medical students, seemed to know it was an acronym for 'growth monitoring, oral rehydration, breastfeeding and immunisation'), I wondered, and still do, how medical care could ever fit into so small a package. What had happened to 'health for all by the year 2000', the goal endorsed by most of the world's health ministers at a meeting in Alma Ata, in the Kazakh Soviet Socialist Republic in 1978?

A 'minimum package' presupposes the existence of a bigger, even a maximum package. If your child has leukaemia, then you'd better hope the package includes chemotherapy (it didn't and, in most countries, still doesn't, although its main components have long been off-patent). If you're hit by a car and need surgical care, you'd hope – I merely assumed as much – that you'd get it (another big no). Most of the misfortunes that exclusively afflict the poor weren't even on the Gobi agenda. The vaccines and drugs required to treat 'emerging infectious diseases' like Ebola do not yet exist because there's no money to be made from them. The kind of care that 'we' receive isn't 'affordable' or 'sustainable' for 'them' – the poorer inhabitants of indebted countries under pressure to shrink their public budget and healthcare payroll. Across sub-Saharan Africa, with a few notable exceptions such as Rwanda, hospitals are either private, expensive and out of reach of the destitute sick, or publicly financed, underequipped, understaffed and frequently avoided by the destitute sick, who know that the quality of care is dismal. They are often huge drains on the scant budgets of health ministries and offer little 'value for money'. They are, in the words of experts in public health and development, 'unsustainable'.

But how did we, the already sustained, get access to sustainable healthcare? How did those long shut out of modern medicine come to have the same aspirations – to be cared for when sick, to be protected from financial ruin – dismissed as unsustainable? The word 'sustainable', Haun Saussy has written,

is a migrant from the sphere of engineering and environmentalism to that of business, and thence to that of political economy ... When used by specialists in international economics, the term refers to a fantasy in which the costs of development (say, the building of a healthcare infrastructure) are borne by the beneficiaries, something that was certainly not the case for Europe during the Industrial Revolution, and is unlikely to occur elsewhere.

This anti-hospital bias, though quietly espoused by many experts in ‘global health’, is bad news for poor people requiring hospital care. It’s really the poor who are ‘unsustainable’ if they get cancer or suffer serious injury. Proper care for trauma or cancer often requires surgery, anaesthesia, chemotherapy and diagnostic capacity (such as computerised tomography or laboratory testing); such services are often delivered within hospitals or clinics and should also be complemented by home-based care.

The need for hospitals is uncontroversial in parts of the world where there are already many – often too many – of them. But the need for improved hospital care in parts of the world where there is little or none of it is hotly contested, in large part because these places also lack the staff, stuff and systems to deliver primary and preventive care. Without such basics, ‘Third World’ hospitals, almost always in urban areas, come to consume the lion’s share of expenditure even as they provide poor quality care. Unsafe spaces, they are also epicentres of drug-resistant bacterial infections that can only be stopped by the prudent use of antibiotics and, like Ebola, by proper infection control. Development economists and public-health specialists may argue that hospitals are a bad investment, but politicians know that cutting off funding to public hospitals is politically and socially unsustainable. The debate is too rarely informed by a consideration of what it might or should cost to link hospital care to better primary care. Everyone, everywhere, is likely to need both at some point between birth and death.

*

Lesotho, one of Africa’s poorer countries, is tiny, landlocked and completely surrounded by South Africa, the continent’s economic and medical powerhouse. Most of the Basotho people live in rural, mountainous areas: the first time I went to one of the highland outposts where Partners In Health was working, I travelled with a young Haitian doctor with whom I’d worked for several years. As our tiny plane landed on an unpaved airstrip, it started to snow. He looked at me accusingly: ‘You didn’t tell me it snows in Africa.’ He worked there for two years: he was the first doctor in recent memory to live full-time in the region.

There’s little doubt of the need in a place like Lesotho for a robust primary care system in which preventive efforts reach the rural poor via community health workers. But as in Haiti, some of the biggest problems in rural Lesotho were catastrophic illnesses: obstructed labour, trauma, Aids, cancer and TB, including its drug-resistant forms. TB also afflicted many Basotho patients with Aids, most of whom had been working in South Africa (often in mines) and had come home to die. Some international public health experts advised caution in investing in such costly endeavours as treating HIV disease, which afflicted up to a third of the young adult population. As these infections rapidly became the leading killers of adults and children, low pay and difficult working conditions – no staff, no stuff, no safe space – fuelled an exodus of health professionals. By 2007, when we began working in Lesotho, there were said to be more Basotho doctors and nurses outside the country than in it.

There was no medical school in Lesotho, which claimed independence from Britain in 1966. The only public referral hospital, named after Queen Elizabeth, in the capital city, Maseru, was decrepit, poorly run and subject to explosive outbreaks of drug-resistant TB: few if any Basotho mourned plans for its closure and replacement. The question was who would build a new hospital and how it would be paid for. Under pressure to privatise a poorly functioning and worn-out public institution, and to improve the quality and cost-effectiveness of care, the government turned to Netcare, a South African company which promised to build a proper teaching hospital for more or less the same amount as Queen Elizabeth was costing to run. This was in 2009. With the help of the International Finance Corporation, part of the World Bank, Lesotho and Netcare negotiated an 18-year contract, which set a cap on the number of patients to be cared for and specified the precise services to be provided. The ministry of health would own the hospital (and its debt) – this was a ‘public-private partnership’ – and pay extra for referrals to South Africa for specialist care unavailable in Lesotho.

A year after the opening of the hospital – an enormous improvement on its crumbling predecessor – it is perhaps too early to say, as a recent Oxfam report does, that the institution represents a ‘dangerous diversion’ of public money to a private concern. But there are significant financial problems and many disappointments. By 2013 the hospital was consuming more than half of the health ministry’s budget, the cost of referrals to South Africa was significantly higher than planned, and programmes to train medical specialists (to care for patients with cancer, for example) had still not begun. The ministry of health also had to pay, as debtors do, late fees which amounted to \$755,000 by April 2014. This was the debt of a small sovereign nation to a private consortium, following the usual pattern: privatising profit, socialising risk. The Oxfam report suggests that, within a couple of years, the agreement may consume 80 per cent of Lesotho’s public health budget; high-ranking government officials (beset by criticism, although they weren’t part of the administration that signed the deal) are considering renovating the old hospital in the hope of providing some of those services within the public sector. That won’t solve the basic problem: most Basotho live in rural areas with no doctors, few nurses and dilapidated clinics. Travelling to Maseru for medical care is often perilous and always expensive.

*

Haiti faced an even graver crisis in 2010, when an earthquake destroyed much of the health infrastructure in its capital. The health ministry collapsed, as did other federal buildings; an estimated 20 per cent of public health employees were killed or injured. The ministry asked Partners In Health to build a teaching hospital in Mirebalais, a small city in central Haiti outside the earthquake zone. (I’d lived there 25 years earlier; it’s where I went to convalesce after breaking my leg, and where, along with Port-au-Prince, my three colleagues received late diagnoses and substandard care.)

Completed in 18 months, it's the largest solar-powered hospital in the developing world. Built by local workers, with volunteer technical assistance from US carpenters, plumbers and electricians, it cost roughly one-fifth what the smaller Maseru hospital did. It's hard to compare the two – one is for-profit, the other isn't – but while the Haitian government made the largest contribution in the first year of operations, the Mirebalais hospital doesn't consume even 15 per cent of the health ministry's budget. During that first year, the hospital saw roughly as many patients as the Maseru hospital and its directors launched training programmes in surgery, paediatrics and internal medicine; others in specialist nursing, management and emergency medicine are now underway. It's the biggest employer in central Haiti. One French economist has estimated conservatively that each dollar invested in the facility generates almost two dollars in the local economy.

In part because of deep ambivalence about services for the poor, whether they live in rich countries or poor ones, and in part because of a relentless push to privatise profits as we socialise losses, we are still asking how to pay for the staff, stuff and systems required to build the House of Yes and make it a space that can serve those most in need. New ways of financing healthcare – and of making it easier to stay healthy – are needed to get beyond the impasse, especially if the hope is to reach those most at risk of untimely death and disability. Only a fraction of the innumerable mechanisms and 'instruments' used by specialists in accumulating capital are ever considered for use in providing healthcare as a public good. A global financial transaction tax has been proposed by activists and politicians in dozens of countries: a tiny sliver of each such transaction would be diverted to healthcare for the global poor, as would 'sin' taxes on noxious or luxury items from cigarettes to champagne. Last summer, a consortium of corporations, banks and charitable foundations announced, from the White House, that they would raise billions through 'social impact bonds' designed to finance malaria control and other efforts that might be shown to save lives while saving money.

Philippe Douste-Blazy, a former French health minister, doggedly pursued the idea of a voluntary – the customer could opt out – two-dollar tax on plane tickets to finance the treatment of Aids, TB and malaria. Clinton and Chirac were solidly behind it, as was Brazil's President Lula. In its first three years, run by a skeleton crew of French bureaucrats, the airline tax raised \$1.06 billion, all of which went to prevent and treat the 'big three' pathogens. 'By April 2007,' Douste-Blazy said, 'we had 23 countries on board. Their leaders had all agreed to introduce the airline ticket tax, and at least half a dozen of them would be collecting it by the end of the year.' It was time 'to go back to our harshest critic':

Just as before, the members of the Bush administration were blunt. 'It's a great idea,' they said, 'but do you know what your French historian Alexis de Tocqueville wrote about our country? It's all about freedom of choice. You say a

child dies every thirty seconds from malaria. If I want to save him, fine, I can pay. But if not, I'm not going to pay.'

The scheme is still running, but the US has never taken part.

As it happens, the US government has chosen to be the largest contributor to efforts to stem these plagues and many others, including Ebola; it's also the biggest donor to some of the multilateral funds established towards the same ends. And so the notion of a voluntary contribution – as opposed to a tax – helped to move billions of dollars to pay for the treatment of Aids, TB and malaria where they cause most deaths. But it's difficult (perhaps almost impossible) to achieve equity of access to decent healthcare when neoliberal market paradigms underpin care delivery. Drèze and Sen argue that building a strong publicly financed health system is critical, even if there are other, non-public insurers (and donors) in the mix. In the absence of fine-mesh public safety nets, quality services are by definition reserved for those who can pay for them. Holes in the nets – even the contraction of the notion of common goods like social protection – are one of 'the causes of the causes' of both ill-health and the impoverishment it so often triggers or complicates.

*

Thomas Piketty argues that 'economics should never have sought to divorce itself from the other social sciences and can advance only in conjunction with them.' Anthropology is one example: *Blind Spot*, by the physician-anthropologist Salmaan Keshavjee, offers a lesson on the impact of dogma over data.[4] The Soviet healthcare system once reached, rather unevenly, into the highlands of Tajikistan; so did pensions and public works. The quality of care was never very good and the centralised system wasn't able to avoid medicine shortages, perverse incentives or demoralisation among care providers. But the collapse of the Soviet Union was catastrophic, leading to the rapid erosion of public institutions – such as they were – and the worsening of social inequalities, themselves exacerbated by the disappearance of social safety nets. While Keshavjee was carrying out his fieldwork, which began in 1995, the collapse was followed by a chaotic proliferation of 'civil society institutions' with competing agendas, rooted in a range of disparities and asymmetries: public-private, centre-periphery, urban-rural, mountains-lowlands, practitioner-patient, foreign-local. The gulf widened between the tottering public health system and the well-resourced, arriviste aid agencies and NGOs. Keshavjee became a consultant for one of them: its projects were openly designed to 'change the mentality' of the 'clients' of health services. The aid-givers talked of 'privatisation', 'user fees' and 'more efficient' ways of 'managing' healthcare delivery with 'free trade' and 'competition'. Patients were known as 'clients', 'consumers' or even 'customers'. When Keshavjee was assessing a revolving drug fund – it was 'sustainable', the claim went, because some of the receipts from the direct sale of pharmaceuticals were used to replenish the fund after the initial investment, and the rest went to 'finance primary healthcare' – one of his

Tajik informants told him: 'You can't sell medicines to starving people.' But that doesn't stop people trying.

The Bamako Initiative, launched in Mali in 1987, encouraged the health officials of African nations, already heavily indebted to international financial institutions and private banks, to finance a slender package of healthcare for the poor (this is where Gobi and the 'basic minimum package' came into their own) by having the 'consumer' pay for care when sick, in order to 'recover costs' and thus finance healthcare through 'community participation'. The dignity conferred by paying for one's own (or one's children's) care would magically make such programmes 'sustainable' and cut down, Bamako's most zealous advocates suggested, on the sort of 'frivolous spending' and 'moral hazard' allegedly encountered in places like rural Mali. Shifting the costs to private payers – meaning patients and their families – would also lower public expenditure on health and 'decentralise' care.

The health officials all signed on, as did various UN agencies, but there must have been many misgivings in Bamako. The initiative clearly contradicted the Alma Ata declaration of 1978, which had been unanimously endorsed by the world's health ministers. But just as it's difficult to find empirical studies to shore up claims that paying for one's own healthcare when sick recovers a substantial proportion of a health system's costs, so it's hard to find dissenting voices on the Bamako agreement. The reason for the widespread support of the Bamako Initiative was not that Africa's health leaders were suddenly alerted to an epidemic of frivolous health spending in their countries' slums and villages, or that they were resolved to replace the slogan of Alma Ata ('healthcare for all by the year 2000') with a new one ('healthcare for some if they can pay for part of it when they're sick and as we shrink our public budgets'). They signed on because adopting the Bamako plan was linked, more or less transparently, to the 'structural adjustment programmes' hawked by the international financial institutions. It was a hidden condition, a 'natural' part of the market globalism that sought to commodify healthcare and to shrink social sector spending.

*

When Amartya Sen accepted the Nobel Prize in Economics in 1998, he spoke of his diagnosis, in 1952 at the age of 19, with a cancer of the mouth. He had just won a scholarship to Cambridge, and was living in the Calcutta YMCA, studying at Presidency College, when he noticed a 'pea-sized lump' on the roof of his mouth. A local GP dismissed it as a reaction to a fish-bone, but Sen, having borrowed textbooks from a medical student in the next room, self-diagnosed a squamous-cell carcinoma. Untreated malignancies of this sort kill slowly, disfiguring the mouth, then the jaw, then the face; death is usually caused by a combination of starvation and asphyxia. Although Sen was not from a deprived background (his father was a chemistry professor at the University of Dhaka, his mother a writer, dancer and magazine editor), it took him months to arrange a biopsy at Chittaranjan Cancer Hospital; the pathology confirmed his diagnosis. Knowing he had received a death sentence, Sen and

his family pushed for what was, in India, a new form of treatment: radiotherapy. In Calcutta, Sen was fitted with a radiation mould and received a total of 10,000 rads, about four times the amount that might be used today. ‘Give me the maximum dose,’ he’d asked. ‘This is my only chance.’ During his treatment, Sen ‘sat there for four hours at a time and read. Out of the window, I could see a tree. What a relief it was to see that one green tree.’

After the acute side effects, which included the usual malaise and difficulty in swallowing even liquids, he went on to suffer chronic ones too, including necrosis of the bones in his palate. But he also went to Cambridge, and then on to a career in economics that might have taken a different path had he not been forced, as a teenager, to consider the misery faced by the sick, even those with access to healthcare. But Sen would have taken no path at all had his cancer not been cured. In most of the places I work – including Haiti, Rwanda, Lesotho, Malawi, Liberia and Sierra Leone – there is, in 2015, still no radiotherapy.

[1] Paul Farmer wrote about the Ebola epidemic in the *LRB* of 23 October 2014.

[2] Princeton, 376 pp., £19.95, August 2013, 978 0 691 15354 4.

[3] Allen Lane, 448 pp., £10.99, March 2014, 978 0 14 197582 5.

[4] California, 288 pp., £44.95, August 2014, 978 0 520 28283 4.

Vol. 37 No. 3 · 5 February 2015 » Paul Farmer » Who Lives and Who Dies
pages 17-20 | 7111 words

A geospatial evaluation of timely access to surgical care in seven countries

Lisa M Knowlton,^a Paulin Banguti,^b Smita Chackungal,^c Traychit Chanthasiri,^d Tiffany E Chao,^e Bernice Dahn,^f Milliard Derbew,^g Debashish Dhar,^h Micaela M Esquivel,^a Faye Evans,ⁱ Simon Hendel,^j Drake G LeBrun,^k Michelle Notrica,^l Iracema Saavedra-Pozo,^m Ross Shockley,ⁿ Tarsicio Uribe-Leitz,^a Boualy Vannavong,^d Kelly A McQueen,^o David A Spain^a & Thomas G Weiser^a

Objective To assess the consistent availability of basic surgical resources at selected facilities in seven countries.

Methods In 2010–2014, we used a situational analysis tool to collect data at district and regional hospitals in Bangladesh ($n=14$), the Plurinational State of Bolivia ($n=18$), Ethiopia ($n=19$), Guatemala ($n=20$), the Lao People's Democratic Republic ($n=12$), Liberia ($n=12$) and Rwanda ($n=25$). Hospital sites were selected by pragmatic sampling. Data were geocoded and then analysed using an online data visualization platform. Each hospital's catchment population was defined as the people who could reach the hospital via a vehicle trip of no more than two hours. A hospital was only considered to show consistent availability of basic surgical resources if clean water, electricity, essential medications including intravenous fluids and at least one anaesthetic, analgesic and antibiotic, a functional pulse oximeter, a functional sterilizer, oxygen and providers accredited to perform surgery and anaesthesia were always available.

Findings Only 41 (34.2%) of the 120 study hospitals met the criteria for the provision of consistent basic surgical services. The combined catchments of the study hospitals in each study country varied between 3.3 million people in Liberia and 151.3 million people in Bangladesh. However, the combined catchments of the study hospitals in each study country that met the criteria for the provision of consistent basic surgical services were substantially smaller and varied between 1.3 million in Liberia and 79.2 million in Bangladesh.

Conclusion Many study facilities were deficient in the basic infrastructure necessary for providing basic surgical care on a consistent basis.

Abstracts in [عربي](#), [中文](#), [Français](#), [Русский](#) and [Español](#) at the end of each article.

Introduction

Access to emergency and essential surgery is integral to a comprehensive health-care system. Since the development of the millennium development goals, the global health community has increasingly recognized the role of surgical care in the treatment of common conditions such as acute abdominal processes, obstetric complications and trauma.¹ Surgical conditions are estimated to account for 18% of the global burden of disease.² However, in low- and middle-income countries there is often inadequate surgical capacity. In 2015, it was estimated that at least 143 million additional operations would be required to address emergency and essential surgical conditions in such countries.³ In the same year, the Lancet Commission on Global Surgery noted that 5 billion people did not have access to affordable, safe and/or timely surgical care³ and, each year, such lack of access results in an estimated 1.5 million avoidable

deaths.² The Lancet Commission also proposed six key indicators to define and measure the availability and affordability of surgical care for a given population³ – including case volume, the density of the surgical specialist workforce, perioperative mortality and timely access. Since 2011, several of these key indicators have been investigated.^{4–8}

The impetus to understand and implement the basic components of the provision of quality surgical care is stronger than ever. With the recent implementation of the United Nation's sustainable development agenda for 2030,⁹ there is renewed opportunity to focus on expanding universal health-care coverage to include essential surgical services. Moreover, to achieve sustainable development goal 3 – i.e. ensuring healthy lives and promoting well-being for all at all ages – a more detailed understanding of the calibre of the surgical care available in low- and middle-income countries is necessary. The substantial and often alarming variability observed in sur-

^a Department of Surgery, Division of General Surgery, Stanford University School of Medicine, 300 Pasteur Drive, S067, Stanford, CA 94305, United States of America (USA).

^b Department of Anaesthesia, University of Rwanda, Butare, Rwanda.

^c London Health Sciences Centre, London, Canada.

^d Department of Anaesthesia, Mahosot Hospital, Vientiane, Lao People's Democratic Republic.

^e Department of Surgery, Massachusetts General Hospital, Boston, USA.

^f Ministry of Health and Social Welfare, Monrovia, Liberia.

^g School of Medicine, Addis Ababa University, Addis Ababa, Ethiopia.

^h National Institute of Diseases of Chest and Hospital, Dhaka, Bangladesh.

ⁱ Department of Anesthesiology, Boston Children's Hospital, Boston, USA.

^j Department of Anaesthesiology, The Alfred Hospital, Melbourne, Australia.

^k Perelman School of Medicine, University of Pennsylvania, Philadelphia, USA.

^l Global Surgical Consortium, Nashville, USA.

^m Department of Surgery, Caja Nacional de Salud Hospital, La Paz, Plurinational State of Bolivia.

ⁿ Department of Otolaryngology, Vanderbilt University Medical Center, Nashville, USA.

^o Department of Anesthesiology, Vanderbilt University Medical Center, Nashville, USA.

Correspondence to Lisa M Knowlton (email: drlmk@stanford.edu).

(Submitted: 17 May 2016 – Revised version received: 19 October 2016 – Accepted: 13 January 2017 – Published online: 16 March 2017)

gical mortality rates within and across countries¹⁰ supports the argument that surgery must occur within an appropriate framework that prioritizes the safety and welfare of patients.

The district hospital is expected to provide emergency and essential surgery and serve as the nexus of surgical services that do not require referral to specialized centres for tertiary care.^{4–8,11} While many district hospitals provide simple and essential surgical procedures, the resources and materials available to provide safe care are frequently inadequate. We decided to assess the difference in access to essential surgical services when minimum resource standards are included in the calculation of surgical availability. We used geographical information systems to investigate, in seven countries, the availability of basic surgical resources for patients who lived within a two-hour vehicle trip of one of a selection of hospitals that provided surgical services.

Methods

In cooperation with health ministries or other partner institutions in each country, sample district or regional hospitals providing emergency and essential surgery were identified in Bangladesh, the Plurinational State of Bolivia, Ethiopia, Guatemala, the Lao People's Democratic Republic, Liberia and Rwanda. We selected these countries because they were considered relatively safe for researchers and offered apparently good opportunities for collaboration with local officials. The study hospitals were selected for convenience and proximity to national roadways. In each study country, unless access was limited by poor road conditions or safety concerns, at least one district hospital providing surgical services was assessed per county or district. If more than one hospital was accessible per county or district, we included all of them in our evaluation and categorized them as district hospitals or regional referral centres.

Between 2010 and 2014, each national survey was conducted by one of the study authors who, in collaboration with local health administrators, performed in-person interviews and on-site assessments of capacity to provide surgical and anaesthesia services. Hospital visits included face-to-face interviews with anaesthesiologists, hospital directors, nurses, pharmacists, physicians and

Box 1. The eight resources considered essential for safe basic surgery at a hospital

Equipment and supplies

- Consistent oxygen supply
- Essential medications – i.e. antibiotic, analgesic, inhaled or intravenous anaesthetic and intravenous fluids
- Functional pulse oximeter
- Functional sterilizer

Infrastructure

- Consistent electricity supply
- Consistent supply of clean water

Personnel

- Accredited anaesthesia provider
- Accredited surgical provider

surgeons. Medical directors provided permission for the researchers to tour relevant infrastructure, including the study hospitals' pharmacies, operating rooms and wards. Audits were documented using an abbreviated version of the World Health Organization's (WHO's) Global Initiative for Emergency and Essential Surgical Care survey questionnaire.^{7,12,13} More detailed descriptions of this questionnaire are included in the reports of previous country-specific investigations.^{4–8}

The Lancet Commission on Global Surgery proposed dimensions for access that included affordability, safety and timeliness.³ We could not assess affordability but assessed access – using a two-hour maximum travel time – and safety – using an on-site assessment of basic infrastructure.³ Through expert consensus, we identified a minimum set of eight resource criteria that, if met entirely by an individual facility, indicated that the facility was able to provide emergency surgical services consistently (Box 1). Consistency in this context meant that all interviewees at a study hospital reported that each of the eight resources assessed at their facility was “always available” rather than “available sometimes” or “never available”.

Surgical facilities were geo-located using ArcGIS version 10.3 (ESRI, Redlands, United States of America) and analysed in Redivis (Redivis Inc., Mountain View, USA) – an online data visualization platform. Additional statistical analyses were performed in Stata version 11.0 (StataCorp. LP, College Station, USA). Estimates of catchment populations were based on the WorldPop database, which provides population densities in terms of individuals per square metre.¹⁴ Travel time to each hospital

was estimated from the relevant road distances and estimated road speeds provided by OpenStreetMaps.¹⁵ For our analyses, we used so-called Manhattan distances – i.e. distances based on the road infrastructure – rather than Euclidean – i.e. straight-line distances. Following the Lancet Commission's suggestion,³ we defined the catchment population of a study hospital as the number of people who could reach the hospital via a vehicle trip that lasted no longer than two hours. For each study country, we used geospatial techniques to map the discrepancy between the total catchment population of all the study hospitals and the catchment populations of the study hospitals that provided consistent emergency surgical services. We also assessed the proportions of the estimated national population in 2013¹⁶ represented by the catchment populations in each study country.

No patient data were collected and institutional review board exemption was obtained by partner institutions, as previously described.^{4–8,17}

Results

Data were collected from a total of 120 hospitals identified as providing surgical care (Table 1). The estimated road travel time needed, by patients, to reach any of our surveyed hospitals – or any of our surveyed hospitals that met all eight resource criteria for basic surgery are illustrated in Fig. 1 and Fig. 2. The median size of a catchment population for a study hospital was 11.1 million (interquartile range, IQR: 3.6–34.8 million). The combined estimated catchment populations of the study hospitals in each country, which varied from 3.3 million people in Liberia and 151.3 million

Table 1. Access to hospitals meeting basic surgical standards in terms of eight resource criteria, seven countries, 2010–2014

Country	Survey year	No. of hospitals		National population ^a	Combined catchment population (% of national population in 2013) ^b	
		Evaluated	Meeting BSS		All evaluated hospitals	Hospitals meeting BSS
Bangladesh	2012	14	3	156 600 000	151 275 600 (96.6)	79 239 600 (50.6)
Bolivia (Plurinational State of)	2011	18	9	10 670 000	8 141 200 (76.3)	5 548 400 (52.0)
Ethiopia	2011	19	7	94 100 000	34 817 000 (37.0)	22 301 700 (23.7)
Guatemala	2013	20	12	15 047 000	13 151 100 (87.4)	11 992 500 (79.7)
Lao People's Democratic Republic	2014	12	9	6 077 000	3 646 200 (60.0)	3 433 500 (56.5)
Liberia	2011	12	2	4 294 000	3 315 000 (77.2)	1 318 300 (30.7)
Rwanda	2010	25	5	11 078 000	11 066 900 (99.9)	10 612 700 (95.8)

BSS: basic surgical standards.

^a In 2013, according to the World Bank.¹⁶

^b Catchment populations represented the estimated number of people who, if using a road vehicle, could reach a study hospital within 2 hours. The estimated numbers were based on estimated vehicle speeds, population densities and typical conditions for each country's main and secondary roads.

Note: The criteria for BSS are presented in Box 1.

in Bangladesh, represented an estimated 37.0–99.9% of the national populations in 2013. The corresponding values for the 41 (34.2%) of the study hospitals that met all eight resource criteria for providing basic surgery consistently were substantially smaller. The combined catchment populations for such hospitals varied from 1.3 million in Liberia to 79.2 million in Bangladesh and represented an estimated 23.7–95.8% of the national populations in 2013 (Table 1). In each study country, the median number of individuals who lived in the catchments of study hospitals that appeared to be unable to provide basic surgery consistently was 2.0 million (IQR: 0.5–12.5 million; $P=0.014$).

Bangladesh

In Bangladesh, we investigated 14 public hospitals. Seven of the study hospitals had affiliations with medical colleges and three of these college-affiliated hospitals were the only study hospitals in Bangladesh to meet the minimum resource criteria. Five of the study hospitals reported routine breaks in their electricity supplies.

Plurinational State of Bolivia

Of the 18 hospitals surveyed in the Plurinational State of Bolivia, 11 were basic or district hospitals and seven general or referral hospitals. Only nine hospitals – three basic and six general – met all of the minimum criteria for providing basic surgery. Seven hospitals reported that they had a discontinuous water sup-

ply and seven reported that they had a discontinuous supply of electricity.

Ethiopia

In Ethiopia, we collected data from 19 hospitals – six district and 13 regional. Only seven of the study hospitals – three district and four regional – met our basic surgical standards. The most common resource gaps were related to personnel and supplies: 12 of the study hospitals had no accredited surgical providers, nine had no accredited anaesthesia providers, seven had no functional pulse oximeters and six routinely experienced shortages in essential medications.

Guatemala

One of the 20 hospitals surveyed in Guatemala was recognized as a referral centre. Only 12 of the study hospitals – including the referral centre – met our basic surgical standards. A lack of equipment and/or medications meant that the other eight study hospitals failed to meet all of the resource criteria. Most of the providers of anaesthesia and surgery we surveyed were primary-care physicians rather than specialists.

Lao People's Democratic Republic

All 12 of the study hospitals surveyed in the Lao People's Democratic Republic appeared to have sufficient equipment for basic surgery but only nine of them – including all four in Vientiane prefecture or Vientiane province – had providers of anaesthesia and surgery and met all of our other basic surgical standards.

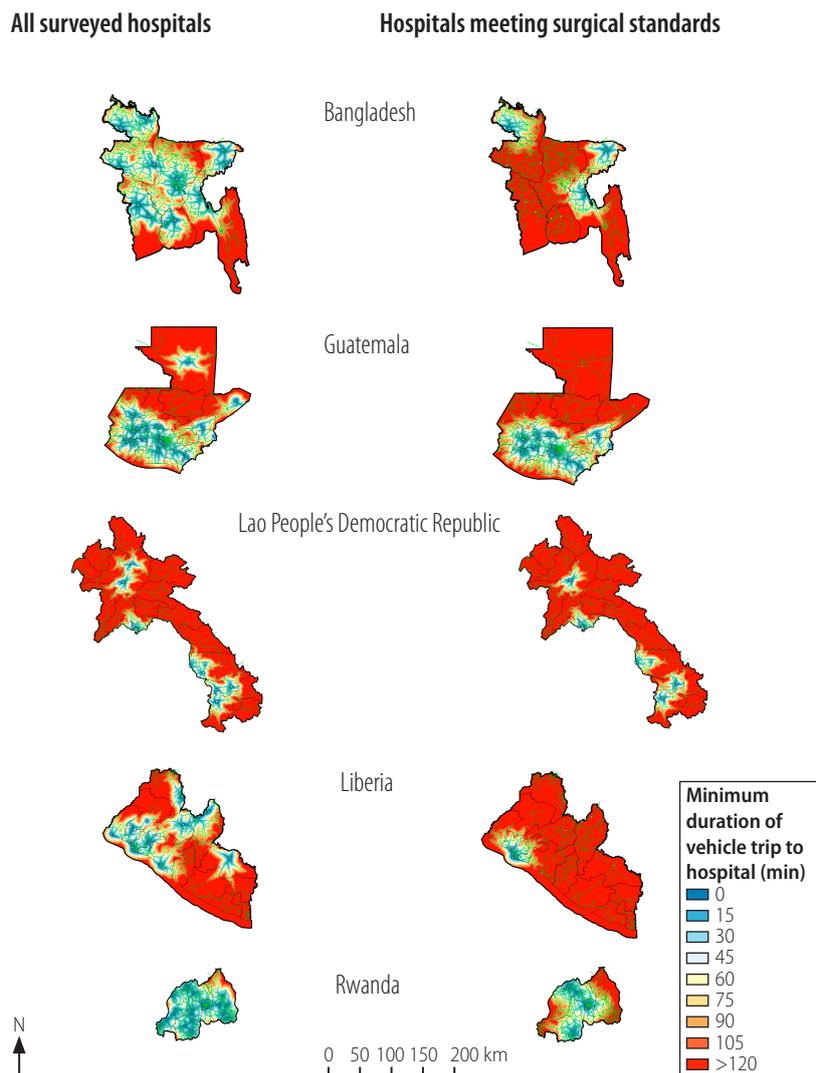
Liberia

We recorded large disparities in surgical coverage across Liberia. Overall, 12 hospitals were assessed, one of which was a referral centre in the capital region of Montserrado. Only two of the study hospitals – one of which was the referral centre – met all of our basic surgical standards. Of the other 10 study hospitals, 10 and seven lacked consistent supplies of water and electricity, respectively, and nine reported routine shortages in essential medications. In most of the study hospitals, all oxygen was provided by a concentrator that was not dedicated to the operating theatre.

Rwanda

The combined catchment population of the 21 district hospitals and four referral hospitals surveyed in Rwanda represented almost all (11.1 million people; 99.9%) of the estimated national population of 11.8 million people. Although only five of the 25 study hospitals – three district and two referral – met the basic surgical standards, the small size of the country meant that 10.6 million people – i.e. an estimated 95.8% of the national population – fell within the catchments of at least one of these hospitals. The other 20 study hospitals reported routine shortages of essential medications. Specialist surgeons and anaesthesiologists were concentrated in the referral hospitals and many general practitioners at district hospitals elected to send patients to the referral centres whenever possible.

Fig. 1. Estimated vehicle trip durations for attending any surveyed hospital or any surveyed hospital meeting basic surgical standards, Bangladesh, Guatemala, the Lao People's Democratic Republic, Liberia and Rwanda, 2010–2014



Notes: Areas shown in red were occupied by people who within 2 hours could probably not have reached a surveyed hospital (left column) or any surveyed hospital meeting basic surgical standards (right column). The estimated durations were based on road distances and estimates of typical vehicle speeds on the country's main and secondary roads. The criteria for a hospital to be deemed meeting basic surgical standards are presented in Box 1. Roads are shown in green. Source: Maps were generated through the computer program Redivis (Redivis Inc., Mountain View, USA), which uses OpenStreetMaps¹⁵ to populate its real-time maps.

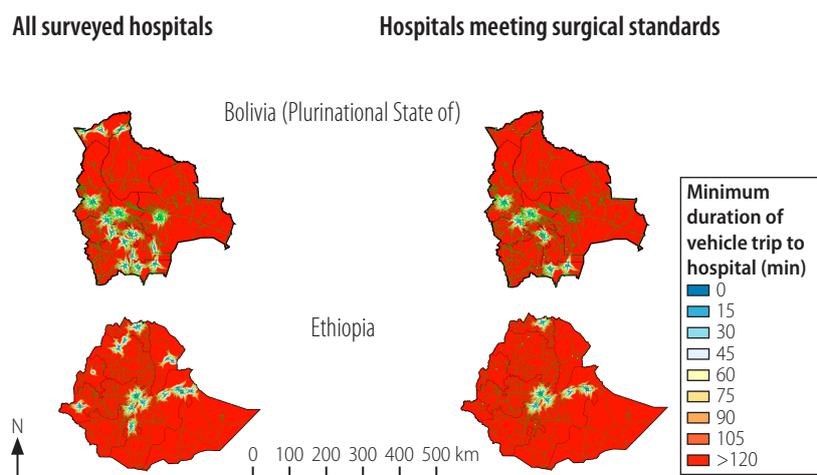
Discussion

We evaluated basic resources and infrastructure for emergency and essential surgical care at 120 hospitals in seven countries and noted that, despite all of these facilities providing surgical services, less than half met basic resource requirements. A median of about 2 million people in each study country lived in catchment areas of hospitals that appeared unable to provide reliable surgical services. In Bangladesh, 72.0 million people lived in such catchment areas. In the Lao People's Democratic

Republic and Rwanda, the impact of the inconsistent availability of surgical services appeared less because the small geographical size of the country meant that most patients could reach a facility with basic surgical resources within two hours. Our results also showed that inconsistent availability of resources even affected referral centres. In some countries there is, potentially, a sizable proportion of patients who are being referred to these larger regional sites only to be met with a similar lack in resources.

The paucity of surgical resources in low-income settings – whether equipment-related, infrastructural or personnel-related – is an ongoing crisis requiring attention. Inconsistencies in resource availability affect the ability to provide timely, high quality surgical care. WHO has attempted to define the specific minimum requirements for surgical care through its Global Initiative for Emergency and Essential Surgical Care programme.¹² Presumably, improved standards for surgical care would accompany improvements

Fig. 2. **Estimated vehicle trip durations for attending any surveyed hospital or any surveyed hospital meeting basic surgical standards, the Plurinational State of Bolivia and Ethiopia, 2011**



Notes: Areas shown in red were occupied by people who within 2 hours could probably not have reached a surveyed hospital (left column) or any surveyed hospital meeting basic surgical standards (right column). The estimated durations were based on road distances and estimates of typical vehicle speeds on the country's main and secondary roads. The criteria for a hospital to be deemed meeting basic surgical standards are presented in Box 1. Roads are shown in green.

Source: Maps were generated through the computer program Redivis (Redivis Inc., Mountain View, USA), which uses OpenStreetMaps¹⁹ to populate its real-time maps.

in infrastructure, qualified personnel and supplies. The ability to provide basic surgical services is dependent upon the simultaneous availability of multiple resources – coupled with strong management practices. Ample evidence exists that, in low- and middle-income countries, emergency and essential surgery is cost-effective and frequently needed.^{18,19}

The introduction of essential medications lists was pivotal in changing the patterns of patient and provider access to life-saving drugs.²⁰ Facilities providing emergency and essential surgery should have similar priority lists – of essential surgical provisions – that are supported by ministries and international organizations such as WHO. Such lists should lead to improved standards of patient monitoring – e.g. through the routine availability and use of pulse oximetry – and infection reduction – e.g. by improving access to antibiotics, clean water and sterilization processes. By establishing a list of the minimum surgical infrastructure, materials and other resources – and holding facilities and health systems accountable for the procurement and availability of the resources – the benchmark for surgical quality could be quickly raised. Although substantial investment would be required, it is likely that the improved delivery of surgical services would have a constructive impact on

numerous hospital-wide services beyond surgical activities.

Our study has several limitations. The country-specific data constituted only a sampling of facilities and should not be considered truly representative of all surgical sites in the countries studied. However, within each study country, we did attempt to include at least one surgical facility per county or district at district-hospital level or higher. Feasibility constraints, safety concerns and time constraints meant that we did not visit – or even list – every surgical site in each country.

We used geographical mapping and estimates of road distances and mean vehicle speeds on roads with typical levels of congestion to delineate the population that could reach a study hospital, by road, within two hours. We ignored breakdowns in transportation, seasonal variation in road conditions, specific referral patterns between local hospitals and socioeconomic barriers to seeking care. Our underrepresentation of the population that did not have the means to travel in a road vehicle or, at least, without a long wait for a bus or other public transport – and, therefore, our overestimation of general access to surgical resources – seems likely. However, the mapping software we used was able to discriminate between main roads and secondary roads and to provide estimated road speeds based

upon the probable congestion and quality of each type of road.

Data on surgical facilities are likely to become rapidly outdated: trained personnel relocate; unanticipated supply shortages occur; existing infrastructure may rapidly deteriorate; and new facilities may be built. Our data, which were collected over six years, are unlikely to reflect the current situation in any of our seven study countries. Most notably, the surgical system in Liberia was irrevocably altered by the effects of – and responses to – the 2013–2016 Ebola virus disease outbreak. A detailed, ongoing and regularly updated inventory of surgical facilities and resources in each country could be very useful.

We used geographical information systems to look at multiple hospitals providing surgery – as well as to examine the nuances in access to appropriate care as defined by basic surgical standards. If data collection were part of an ongoing evaluation process, such systems could help ministries of health target their efforts more effectively and evaluate improvements – or deterioration – over time.

In conclusion, the measurement of the quality of surgical care in resource-poor settings is a complex task. Analysis based on a set of minimum resource criteria for providing basic surgical care has emphasized the many gaps in surgical services in several resource-poor settings. In several of our study countries, many hospitals that, in theory,

were providing surgical coverage to their catchment population were unable to meet basic surgical standards consistently. Many people in our study countries may have poor access to centres for emergency or essential surgical care and – because of resource constraints – the surgical care available to them may not be safe or of high quality. ■

Funding: TGW was supported by the Stanford Clinical and Translational Science Award (CTSA) to Spectrum (UL1TR001085). The CTSA programme is led by the National Center for Advancing Translational Sciences at the United States National Institutes of Health. Salary support for MME was provided by a Stanford Hispanic Center of Excellence

Postdoctoral Fellowship. Additional sources of funding for collection of the data we analysed are listed in detail in previous country-specific publications.^{4-8,17}

Competing interests: None declared.

ملخص

تقييم جغرافي مكاني لإمكانية تلقي الرعاية الجراحية في الوقت المناسب في سبع دول

على الأقل، والمضاد الحيوي، ومسكن الألم، وجهاز عامل لقياس النبض، وجهاز عامل للتعقيم، والأكسجين، وأفراد الطاقم الطبي المعتمدين لإجراء العملية الجراحية والتخدير.

النتائج لم تنجح سوى 41 مستشفى (34.2%) من أصل 120 مستشفى خضعت الدراسة في استيفاء معايير توفير الخدمات الجراحية الأساسية المستمرة. اختلفت مناطق التغطية الخدمية المجمعة للمستشفيات المشمولة في الدراسة في كل دولة خضعت للدراسة بين 3.3 مليون شخص في ليبيريا و151.3 مليون شخص في بنغلاديش. ولكن التجمعات المشتركة للمستشفيات الخاضعة للدراسة في كل دولة خضعت للدراسة من وافقت معايير تقديم الخدمات الجراحية الأساسية المستمرة كانت أصغر بصورة ملحوظة وتراوح بين 1.3 مليون في ليبيريا و79.2 مليون في بنغلاديش.

الاستنتاج أظهرت العديد من المرافق الخاضعة للدراسة قصوراً في البنية التحتية الأساسية اللازمة لتوفير الرعاية الجراحية الأساسية بشكل مستمر.

الغرض تقييم التوافر المستمر للموارد الجراحية الأساسية في المرافق المحددة في سبع دول.

الطريقة في الفترة الممتدة ما بين عامي 2010 وحتى 2014، استخدمنا أداة تحليل ظرفية لجمع البيانات في المستشفيات الواقعة في الأحياء والمناطق في بنغلاديش (عدد = 14)، ودولة بوليفيا متعددة القوميات (عدد = 18)، وإثيوبيا (عدد = 19)، وغواتيمالا (عدد = 20)، وجمهورية لاو الديمقراطية الشعبية (عدد = 12)، وليبيريا (عدد = 12)، ورواندا (عدد = 25). تم تحديد مواقع المستشفيات باستخدام أسلوب أخذ العينات البراغماقي. وتم تشفير البيانات جغرافياً ثم تحليلها باستخدام منصة للعرض للبصري للبيانات على الإنترنت. وقد تم تحديد كل فئة سكانية خاضعة للتغطية الخدمية للمستشفى حسب الأشخاص الذين يمكنهم الوصول إلى المستشفى من خلال رحلة بالمرحلة لا تتعدى ساعتين. وتم اعتبار أن المستشفى لا تقدم التوافر المستمر للموارد الجراحية الأساسية إلا في حال التوفر الدائم للماء النظيف، والكهرباء، والأدوية الأساسية بما في ذلك السوائل الوريدية ومخدر واحد

摘要

对七个国家及时获得外科护理的地理空间评估

目的 旨在评估七个国家选定机构持续提供基本外科资源的能力。

方法 在 2010 年到 2014 年期间，我们使用情景分析工具收集了埃塞俄比亚 (n=19)、多民族玻利维亚 (n=18)、老挝人民民主共和国 (n=12)、利比里亚 (n=12)、卢旺达 (n=25)、孟加拉国 (n=14) 以及危地马拉 (n=20) 的地方和地区医疗机构的数据。我们通过务实的抽样方法选择医疗机构。然后使用一个在线数据可视化平台对数据进行地理编码和分析。我们将每家医院的服务范围人口定义为到达医院车程不超过 2 小时的人口。具有持续提供基本外科资源能力的医院被视为必须能够提供清洁用水、电力、必要的药

物 (包括静脉注射以及至少一种麻醉剂、止痛剂和抗生素)、功能齐全脉搏血氧计和灭菌剂、氧气以及执业外科手术医生和麻醉人员。

结果 在调查的 120 家医院中，仅 41 (34.2%) 家医院满足标准，能够提供持续的基本外科服务。每个调查对象医院的综合服务范围人口在 330 万 (利比里亚) 和 15,130 万 (孟加拉国) 之间变动。但是，符合提供持续基本外科服务的调查对象医院的综合服务范围人口显著更小，在 130 万 (利比里亚) 和 7,920 万 (孟加拉国) 之间变动。

结论 许多研究医疗机构在持续提供基本外科护理必要的基本设施方面存在不足。

Résumé

Évaluation géospatiale de l'accès en temps voulu aux soins chirurgicaux dans sept pays

Objectif Évaluer la disponibilité constante des ressources chirurgicales de base dans certains établissements de sept pays.

Méthodes En 2010–2014, nous avons utilisé un outil d'analyse de situation pour recueillir des données dans des hôpitaux régionaux et de district au Bangladesh (n=14), dans l'État plurinational de Bolivie (n=18), en Éthiopie (n=19), au Guatemala (n=20), au Liberia (n=12),

dans la République démocratique populaire lao (n=12) et au Rwanda (n=25). Les sites ont été sélectionnés par échantillonnage pragmatique. Les données ont été géocodées puis analysées à l'aide d'une plateforme de visualisation des données en ligne. La population desservie par chaque hôpital a été définie comme celle pouvant s'y rendre à bord d'un véhicule en deux heures maximum. Nous avons considéré qu'un

hôpital disposait en permanence des ressources chirurgicales de base si celui-ci avait toujours à disposition de l'eau claire, de l'électricité, des médicaments essentiels, notamment des solutions intraveineuses, et au moins un anesthésique, un analgésique, un antibiotique, un oxymètre de pouls fonctionnel, un stérilisateur fonctionnel, de l'oxygène et des prestataires accrédités pour effectuer des interventions chirurgicales et des anesthésies.

Résultats Seuls 41 (34,2%) des 120 hôpitaux analysés remplissaient les critères définissant une offre constante de services chirurgicaux de base. La population totale desservie par les hôpitaux analysés dans chaque

pays allait de 3,3 millions de personnes au Liberia à 151,3 millions de personnes au Bangladesh. Cependant, la population totale desservie par les hôpitaux analysés dans chaque pays et qui remplissaient les critères définissant une offre constante de services chirurgicaux de base était nettement inférieure, allant de 1,3 millions de personnes au Liberia à 79,2 millions de personnes au Bangladesh.

Conclusion De nombreux établissements analysés n'avaient pas les infrastructures élémentaires nécessaires pour offrir de façon constante des soins chirurgicaux de base.

Резюме

Геопространственная оценка своевременного доступа к хирургической помощи в семи странах

Цель Оценить постоянную доступность основных хирургических ресурсов в отдельных медицинских учреждениях в семи странах.

Методы В 2010–2014 годах мы использовали инструмент ситуационного анализа для сбора данных в районных и областных больницах в Бангладеш ($n = 14$), Боливии (Многонациональное государство) ($n = 18$), Гватемале ($n = 20$), Лаосской Народно-Демократической Республике ($n = 12$), Либерии ($n = 12$), Руанде ($n = 25$) и Эфиопии ($n = 19$). Участки больниц были выбраны в условиях реальной клинической практики. Данные были геокодированы, а затем проанализированы с помощью онлайн-платформы визуализации данных. Популяция, обслуживаемая в каждой больнице, была определена как количество людей, которые могли бы добраться до больницы на автомобиле в течение не более двух часов. Больница рассматривалась только на предмет постоянной доступности основных хирургических ресурсов, т. е. были ли постоянно доступны чистая вода, электричество, необходимые лекарства, включая препараты для внутривенного введения и по меньшей мере один анестетик, анальгетик и антибиотик, функциональный пульсоксиметр,

функциональный стерилизатор, кислород и медицинские работники, аккредитованные для проведения хирургических операций и анестезии.

Результаты Только 41 (34,2%) из 120 больниц, участвовавших в исследовании, отвечала критериям предоставления постоянных базовых хирургических услуг. Совокупные популяции, обслуживаемые исследуемыми больницами в каждой исследуемой стране, варьировались между 3,3 млн человек в Либерии и 151,3 млн человек в Бангладеш. Тем не менее совокупные популяции, обслуживаемые исследуемыми больницами в каждой исследуемой стране, которые соответствовали критериям предоставления постоянных базовых хирургических услуг, были существенно меньше и варьировались между 1,3 млн человек в Либерии и 79,2 млн человек в Бангладеш.

Вывод Многие из исследуемых медицинских учреждений испытывали недостаток в базовой инфраструктуре, необходимой для обеспечения базовой хирургической помощи на постоянной основе.

Resumen:

Una evaluación geoespacial del acceso oportuno a la atención quirúrgica en siete países

Objetivo Evaluar la disponibilidad coherente de recursos quirúrgicos básicos en centros seleccionados de siete países.

Métodos En 2010–2014, se utilizó una herramienta de análisis situacional para recopilar datos en hospitales de distrito y regionales de Bangladesh ($n = 14$), el Estado Plurinacional de Bolivia ($n = 18$), Etiopía ($n = 19$), Guatemala ($n = 20$), la República Democrática Popular Lao ($n = 12$), Liberia ($n = 12$) y Rwanda ($n = 25$). Los hospitales se seleccionaron según un muestreo pragmático. Los datos se geocodificaron y posteriormente se analizaron utilizando una plataforma de visualización de datos en línea. La población beneficiaria de cada hospital se definió como aquellas personas que podían llegar al hospital con un viaje en vehículo de dos horas como máximo. Solo se consideraba que un hospital mostraba una disponibilidad coherente de recursos quirúrgicos básicos si contaba en todo momento con agua potable, electricidad, medicamentos esenciales, incluidos fluidos intravenosos

y, al menos, un anestésico, un analgésico y un antibiótico, un oxímetro de pulso funcional, un esterilizador funcional, oxígeno y proveedores acreditados para realizar cirugía y administrar anestesia.

Resultados Únicamente 41 (34,2%) de los 120 hospitales del estudio cumplieron con los requisitos de suministro constante de servicios quirúrgicos básicos. Los beneficiarios combinados de los hospitales del estudio en cada país de estudio oscilaron entre 3,3 millones de personas en Liberia y 151,3 millones de personas en Bangladesh. Sin embargo, los beneficiarios combinados de los hospitales del estudio en cada país de estudio que cumplieron los criterios de suministro constante de servicios quirúrgicos básicos fueron mucho menores y oscilaron entre 1,3 millones en Liberia y 79,2 millones en Bangladesh.

Conclusión Muchos de los centros del estudio carecían de la infraestructura básica necesaria para suministrar atención quirúrgica básica de forma coherente.

References

1. Ng-Kamstra JS, Dare AJ, Patra J, Fu SH, Rodríguez PS, Hsiao M, et al.; Million Death Study Collaborators. Deaths from acute abdominal conditions and geographic access to surgical care in India: a nationally representative population-based spatial analysis. *Lancet*. 2015 Apr 27;385 Suppl 2:S32. doi: [http://dx.doi.org/10.1016/S0140-6736\(15\)60827-3](http://dx.doi.org/10.1016/S0140-6736(15)60827-3) PMID: 26313080
2. Mock CN, Donkor P, Gawande A, Jamison DT, Kruk ME, Debas HT, et al. Essential surgery: key messages from Disease Control Priorities, 3rd edition. *Lancet*. 2015 May 30;385(9983):2209–19. doi: [http://dx.doi.org/10.1016/S0140-6736\(15\)60091-5](http://dx.doi.org/10.1016/S0140-6736(15)60091-5) PMID: 25662414

3. Meara JG, Leather AJ, Hagander L, Alkire BC, Alonso N, Ameh EA, et al. Global surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Surgery*. 2015 Jul;158(1):3–6. doi: <http://dx.doi.org/10.1016/j.surg.2015.04.011> PMID: 25987187
4. Knowlton LM, Chackungal S, Dahn B, LeBrun D, Nickerson J, McQueen K. Liberian surgical and anesthesia infrastructure: a survey of county hospitals. *World J Surg*. 2013 Apr;37(4):721–9. doi: <http://dx.doi.org/10.1007/s00268-013-1903-2> PMID: 23404484
5. LeBrun DG, Dhar D, Sarkar MI, Imran TM, Kazi SN, McQueen KA. Measuring global surgical disparities: a survey of surgical and anesthesia infrastructure in Bangladesh. *World J Surg*. 2013 Jan;37(1):24–31. doi: <http://dx.doi.org/10.1007/s00268-012-1806-7> PMID: 23052803
6. Notrica MR, Evans FM, Knowlton LM, Kelly McQueen KA. Rwandan surgical and anesthesia infrastructure: a survey of district hospitals. *World J Surg*. 2011 Aug;35(8):1770–80. doi: <http://dx.doi.org/10.1007/s00268-011-1125-4> PMID: 21562869
7. Merchant A, Hendel S, Shockley R, Schlesinger J, Vansell H, McQueen K. Evaluating progress in the global surgical crisis: contrasting access to emergency and essential surgery and safe anesthesia around the world. *World J Surg*. 2015 Nov;39(11):2630–5. doi: <http://dx.doi.org/10.1007/s00268-015-3179-1> PMID: 26246114
8. Chao TE, Burdic M, Ganjawalla K, Derbew M, Keshian C, Meara J, et al. Survey of surgery and anesthesia infrastructure in Ethiopia. *World J Surg*. 2012 Nov;36(11):2545–53. doi: <http://dx.doi.org/10.1007/s00268-012-1729-3> PMID: 22851147
9. Resolution A/RES/70/1. Transforming our world: the 2030 agenda for sustainable development. In: Seventieth United Nations General Assembly, New York, 25 September 2015. New York: United Nations; 2015. Available from: http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E [cited 2016 Apr 15].
10. Uribe-Leitz T, Jaramillo J, Maurer L, Fu R, Esquivel MM, Gawande AA, et al. Variability in mortality following caesarean delivery, appendectomy, and groin hernia repair in low-income and middle-income countries: a systematic review and analysis of published data. *Lancet Glob Health*. 2016 Mar;4(3):e165–74. doi: [http://dx.doi.org/10.1016/S2214-109X\(15\)00320-4](http://dx.doi.org/10.1016/S2214-109X(15)00320-4) PMID: 26916818
11. Surgical care at the district hospital. Geneva: World Health Organization; 2003. Available from: <http://www.who.int/surgery/publications/en/SCDH.pdf>. [cited 2016 Feb 20].
12. World Health Organization Global Initiative for Emergency and Essential Surgical Care. Geneva: World Health Organization. Available from: <http://www.who.int/surgery/globalinitiative/en/> [cited 2016 April 12].
13. LeBrun DG, Chackungal S, Chao TE, Knowlton LM, Linden AF, Notrica MR, et al. Prioritizing essential surgery and safe anesthesia for the Post-2015 Development Agenda: operative capacities of 78 district hospitals in 7 low- and middle-income countries. *Surgery*. 2014 Mar;155(3):365–73. doi: <http://dx.doi.org/10.1016/j.surg.2013.10.008> PMID: 24439745
14. WorldPop [Internet]. Southampton: World Pop; 2016. Available from: <http://www.worldpop.org.uk/> [cited 2016 Oct 5].
15. OpenStreetMap [Internet]. Sutton Coldfield: OpenStreetMap Foundation; 2016. Available from: <https://www.openstreetmap.org/> [cited 2016 Oct 5].
16. Population, total [Internet]. Washington: World Bank; 2014. Available from: <http://data.worldbank.org/indicator/SP.POP.TOTL> [cited 2015 Jun 18].
17. LeBrun DG, Saavedra-Pozo I, Agreda-Flores F, Burdic ML, Notrica MR, McQueen KA. Surgical and anesthesia capacity in Bolivian public hospitals: results from a national hospital survey. *World J Surg*. 2012 Nov;36(11):2559–66. doi: <http://dx.doi.org/10.1007/s00268-012-1722-x> PMID: 22864566
18. Shillcutt SD, Clarke MG, Kingsnorth AN. Cost-effectiveness of groin hernia surgery in the Western Region of Ghana. *Arch Surg*. 2010 Oct;145(10):954–61. doi: <http://dx.doi.org/10.1001/archsurg.2010.208> PMID: 20956763
19. Weiser TG, Haynes AB, Molina G, Lipsitz SR, Esquivel MM, Uribe-Leitz T, et al. Estimate of the global volume of surgery in 2012: an assessment supporting improved health outcomes. *Lancet*. 2015 Apr 27;385 Suppl 2:S11. doi: [http://dx.doi.org/10.1016/S0140-6736\(15\)60806-6](http://dx.doi.org/10.1016/S0140-6736(15)60806-6) PMID: 26313057
20. Laing R, Waning B, Gray A, Ford N, 't Hoen E. 25 years of the WHO essential medicines lists: progress and challenges. *Lancet*. 2003 May 17;361(9370):1723–9. doi: [http://dx.doi.org/10.1016/S0140-6736\(03\)13375-2](http://dx.doi.org/10.1016/S0140-6736(03)13375-2) PMID: 12767751

Systematic Review of Barriers to Surgical Care in Low-Income and Middle-Income Countries

Caris E. Grimes · Kendra G. Bowman ·
Christopher M. Dodgion · Christopher B. D. Lavy

Published online: 1 March 2011
© Société Internationale de Chirurgie 2011

Abstract

Background There is increasing evidence that lack of facilities, equipment, and expertise in district hospitals across many low- and middle-income countries constitutes a major barrier to accessing surgical care. However, what is less clear, is the extent to which people perceive barriers when trying to access surgical care.

Methods PubMed and EMBASE were searched using key words (“access” and “surgery,” “barrier” and “surgery,” “barrier” and “access”), MeSH headings (“health services availability,” “developing countries,” “rural population”), and the subject heading “health care access.” Articles were included if they were qualitative and applied to illnesses where the treatment is primarily surgical.

Results Key barriers included difficulty accessing surgical services due to distance, poor roads, and lack of suitable transport; lack of local resources and expertise; direct and indirect costs related to surgical care; and fear of undergoing surgery and anesthesia.

Conclusions The significance of cultural, financial, and structural barriers pertinent to surgery and their role in wider health care issues are discussed. Immediate action to

improve financial and geographic accessibility along with investment in district hospitals is likely to make a significant impact on overcoming access and barrier issues. Further research is needed to identify issues that need to be addressed to close the gap between the care needed and that provided.

Introduction

The exact burden of surgical disease in low- and middle-income countries (LMICs) is unknown but is thought to be high, and there is a large discrepancy between the care needed and that provided. The second edition of *Disease Control Priorities in Developing Countries* estimated that 11% of the global burden of disease can be treated with surgery. This 11% is comprised of an estimated 38% injuries, 19% malignancies, 9% congenital abnormalities, 6% pregnancy complications, and 5% cataracts [1]. Of an estimated 234.2 million major surgical procedures performed worldwide each year, 30% of the world’s population undergo 73.6% of these procedures, with the poorest third undergoing only 3.5% [2], demonstrating the enormous unmet need in developing countries. Reasons for this are multifaceted. A series of barriers exist that limit the successful provision of surgical care in LMICs.

There is substantial evidence that one of the main barriers to care for surgical conditions is a lack of facilities, equipment, and expertise in district hospitals as well as a lack of anesthesia and critical care provision. Government corruption and poor health system infrastructure are also significant factors in most LMICs [3–7]. However, provision of surgical services in district hospitals, even at low cost, may not be enough to ensure that those who need surgical care are able to obtain it.

C. E. Grimes (✉)
Department of General Surgery, Epsom & St. Helier Hospitals
NHS Trust, Wrythe Lane, Carshalton, Surrey SM5 1AA, UK
e-mail: carisgrimes@doctors.org.uk

K. G. Bowman · C. M. Dodgion
Department of Surgery, Center for Surgery and Public Health,
Brigham and Women’s Hospital, Boston, MA 02115, USA

C. B. D. Lavy
Department of Orthopaedic Surgery, Nuffield Department
of Orthopaedic Surgery, John Radcliffe Hospital, University
of Oxford, Windmill Road, Oxford OX3 7LD, UK

An initial look at the literature showed that there were many barriers common to all health specialties (Tables 1, 2) [8–25] but that there were some that were more pertinent to surgical specialties. Therefore, the objective of this study was to determine those barriers that apply to surgical diseases, with a view to informing further research and resource allocation in this field.

Materials and methods

A literature search was performed to identify primary qualitative studies (interviews and focus groups) of barriers to surgery. PubMed and EMBASE were searched using key words (“access” and “surgery,” “barrier” and “surgery,” “barrier” and “access”), MeSH headings (“health services availability,” “developing countries,” “rural population”), and the subject heading “health care access.” The “related articles” algorithm was used to identify other suitable articles and the references within each article, which were also reviewed to obtain further data. Articles were included if they were qualitative studies (focus groups and/or interviews) that looked at barriers to use of health care facilities in low- and middle-income economies. Articles were excluded if they were not qualitative, looked at governmental policy, or were not conducted in an LMIC. All abstracts were then reviewed, and those that applied to illnesses where the treatment is primarily surgical or that may have data relating to surgical conditions were included. The others were excluded. Full papers were then

obtained and assessed as to whether they fit the inclusion criteria. If they did, the results were analyzed.

No universally acceptable and applicable categorization scheme exists for classifying barriers to care, although a number of articles have attempted to describe categorization strategies. Obrist et al. [26] categorized barriers to accessing health care in poor countries into five dimensions: availability, accessibility, affordability, adequacy, acceptability. Peters et al. [27] categorized them into four dimensions: geographic accessibility, availability, financial accessibility, acceptability. McIntyre et al. [28] used three dimensions: availability, affordability, acceptability. We found that our barriers easily fell into three categories, which we called social/cultural, financial, and structural. These fit closely with those of McIntyre et al., with structural (availability) referring primarily to the location of health care facilities and the ability and willingness of the health services to provide for the needs of the population; financial (affordability) referring to the direct and indirect costs associated with accessing health care; and social/cultural (acceptability) referring to patient beliefs, perceptions, and expectations.

Results

Study selection

A total of 179 articles were initially identified, 52 of which were included in the final analysis (Table 3). During the

Table 1 Reviews: barriers common across health specialties

Study	Date	Subject
Campbell et al. [8]	2006	Barriers to fertility regulation
Filippi et al [9]	2009	Barriers to medical help during obstetric difficulties
Gabrysch and Campbell [10]	2009	Use of delivery services
Kiwanuka et al. [11]	2008	Access to health care in Uganda
Lewallen and Courtright [12]	2002	Use of cataract services
Maslove et al. [13]	2009	Barriers to effective treatment and prevention of malaria
Mills et al. [14]	2005	Common barriers to childhood vaccination
O'Donnell [15]	2007	Barriers to health care in developing countries
Ojanuga and Gilbert [16]	1992	Women's access to health care
Posse et al. [17]	2008	Barriers to accessing antiretroviral treatment
Puentes-Markides [18]	1992	Women's access to health care
Ravishankar [19]	2004	Barriers to accessing treatment for headache in India
Rutherford et al. [20]	2010	Access to health care in mortality of under-fives in sub-Saharan Africa
Say and Raine [21]	2007	Use of maternal health care
Simkhada et al. [22]	2008	Use of antenatal care
Thaddeus and Maine [23]	1994	Accessing health care during obstetric complications
Thomas [24]	2002	Delayed presentation of tuberculosis
Yorston [25]	2005	Cataract surgery

Table 2 Barriers common across health specialties

Dimension and barrier	References
Cultural (acceptability)	
Perceived severity of symptoms/need for intervention	[8, 9, 12, 14, 19, 22, 23]
Influence of other family members on decision-making	[9, 16, 17, 20]
Education, knowledge, awareness, and information	[8, 10, 12–22, 24, 25]
Perceived quality of care available	[9–11, 23]
Lack of time, family/work constraints	[11, 12, 14, 17, 20, 22]
Preference for traditional remedies	[13–15]
Fear of treatments and side effects or distrust of medical community	[8, 11, 14, 17, 21]
Social status	[8, 15, 16, 20, 22]
Social/family support	[8, 9, 17, 20, 22]
Religion and cultural beliefs and explanations	[10, 11, 14, 16, 18, 22, 24]
Financial (affordability)	
Cost of transport	[12, 15, 17]
Loss of income	[12, 15, 17]
Living expenses for carer	[12]
Cost of treatment and related services	[8, 10, 13, 15, 17, 20, 22–25]
Occupation of main wage earner and economic status of person seeking health care	[10, 18, 19, 21, 22]
Lack of income	[15, 17, 23]
Food costs	[17]
Structural (accessability)	
Distance to health facility	[8–14, 16, 18, 20, 22–25]
Lack of transport	[9, 10, 14–16]
Lack of facilities to treat patient	[9, 11, 16, 18, 22, 23, 25]
Lack of providers/health professionals	[9, 11, 15, 16, 23]
Lack of training of health professionals/failure to recognize need to refer/late referrals/inappropriate treatment	[9, 11, 18, 19, 24]
Poor roads	[10, 15]
Rural areas	[10, 12, 21]
Poor quality of services	[11, 15, 19]
Lack of drugs/equipment	[11, 16, 17, 19, 23]
Health worker attitude/poor quality care/poor communication	[8, 11, 14]
Waiting times	[11, 14]
Facility opening hours/irregular opening and closing hours	[14, 15]
Lack of sustainable long-term treatment/regular care	[17]
Lack of coordination among health institutions	[18]
Administrative delay	[23]
Convenience	[8, 24]

review of abstracts, 55 articles were excluded because they did not address diseases where the treatment is primarily surgical: tuberculosis, human immunodeficiency virus (HIV), malaria, vaccination, contraceptives, diabetes, epilepsy, sexually transmitted diseases, and hepatitis). Four articles were not in English. During the review of the full-text articles, 57 articles were excluded because they did not address barriers to care or did not contain data addressing surgical care. It was not possible to access the full text of 11 articles.

Of the 52 studies included, 28 evaluated barriers to ophthalmology services, including cataract surgery, glaucoma, and trichiasis; 16 studies looked at barriers to aspects of obstetric and gynaecologic care, including abortion, obstetric care, delivery, and postnatal care; 3 studies addressed barriers to care following injury; 1 addressed barriers to breast cancer treatment; 1 one to burns; 1 to emergency care; 1 to tubal ligation; and 1 to vasectomy. In all, 51 of the 52 studies used qualitative methods to determine barriers to care from service users.

Table 3 Study outline

Parameter	No.
Additional records identified through other sources	14
Abstracts identified through database searching	185
Records after duplicates removed	179
Records excluded	59
Not in English	4
Not surgical	55
Tuberculosis	19
HIV	17
Malaria	5
Vaccination	4
Contraceptives/reproductive health	3
Diabetes	1
Epilepsy	1
STD	2
Hepatitis	1
Childhood health	1
Antenatal care	1
Full text articles assessed for eligibility	120
Records excluded	68
Did not meet inclusion criteria	57
No access to full text	11
Studies included in final analysis	52

HIV human immunodeficiency virus, *STD* sexually transmitted disease

One study looked at the perception of health care providers regarding barriers to providing emergency care (Table 4) [29–80].

Barriers to surgical care

Cultural barriers

Many of the barriers listed are more pertinent, although not exclusive, to surgical disciplines (Table 5). They include fear of undergoing surgery, fear of having an anesthetic, and fear of bad outcomes as a result of surgery. For example, Athanasiov et al. found that 9.2% of patients with cataracts in Myanmar were frightened of surgery or complications such as loss of sight or life [29]. Other studies found that 19.2% and 12.3% of cataract patients, respectively, in India admitted to fear of surgery [32, 46], 15% in Nigeria [39] and 33% in Nepal [45]. Interestingly, when “eye operation/surgery” was replaced by “washing of the cataract” or “cloud,” uptake of surgery for cataracts increased [41], showing that uptake of surgical services is affected by the way information is presented.

In many cultures, family and social support networks play an important role in health care decisions. Several

studies of childbirth suggested that it is usually a member of the family, rather than the patient, who decides if and when a woman is transferred to a health care facility (the “decision-maker”) [57–59, 63, 65, 68, 71]. In addition, family attitudes play an important part in deciding whether people with illness receive treatment for such diseases as breast cancer [76] or cataract surgery [33, 43, 53]. Family and social support networks are also needed to raise funds for surgery and other costs associated with the inpatient stay, cover household responsibilities during the absence, and provide an escort. In some studies, lack of an escort was found to be a more important factor in preventing access of health services than fear [36, 37, 46].

Cultural beliefs surrounding specific surgical conditions and their treatment have a direct effect on the likelihood of people seeking standard medical care. For example, a belief that blindness caused by cataracts is “God’s will” or is due to witchcraft/sorcery and is therefore incurable prevents attendance for surgery [31]. In some cultures, childbirth is seen as a natural event, and a difficult birth carries the stigma of the woman having a defective body [65] or is thought to be the result of infidelity or an extramarital affair [68, 71]. As a consequence, women are discouraged from seeking formal health care.

Financial barriers

Many studies found that financial concern was one of the most significant barriers preventing access to care. For example, Gyasi et al. found that the cost of cataract surgery in Ghana was the most important barrier, cited by 91% of patients [35], and cost was also cited as the most important barrier in 76% of Pakistani cataract patients [36]. Mills et al. found that women who knew delivery care was free of charge were 4.6 times more likely to seek professional health care [69].

Financial barriers to care included both direct and indirect costs. Direct costs are those directly related to care, such as surgical fees, drugs, supplies (e.g., syringes and bandages), laboratory tests, transport, stay at hospital, and food and drink. Indirect costs are the costs accumulated because of the sickness or absence of the patient. Indirect costs identified in this study included the loss of income/wages [31, 45, 51, 52, 61] and costs of bringing a caregiver [71]. The financial burden associated with surgery can be tremendous. For example, on interviewing people in Kenya who had survived road traffic accidents and made it to hospital, Macharia et al. [74] found the following.

Seven (14.6%) of 48 health facilities demanded cash deposits or letters of guarantee of payment before providing treatment.... While most seriously ill patients who could not afford to pay were granted

Table 4 Studies included: barriers to surgery

Subject	Studies
Ophthalmology: cataracts/glaucoma, trichiasis, eye services	Athanasiov et al. [29]; Briesen et al. [30]; Bronsard et al. [31]; Chandrashekar [32]; Geneau et al. [33]; Geneau et al. [34]; Gyasi et al. [35]; Jadoon et al. [36]; Johnson et al. [37]; Kessy and Lewellan [38]; Mpyet et al. [39]; Mwendu et al. [40]; Ojabo and Alao [41]; Rabiou [42]; Rotchford et al. [43]; Shrestha et al. [44]; Snellingen et al. [45]; Vaidyanathan et al. [46]; Yin et al. [47]; Zhang et al. [48]; Amansakhatov [49]; Melese et al. [50]; Lee et al. [51]; du Toit et al. [52]; Bowman et al. [53]; Mahande et al. [54]; Nagpal et al. [55]; Oliva et al. [56]
Obstetrics and gynecology: antenatal care, obstetric care, delivery, postnatal care, abortion	Bhuiya et al. [57]; Iyengar et al. [58]; Telfer et al. [59]; Gage et al. [60]; Kowalewski et al. [61]; Mahabub-Ul-Anwar et al. [62]; Parkhurst et al. [63]; Urassa et al. [64]; Afsana and Rashid [65]; Afsana et al. [66]; Hasan and Nisar [67]; Mills and Bertrand [68]; Mills et al. [69]; Pembe et al. [70]; Seljeskog et al. [71]; Dhakal et al. [72]
Injury	Hang and Byass [73]; Macharia et al. [74]; Mock et al. [75]
Breast cancer	Dye et al. [76]
Burns	Forjough et al. [77]
Emergency care	Levine et al. [78]
Tubal ligation and vasectomy	Witwer [79]; Bunce et al. [80]

waivers in public and some faith-based hospitals, private facilities always demanded signing of binding agreements and securities. Out of 197 of the respondents, 44 (22.3%) owed the hospitals more than of US \$133. However, only 19.7% of all those interviewed were in a position to pay the bills while 58.7% indicated that they would approach relatives and friends for financial assistance.

Often, visits to district and tertiary level hospitals have to be deferred until people have accumulated enough money by saving, borrowing, and selling [61], which partly explains why local, less expensive traditional healers and traditional methods are often tried in all sorts of situations before resorting to more expensive, and often more remote, formal health care.

Structural barriers

A number of structural factors contribute to the difficulty and delay in accessing surgical services. The equipment, infrastructure, and expertise needed to perform surgery mean that frequently surgical services are not available locally, and there is often a significant distance to the nearest facility with adequate facilities [e.g., 31, 32, 35, 39–41, 52, 57, 60, 62–64, 68]. The ability of primary care providers to diagnose and refer patients who needed further surgical intervention was also a problem [58, 64, 76]. Primary health centers were not usually equipped to

provide specialist intervention, and treatment at district hospitals could also be problematic. For example, Afsana found that although district hospitals had the facilities for comprehensive obstetric care the lack of trained doctors on site meant that the woman referred was often addressed by an untrained female attendant. Ironically, by referring women to a district hospital, health centers were actually placing vulnerable patients with an obstetric emergency in an even more dangerous situation [66]. Poor communication between the various tiers of health care compounded the delay in care [71]. There was also a lack of suitable transport for patients to, and between, health care facilities. For example, Levine et al. found that lack of transportation from a health center to a referral hospital meant that 63% of patients had to travel more than 10 km, and 38% more than 20 km, to receive appropriate emergency care, with only a small number having access to motorized transport [78].

Relative importance of the various barriers

It can be difficult to tease out the relative importance of the various barriers, partly because many of them are inter-linked and partly because there is bias in such qualitative studies. For example, Kessy and Lewallen [38] noted:

[A] significant proportion of patients with cataract will tell health workers that the cost of surgery is too much for them when, in fact, there are other significant reasons they do not want surgery. This is

Table 5 Barriers to surgery

Barrier	References
Cultural (acceptability)	
Fear of surgery/anesthetic and complications/rumors of bad outcomes	[29–32, 34–39, 41, 43, 45, 46, 51–53, 55, 65, 79]
Lack of family/social support	[29–31, 34, 43, 44, 53, 55–60, 63–65, 68, 71, 76, 79, 80]
Lack of time	[29, 45, 46, 52, 53]
No one to accompany	[32, 35–37, 42, 45, 46, 53, 55, 56, 60]
Role of decision makers	[31, 34, 57, 59, 63, 65, 71, 80]
Social role (e.g., as beggars)	[41]
Too old for surgery	[41, 42, 49]
Acceptance of potentially correctable condition/no perceived need	[29, 32, 34, 35, 37, 39, 42–44, 46, 49, 51–54, 56, 58, 72]
Lack of understanding of severity of condition/unaware of danger signs	[58, 59, 64, 67, 70, 71, 73, 75, 77]
Cultural beliefs surrounding specific surgical conditions/use of traditional healers	[31, 35, 37, 41, 53, 57, 64, 65, 68, 71, 72, 75, 76, 79]
Lack of information/understanding of disease process, surgical procedures, and aftercare	[35–37, 41, 43, 44, 46–48, 51–53, 55–57, 59, 60, 63, 67, 71, 76, 77, 79]
Financial (affordability)	
Direct cost: surgical and inpatient fees, transport, food, clothes, accommodation for caregiver, emergency care, informal payments	[29, 31–39, 41–48, 50–53, 55–66, 68, 69, 71, 72, 74–76, 79]
Indirect costs: loss of earnings during surgery and recovery	[31, 32, 45, 51, 71];
Structural (accessibility)	
Delayed diagnosis/decision to transfer	[31, 58, 64, 76]
Distance to nearest treatment facility/service not available locally/poor quality of service	[31, 32, 35, 39–42, 47, 50, 52, 55, 57, 58, 60, 62, 64, 65, 68, 69, 71, 73, 75–80]
Lack of infrastructure: theaters, equipment, drugs, blood, laboratory equipment, radiography equipment	[41, 54, 57, 64, 65, 71, 74, 78]
Lack of staff or knowledge/training of staff	[46, 54, 58, 60, 64, 72, 76]
Lack of appropriate transport to health facility and between health facilities	[37, 47, 50, 52, 53, 56, 59, 66, 68, 69, 72, 74, 75, 78]
Poor roads	[41, 59, 62, 64, 71, 72]
Poor communication between local and referral hospitals/difficulty navigating health care system to receive appropriate treatment	[65, 71, 76]

demonstrated by the fact that 12/27 (44.4%) of patients who told health workers that they were too poor to pay for surgery gave additional reasons when they were interviewed at home by someone who was not from the health service, and 7 of these clearly indicated unwillingness to have surgery at any price. Furthermore, only 6/26 (23%) of patients given waivers for free surgery during the interviews elected to use these after 10 months. We believe that “lack of money” serves as a convenient and acceptable explanation that will not be challenged by health workers.

“Lack of time” also competes with lack of money as a barrier cited in some articles as to why patients are not able to have surgery, and this was tied in with occupations such as farming and fishing [52] and harvesting and planting [45]. As Kowalewski et al. wrote: “Time costs consistently exceed financial costs” [61].

Finally, although financial constraints were prominent in many of the studies reviewed, people still did not seek care when services were offered free of charge. For example, when cataract surgery was so offered and those who turned down surgery were interviewed, other barriers prevented uptake, such as lack of someone to accompany them, no desire for surgery despite significant symptoms, and having children to look after [56].

In particular, cultural factors may be underappreciated as barriers to care. For example, poor communication between health care staff and patients has been shown to be a major barrier to effective referral to district hospitals from health centers, a barrier that would not be solved by dealing with access and cost issues [81]. This suggests that affordable and accessible health care is necessary but not sufficient for overcoming barriers to care and that cultural barriers may play a decisive role in whether care is sought.

Discussion

We have attempted to summarize the main barriers to receiving care and distinguish between those that are common to many medical disciplines and those pertinent to surgical disciplines. We identified three broad categories of barriers: structural aspects of health care, cultural beliefs and attitudes, and financial barriers.

The structural barriers most commonly identified were lack of facilities or facilities that were inaccessible. Cultural barriers included a family role in decision making that was influenced by adverse attitudes and beliefs about available care. The most frequently identified financial barriers were the cost of care and the indirect costs related to lost opportunity for work, finding a caretaker for their children, and the cost of bringing a caretaker with them. Collectively, these demonstrate the multiple dimensions of delivery and obtaining health care in low-resource settings.

This systematic review was not designed specifically to look at interventions that have been attempted to overcome barriers to surgical care. However, based on the

information gained from the articles reviewed, a number of recommendations can be put forward (Table 6). They include public education about the *availability* of surgical care, such as burn, trauma and obstetric care; education about the *benefits* in seeking care, such as an attended birth and timely posttrauma care; and education about *preventing* burn and trauma and obstetric emergencies.

Overcoming issues of cost is not straightforward. Ridde et al., in a recent systematic review, showed that the abolition of user fees in Africa generally has a positive effect on service use [82]. Such policies can be difficult to implement and tailor to the health service due to limited financial resources, poor communication and poor health infrastructure. However, upfront costs for emergency care must be eradicated, and costs of elective care need to be subsidized simply because the current costs are prohibitive for most individuals/patients. Transport must be available and affordable, and road infrastructure needs to be improved. Malhotra and coworkers confirmed that providing transport for patients needing cataract surgery increased uptake, and similar facilitated transportation

Table 6 Recommended solutions

Dimension/solution	References
Cultural (acceptability)	
Educational programs/improved awareness at both community and household level of available services, preventive practices, signs/symptoms, and benefits of early intervention	[29–33, 35, 37, 39, 40, 48, 49, 51, 52, 54–56, 59, 60, 62, 67, 70, 72, 77, 79, 80, 87, 88, 90]
Involvement of family and local community in decision making	[30, 34]
Financial (affordability)	
Subsidization of elective care	[29, 33, 38, 69, 73]
Eradication of up-front costs for emergency care	[58, 74]
Encourage families to have an emergency plan in place that includes cash for transport	[59]
Rural health insurance	[65]
Organize free travel for elective surgery/attended delivery	[50, 83, 88]
Provision of patient escort	[51]
Structural (accessibility)	
Reforms to local health service/reorganization of service delivery	[29, 61]
Improved training of health workers	[31, 64, 65, 78, 81]
Expansion of outreach services and screening programs	[35, 48, 50, 85]
Good surgical outcomes	[30, 39]
Use of traditional healers as referrers/training of traditional birth attendants	[39, 59]
Improved collaboration between services	[39]
Clear protocols for management and referral of emergencies	[64]
Provision of necessary resources and supplies	[64–66]
Eradication of corruption in the form of under-the-table payments	[66]
Streamline and standardize referral process for cancer care	[76, 89]
Improve travel infrastructure	[85]
Decrease intake criteria	[49]
Regular audits of outcomes and retraining where necessary	[53]

programs for other elective surgery would be a rational intervention where travel is a significant barrier to obtaining surgical care [85]. For urgent surgical care, an ambulance service would be valuable, as delayed transport or lack of early medical intervention is detrimental in several settings, particularly for obstetric care.

The referral system must be streamlined and standardized, and health care workers require further education on both the clinical criteria for referral and the administrative process. Greater resources must be allocated to maintain and expand current providers' skill sets and to develop quality improvement programs. Finally, it is essential that a sustainable supply chain be established. Functioning facilities often lack basic supplies and cannot deliver surgical care [e.g., 74]. A reliable supply chain system would immediately improve the function of available facilities.

The barriers to surgical care identified in our review are multifactorial, and their solutions are equally complex and interdependent. Providing and improving surgical access in LMICs require a concerted effort by all involved in the health care delivery system.

It should be recognized that surgical disciplines are themselves highly diverse, and factors that may apply to one discipline may not apply to others. In addition, chronic conditions present a set of problems that are different from those associated with acute conditions, and life-threatening conditions present a set of problems different from those that arise during day-to-day living.

One of the problems we have encountered is that the current available literature is dominated by studies looking at barriers to treatment for eye conditions, particularly cataract surgery, and those related to maternal and obstetric conditions. Few articles address other surgical conditions, including hernias, obstetric fistulas, trauma, musculoskeletal disorders, burns, cleft lip and palate, cancer, and acute abdominal conditions, among others; and there are different sets of barriers related to each.

Another limitation of this study is that all but one of the studies included here questioned the service users about the barriers they perceived. Only one studied the barriers perceived by health practitioners in providing adequate care [78]. Of note, most of the studies were conducted in rural rather than urban areas; this is probably because rural populations are less likely to have access to health care [75].

Quantitative studies were excluded from the study but tend to substantiate the data from the qualitative studies. For example, late presentation of children with congenital cardiac disease is associated with living in rural areas and cost of treatment [83]; and poverty, mountainous terrain, and distance to hospitals are negatively associated with use of trained health care providers [84].

Eleven articles were excluded from the final analysis because of lack of access to the full text, although

reviewing the abstracts from these articles substantiated the findings of the rest of the study. For example, cost [85–88], distance to the hospital, lack of appropriate transport [88], poor communication among health facilities [89], and lack of awareness/education [90] are all common themes.

Finally, many commonalities exist between barriers to the provision of both medical and surgical care in LMICs (e.g., infrastructure, supply chain, workforce shortage). Therefore, improving infrastructure, funding, governance, transport, and personnel would have an impact on all aspects of health care [91].

Future directions

We have attempted to outline what is known and what is unknown about barriers to surgical care in LMICs. Immediate investment in district hospitals is an essential first step to providing a better standard of care for anesthesia and critical care and for surgery. Secondly, governments must implement financing strategies, particularly for rural populations, to allow immediate access to emergency care.

Further research is needed in three areas. First, there is a need to broaden the literature about barriers to care within and between surgical disciplines. Studies are needed that specifically address barriers to surgical care in resource-poor settings. Second, there is a need to design a tool that can look at the best way of researching the barriers to surgical care and that can look at both the perceived barriers to care of service users and the actual barriers encountered by service providers. Finally, there is a need to review and determine which interventions are most effective in overcoming barriers to care.

References

1. Debas H, Gosselin R, McCord C et al (2006) Surgery. In: Jamison DT, Breman JG, Measham AR et al (eds) Disease control priorities in developing countries, 2nd edn. Oxford University Press, New York
2. Weiser TG, Regenbogen SE, Thompson KD et al (2008) An estimation of the global volume of surgery: a modelling strategy based on available data. *Lancet* 372:90–92
3. Kushner AL, Cherian MN, Noel L et al (2010) Addressing the millennium development goals from a surgical perspective: essential surgery and anaesthesia in 8 low- and middle-income countries. *Arch Surg* 145:154–159
4. Contini S, Taqdeer A, Cherian MN et al (2010) Emergency and essential surgical services in Afghanistan: still a missing challenge. *World J Surg* 34:473–479
5. Kingham TP, Kamara TB, Cherian MN et al (2009) Quantifying surgical capacity in Sierra Leone: a guide for improving surgical care. *Arch Surg* 144:122–127
6. Funk LM, Weiser TG, Berry WR et al (2010) Global operating theatre distribution and pulse oximetry supply: an estimation from reported data. *Lancet* 376:1055–1061

7. Kruk ME, Wladis A, Mbembati N et al (2010) Human resource and funding constraints for essential surgery in district hospitals in Africa: a retrospective cross-sectional survey. *PLoS Med* 9:7:e1000242
8. Campbell M, Sahin-Hodoglugil NN, Potts M (2006) Barriers to fertility regulation: a review of the literature. *Stud Fam Plann* 37:87–98
9. Filippi V, Richard F, Lange I (2009) Identifying barriers from home to the appropriate hospital through near-miss audits in developing countries. *Best Pract Res Clin Obstet Gynaecol* 23:389–400
10. Gabrysch S, Campbell OM (2009) Still too far to walk: literature review of the determinants of delivery service use. *BMC Pregnancy Childbirth* 9:34
11. Kiwanuka SN, Ekirapa EK, Peterson S et al (2008) Access to and utilisation of health services for the poor in Uganda: a systematic review of available evidence. *Trans R Soc Trop Med Hyg* 102:1067–1074
12. Lewallen S, Courtright P (2002) Gender and use of cataract surgical services in developing countries. *Bull World Health Organ* 80:300–303
13. Maslove DM, Mnyusiwalla A, Mills EJ et al (2009) Barriers to the effective treatment and prevention of malaria in Africa: a systematic review of qualitative studies. *BMC Int Health Hum Rights* 9:26
14. Mills E, Jadad AR, Ross C et al (2005) Systematic review of qualitative studies exploring parental beliefs and attitudes toward childhood vaccination identifies common barriers to vaccination. *J Clin Epidemiol* 58:1081–1088
15. O'Donnell O (2007) Access to health care in developing countries: breaking down demand side barriers. *Cad Saude Publica* 23:2820–2834
16. Ojanuga DN, Gilbert C (1992) Women's access to health care in developing countries. *Soc Sci Med* 35:613–617
17. Posse M, Meheus F, van Asten H et al (2008) Barriers to access to antiretroviral treatment in developing countries: a review. *Trop Med Int Health* 13:904–913
18. Puentes-Markides C (1992) Women and access to health care. *Soc Sci Med* 35:619–626
19. Ravishankar K (2004) Barriers to headache care in India and efforts to improve the situation. *Lancet Neurol* 3:564–567
20. Rutherford ME, Mulholland K, Hill PC (2010) How access to health care relates to under-five mortality in sub-Saharan Africa: systematic review. *Trop Med Int Health* 15:508–519
21. Say L, Raine R (2007) A systematic review of inequalities in the use of maternal health care in developing countries: examining the scale of the problem and the importance of context. *Bull World Health Organ* 85:812–819
22. Simkhada B, Teijlingen ER, Porter M et al (2008) Factors affecting the utilization of antenatal care in developing countries: systematic review of the literature. *J Adv Nurs* 61:244–260
23. Thaddeus S, Maine D (1994) Too far to walk: maternal mortality in context. *Soc Sci Med* 38:1091–1110
24. Thomas C (2002) A literature review of the problems of delayed presentation for treatment and non-completion of treatment for tuberculosis in less developed countries and ways of addressing these problems using particular implementations of the DOTS strategy. *J Manag Med* 16:371–400
25. Yorston D (2005) High-volume surgery in developing countries. *Eye (Lond)* 19:1083–1089
26. Obrist B, Iteba N, Lengeler C et al (2007) Access to health care in contexts of livelihood insecurity: a framework for analysis and action. *PLoS Med* 4:1584–1588
27. Peters DH, Garg A, Bloom G et al (2008) Poverty and access to health care in developing countries. *Ann NY Acad Sci* 1136:161–171
28. McIntyre D, Thiede M, Birch S (2009) Access as a policy-relevant concept in low- and middle-income countries. *Health Econ Policy Law* 4(Pt 2):179–193
29. Athanasiov PA, Casson RJ, Newland HS et al (2008) Cataract surgical coverage and self-reported barriers to cataract surgery in a rural Myanmar population. *Clin Exp Ophthalmol* 36:521–525
30. Briesen S, Geneau R, Roberts H et al (2010) Understanding why patients with cataract refuse free surgery: the influence of rumours in Kenya. *Trop Med Int Health* 15:534–539
31. Bronsard A, Geneau R, Shirima S et al (2008) Why are children brought late for cataract surgery? Qualitative findings from Tanzania. *Ophthalmic Epidemiol* 15:383–388
32. Chandrashekar TS, Bhat HV, Pai RP et al (2007) Coverage, utilization and barriers to cataract surgical services in rural South India: results from a population-based study. *Public Health* 121:130–136
33. Geneau R, Lewallen S, Bronsard A et al (2005) The social and family dynamics behind the uptake of cataract surgery: findings from Kilimanjaro region, Tanzania. *Br J Ophthalmol* 89:1399–1402
34. Geneau R, Massae P, Courtright P et al (2008) Using qualitative methods to understand the determinants of patients' willingness to pay for cataract surgery: a study in Tanzania. *Soc Sci Med* 66:558–568
35. Gyasi M, Amoaku W, Asamany D (2007) Barriers to cataract surgical uptake in the upper east region of Ghana. *Ghana Med J* 41:167–170
36. Jadoon Z, Shah SP, Bourne R et al (2007) Cataract prevalence, cataract surgical coverage and barriers to uptake of cataract surgical services in Pakistan: the Pakistan National Blindness and Visual Impairment Survey. *Br J Ophthalmol* 91:1269–1273
37. Johnson JG, Goode Sen V, Faal H (1998) Barriers to the uptake of cataract surgery. *Trop Doct* 28:218–220
38. Kessy JP, Lewallen S (2007) Poverty as a barrier to accessing cataract surgery: a study from Tanzania. *Br J Ophthalmol* 91:1114–1116
39. Mpyet C, Dineen BP, Solomon AW (2005) Cataract surgical coverage and barriers to uptake of cataract surgery in leprosy villages of northeastern Nigeria. *Br J Ophthalmol* 89:936–938
40. Mwende J, Bronsard A, Moshia M et al (2005) Delay in presentation to hospital for surgery for congenital and developmental cataract in Tanzania. *Br J Ophthalmol* 89:1478–1482
41. Ojabo CO, Alao O (2009) Cataract surgery: limitations and barriers in Makurdi, Benue State. *Nigerian J Med* 18:250–255
42. Rabi MM (2001) Cataract blindness and barriers to uptake of cataract surgery in a rural community of northern Nigeria. *Br J Ophthalmol* 85:776–780
43. Rotchford AP, Rotchford KM, Mthethwa LP et al (2002) Reasons for poor cataract surgery uptake: a qualitative study in rural South Africa. *Trop Med Int Health* 7:288–292
44. Shrestha MK, Thakur J, Gurung CK et al (2004) Willingness to pay for cataract surgery in Kathmandu valley. *Br J Ophthalmol* 88:319–320
45. Snellingen T, Shrestha BR, Gharti MP et al (1998) Socioeconomic barriers to cataract surgery in Nepal: the South Asian cataract management study. *Br J Ophthalmol* 82:1424–1428
46. Vaidyanathan K, Limburg H, Foster A et al (1999) Changing trends in barriers to cataract surgery in India. *Bull World Health Organ* 77:104–109
47. Yin Q, Hu A, Liang Y et al (2009) A two-site, population-based study of barriers to cataract surgery in rural China. *Invest Ophthalmol Vis Sci* 50:1069–1075
48. Zhang M, Wu J, Li L et al (2010) Impact of cataract screening outreach in rural China. *Invest Ophthalmol Vis Sci* 51:110–114
49. Amansakhatov S, Volokhovskaya ZP, Afanasyeva AN et al (2002) Cataract blindness in Turkmenistan: results of a national survey. *Br J Ophthalmol* 86:1207–1210
50. Melese M, Alemayehu W, Friedlander E et al (2004) Indirect costs associated with accessing eye care services as a barrier to service use in Ethiopia. *Trop Med Int Health* 9:426–431

51. Lee BW, Sathyan P, John RK et al (2008) Predictors of and barriers associated with poor follow-up in patients with glaucoma in South India. *Arch Ophthalmol* 126:1448–1454
52. Du Toit R, Ramke J, Naduvilath T et al (2006) Awareness and use of eye care services in Fiji. *Ophthalmic Epidemiol* 13:309–320
53. Bowman RJ, Faal H, Jatta B et al (2002) Longitudinal study of trachomatous trichiasis in The Gambia: barriers to acceptance of surgery. *Invest Ophthalmol Vis Sci* 43:936–940
54. Mahande M, Tharaney M, Kirumbi E et al (2007) Uptake of trichiasis surgical services in Tanzania through two village-based approaches. *Br J Ophthalmol* 91:139–142
55. Nagpal G, Dhaliwal U, Bhatia MS (2006) Barriers to acceptance of intervention among patients with trachomatous trichiasis or entropion presenting to a teaching hospital. *Ophthalmic Epidemiol* 13:53–58
56. Oliva MS, Munoz B, Lynch M et al (1997) Evaluation of barriers to surgical compliance in the treatment of trichiasis. *Int Ophthalmol* 21:235–241
57. Bhuiya A, Aziz A, Chowdhury M (2001) Ordeal of women for induced abortion in a rural area of Bangladesh. *J Health Popul Nutr* 19:281–290
58. Iyengar K, Iyengar SD, Suhalka V et al (2009) Pregnancy-related deaths in rural Rajasthan, India: exploring causes, context, and care-seeking through verbal autopsy. *J Health Popul Nutr* 27:293–302
59. Telfer ML, Rowley JT, Walraven GE (2002) Experiences of mothers with antenatal, delivery and postpartum care in rural Gambia. *Afr J Reprod Health* 6:74–83
60. Gage AJ (2007) Barriers to the utilization of maternal health care in rural Mali. *Soc Sci Med* 65:1666–1682
61. Kowalewski M, Mujinja P, Jahn A (2002) Can mothers afford maternal health care costs? User costs of maternity services in rural Tanzania. *Afr J Reprod Health* 6:65–73
62. Mahabub-Ul-Anwar M, Rob U, Talukder MN (2006–2007) Inequalities in maternal health care utilization in rural Bangladesh. *Int Q Community Health Educ* 27:281–297
63. Parkhurst JO, Rahman SA, Ssengooba F (2006) Overcoming access barriers for facility based delivery in low-income settings: insights from Bangladesh and Uganda. *J Health Popul Nutr* 24:438–445
64. Urassa E, Massawe S, Lindmark G et al (1997) Operational factors affecting maternal mortality in Tanzania. *Health Policy Plan* 12:50–57
65. Afsana K, Rashid SF (2001) The challenges of meeting rural Bangladeshi women's needs in delivery care. *Reprod Health Matters* 9:79–89
66. Afsana K (2004) The tremendous cost of seeking hospital obstetric care in Bangladesh. *Reprod Health Matters* 12:171–180
67. Hasan II, Nisar N (2002) Women's perceptions regarding obstetric complications and care in a poor fishing community in Karachi. *J Pak Med Assoc* 52:148–152
68. Mills S, Bertrand JT (2005) Use of health professionals for obstetric care in northern Ghana. *Stud Fam Plann* 36:45–56
69. Mills S, Williams JE, Adjuik M et al (2008) Use of health professionals for delivery following the availability of free obstetric care in northern Ghana. *Matern Child Health J* 12:509–518
70. Pembe AB, Urassa DP, Carlstedt A et al (2009) Rural Tanzanian women's awareness of danger signs of obstetric complications. *MC Pregnancy Childbirth* 9:12
71. Seljeskog L, Sundby J, Chimango J (2006) Factors influencing women's choice of place of delivery in rural Malawi: an explorative study. *Afr J Reprod Health* 10:66–75
72. Dhakal S, Chapman GN, Simkhada PP et al (2007) Utilisation of postnatal care among rural women in Nepal. *BMC Pregnancy Childbirth* 7:19
73. Hang HM, Byass P (2009) Difficulties in getting treatment for injuries in rural Vietnam. *Public Health* 123:58–65
74. Macharia WM, Njeru EK, Muli-Musiime F et al (2009) Severe road traffic injuries in Kenya, quality of care and access. *African Health Sci* 9:118–124
75. Mock CN, nii-Amon-Kotei D, Maier RV (1997) Low utilization of formal medical services by injured persons in a developing nation: health service data underestimate the importance of trauma. *J Trauma* 42:504–511
76. Dye TD, Bogale S, Hobden C et al (2010) Complex care systems in developing countries: breast cancer patient navigation in Ethiopia. *Cancer* 116:577–585
77. Forjuoh SN, Guyer B, Strobino DM (1995) Determinants of modern health care use by families after a childhood burn in Ghana. *Inj Prev* 1:31–34
78. Levine AC, Presser DZ, Rosborough S et al (2007) Understanding barriers to emergency care in low-income countries: view from the front line. *Prehosp Disaster Med* 22:467–470
79. Witwer M (1989) Traditional attitudes, fear of surgery represent important barriers to female sterilization in Zaire. *Int Fam Plan Perspect* 15:149–150
80. Bunce A, Guest G, Searing H et al (2007) Factors affecting vasectomy acceptability in Tanzania. *Int Fam Plan Perspect* 33:13–21
81. Bossyns P, Van Lerberghe W (2004) The weakest link: competence and prestige as constraints to referral by isolated nurses in rural Niger. *Hum Resource Health* 2:1
82. Ridde V, Morestin F (2011) A scoping review of the literature on the abolition of user fees in health care services in Africa. *Health Policy Plan* 26:1–11
83. Kowalsky RH, Newburger JW, Rand WM et al (2006) Factors determining access to surgery for children with congenital cardiac disease in Guatemala, Central America. *Cardiol Young* 16:385–391
84. Gage AJ, Guirlène Calixte M (2006) Effects of the physical accessibility of maternal health services on their use in rural Haiti. *Popul Stud (Camb)* 60:271–288
85. Malhotra R, Uppal Y, Misra A et al (2005) Increasing access to cataract surgery in a rural area: a support strategy. *Ind J Public Health* 49:63–67
86. Oluleye TS (2004) Cataract blindness and barriers to cataract surgical intervention in three rural communities of Oyo State, Nigeria. *Niger J Med* 13:156–160
87. Zhou JB, Guan HJ, Qu J et al (2008) A study on the awareness of cataract disease and treatment options in patients who need surgery in a rural area of eastern China. *Eur J Ophthalmol* 18:544–550
88. Tuladhar H, Khanal R, Kayastha S et al (2009) Complications of home delivery: our experience at Nepal Medical College Teaching Hospital. *Nepal Med Coll J* 11:164–169
89. Al-Attas AH, Williams CD, Pitchforth EL et al (2010) Understanding delay in accessing specialist emergency eye care in a developing country: eye trauma in Tanzania. *Ophthalmic Epidemiol* 17:103–112
90. Kirkpatrick M, Lamichhane S (1990) Demographic patterns, attitudes and practices of women attending an antenatal clinic in rural Nepal. *J Inst Med* 12:37–44
91. Grimes C, Lavy C (2010) A plea for investment in district hospitals. *Lancet* 376(9758):2073

What does 'access to health care' mean?

Martin Gulliford, Jose Figueroa-Munoz, Myfanwy Morgan, David Hughes, Barry Gibson¹, Roger Beech², Meryl Hudson

Department of Public Health Sciences and ¹Department of Dental Public Health, King's College London;

²Centre for Health Planning and Management, University of Keele, UK

Facilitating access is concerned with helping people to command appropriate health care resources in order to preserve or improve their health. Access is a complex concept and at least four aspects require evaluation. If services are available and there is an adequate supply of services, then the opportunity to obtain health care exists, and a population may 'have access' to services. The extent to which a population 'gains access' also depends on financial, organisational and social or cultural barriers that limit the utilisation of services. Thus access measured in terms of utilisation is dependent on the affordability, physical accessibility and acceptability of services and not merely adequacy of supply. Services available must be relevant and effective if the population is to 'gain access to satisfactory health outcomes'. The availability of services, and barriers to access, have to be considered in the context of the differing perspectives, health needs and material and cultural settings of diverse groups in society. Equity of access may be measured in terms of the availability, utilisation or outcomes of services. Both horizontal and vertical dimensions of equity require consideration.

Journal of Health Services Research & Policy Vol 7 No 3, 2002: 186–188

© The Royal Society of Medicine Press Ltd 2002

Introduction

Universal eligibility and the removal of financial barriers to health care were among the founding principles of the National Health Service in Britain, but until now an explicit policy of equity of access to health care has not been pursued systematically. Recently, the UK government proposed that 'patients will get fair access to consistently high quality, prompt and accessible services right across the country'.¹ The priority being given to achieving access to health care raises questions about the meaning of the term and the measures that can be used to evaluate whether access to health care exists. But what is meant by 'access to health care'? To answer this, we discuss published work on access and suggest that access is a complex concept which should be measured on at least four dimensions.

Four dimensions of access

In an early discussion of access, Aday and Andersen suggested that 'it is perhaps most meaningful to consider access in terms of whether those who need care get into the system or not'.² They suggested that access might describe either the potential or the actual

entry of a given individual or population group into the health care system. Thus 'having access' denotes a potential to utilise a service if required, whereas 'gaining access' refers to the initiation into the process of utilising a service. Much confusion has resulted from these two distinct uses of the term and these provide the first two proposed dimensions of access.

Service availability

Having access to health care requires that there is an adequate supply of health services available. According to this dimension, access to health care is concerned with the opportunity to obtain health care when it is wanted or needed. The availability of services is measured traditionally using indicators such as the numbers of doctors or hospital beds per capita. In England there are large variations between districts in the numbers of general practitioners per head of population, the proportion of the population registered with dentists, or the proportion accessing specialist surgical services.³ These variations raise questions about the level of resources required for health care, the methods used to allocate resources to different geographical areas and the ways that services should be configured at regional and local levels in order to optimise the availability of both primary and specialist services.⁴

Mooney⁵ suggested that, from a health economic perspective, the availability of services may be measured in terms of the costs to individuals of obtaining care. These costs might include the costs of travel and other

Martin Gulliford FFPHM, Senior Lecturer, **Jose Figueroa-Munoz** PhD, Lecturer, **Myfanwy Morgan** PhD, Reader, **David Hughes** PhD, Senior Lecturer, **Meryl Hudson** MPhil, Research Assistant, Department of Public Health Sciences. **Barry Gibson** PhD, Lecturer, Department of Dental Public Health, King's College London, London, UK. **Roger Beech** PhD, Senior Lecturer, Centre for Health Planning and Management, University of Keele, Keele, UK.

Correspondence to: MG.

inconvenience incurred in obtaining care or the health benefits forgone by not obtaining care. When services are geographically distant, these costs will be generally higher. In this formulation, individuals facing equal costs have equal access. Mooney argued that 'access is wholly a question of supply; utilisation is a function of both supply and demand' and that 'It is important to stress that equality of access is about equal opportunity: the question of whether or not the opportunity is exercised is not relevant to equity defined in terms of access'.

Utilisation of services and barriers to access

Other writers have suggested that service availability is a rather limited measure of access to health care. People in need may often have access to services and yet encounter difficulties in utilising services. In other words, potential access may not be realised.⁶ Thus, Donabedian observed that 'the proof of access is use of service, not simply the presence of a facility'.⁷ Pechansky and Thomas developed this idea and suggested that access described the 'degree of fit' between clients and the health system.⁸ The 'degree of fit' might be influenced by the acceptability, affordability and accommodation of services. Pechansky and Thomas' approach extended the concept of access beyond service availability, to consider the personal, financial and organisational barriers to service utilisation.

Personal barriers

Patients' recognition of their needs for services and their decisions to seek medical care generally form the first step in the process of accessing services. The probability of utilising services depends on the balance between individuals' perceptions of their needs and their attitudes, beliefs and previous experiences with health services.⁹ Access to health services implies that individuals recognise and accept their need for services, consent to a role as service user, and acknowledge socially generated resources that they are willing to utilise. These processes of access are subject to social and cultural influences as well as environmental constraints.

It follows that individuals' expectations as service users may not always be consistent with those of health care professionals. This is evident in the non-uptake of preventive services or the delays in patients presenting with serious conditions requiring treatment or in 'inappropriate' demands on general practitioners and emergency services. Policy responses have shifted in recent years from attempting to change patients' behaviours to acknowledging patients' needs and managing their demands by developing a graduated service to reduce demands on general practitioners and on hospital staff in accident and emergency departments: for example, an increased role for community pharmacies, telephone advice lines, web pages or walk-in clinics as additional pathways to access that will allow patients' concerns about less serious conditions to be

addressed. Some of these developments extend the concept of access beyond the notion of physical accessibility of services to include remote access through electronic media.

Financial barriers

Financial barriers can influence patients' utilisation of services even in the UK where, even though the system is essentially free at the point of use, there are charges for specific services, including eye tests, dental check-ups and dispensing of prescription medicines. As we noted earlier, patients may also experience costs as a result of time lost from work or in travelling to and from a clinic. The impact of user charges and other costs of accessing care affect different socio-economic groups in different ways. For some groups, access may not be compromised, whereas for others costs may represent a significant deterrent.¹⁰ The impact depends on the magnitude of the costs and on the user's willingness and ability to pay. In other words, equal costs do not necessarily give equal access. Financial incentives to service providers can also influence the availability of services and the types of service available.

Organisational barriers

Long waiting lists and waiting times may sometimes be indicative of organisational barriers to access which may result from inefficient use of existing capacity or a failure to design services around the needs of patients. Systematic variations in referral practices also act as barriers to accessing care, especially referral from primary to secondary care. Redesign of the way clinical services are delivered, such as the replacement of waiting lists with booking systems, might do much to reduce organisational barriers to access.

Relevance, effectiveness and access

The processes of entry into and utilisation of health services represent only a limited part of the interaction between supply and demand for health care. The ultimate objective is to promote or preserve health. Rogers et al defined optimal access as 'providing the right service at the right time in the right place'.¹¹ The US Institute of Medicine defined access as the 'timely use of personal health services to achieve the best possible outcome'.¹² These definitions added the notions of the right service or the best possible outcomes. On this dimension, access could be measured using appropriate indicators of health status. For example, organisational barriers to access may result in delays in treatment, which can cause dissatisfaction among users and may lead to worse clinical outcomes.

Assessment of access according to health outcomes, rather than according to the availability or utilisation of services, may alter conclusions. Poor-quality services may be associated with high levels of utilisation. When a service achieves a favourable outcome in terms of

improved health status, the need for health care and subsequent service utilisation may be reduced.¹³

Equity and access

A concern to ensure that health care resources are mobilised to meet the needs of different groups in the population is central to the concept of access. Equity introduces the notion of fairness or social justice. One of the more widely applied and documented definitions of equity concerns fairness in access for groups with equivalent needs. This horizontal form of equity may be assessed with respect to health service availability, health service utilisation or health care outcomes.⁵ Most work has focused on utilisation as the preferred indicator of access, with the relationship between utilisation and need being expressed in the form of use/needs ratios or by standardising utilisation measures for differences in needs using regression methods.^{5,14} The more sophisticated analyses have shown surprisingly little evidence of horizontal inequity in utilisation of care, even in countries where access to care is considered to be severely rationed according to income.¹⁴ In contrast, inequity in service availability or health outcomes has been more readily demonstrated.

Another difficulty in the assessment of equity of access is that the health problems of different groups are diverse, health care needs for similar health problems vary and different groups have their own priorities and values. Groups with different needs require access to services that are appropriately differentiated in terms of volume and quality. This vertical dimension to equity (the unequal treatment of unequals) is acknowledged to be more difficult to measure than the horizontal, not least because there is little consensus on how vertical equity could be judged to exist.¹⁵

Conclusions

Facilitating access is concerned with helping people to command appropriate health care resources to preserve or improve their health. Like 'quality', 'access' is a complex concept that must be assessed on several dimensions. Different aspects of access can be assessed in terms of health service availability, health service utilisation, or health service outcomes but, for the reasons discussed, no one of these dimensions is sufficient in its own right. In a system that seeks to be egalitarian, equity is perhaps the most important measure of access, though this is also the most difficult to operationalise.

Recognising that access is a multi-dimensional concept helps to explain earlier conflicts in the definition of access and also the tensions that may exist in attempting to achieve access according to different measures. For example, some evidence suggests that people who are treated at national or regional centres of excellence may achieve better outcomes than those treated by local services. Centralised services may provide greater

efficiency, through improved quality of care and potential economies of scale, but may be less easily utilised because of increased costs to users. The barriers to uptake of centralised services vary for different groups of patients, especially those living in rural areas.⁴

There may also be a tension between horizontal and vertical dimensions of equity of access. Thus, the desire for a universal, standard service with equality of access may conflict with the development of services based on local needs and priorities, which will inevitably lead to local variations in access. This is recognised in recent policy documents in the UK that refer to the need to 'tackle the unacceptable variations that exist' while at the same time recommending that 'local doctors and nurses who . . . know what patients need will be in the driving seat in shaping services'.¹ A key issue for those responsible for designing services is to resolve such tensions between competing objectives so as to facilitate appropriate utilisation of care while at the same time safeguarding equity in treatment outcomes.

References

1. NHS Executive. The new NHS modern and dependable: a national framework for assessing performance. Consultation document. Leeds: NHS Executive, 2001
2. Aday LA, Andersen R. Development of indices of access to medical care. Ann Arbor: Health Administration Press, 1975
3. Department of Health. High level performance indicators. London: Department of Health, 2001
4. Haynes R, Bentham G, Lovett A, Gale S. Effects of distances to hospital and GP surgery on hospital inpatient episodes, controlling for needs and provision. *Social Science and Medicine* 1999; 49: 425-433
5. Mooney GH. Equity in health care: confronting the confusion. *Effective Health Care* 1983; 1: 179-185
6. Aday LA, Anderson RM. Equity of access to medical care: a conceptual and empirical overview. *Medical Care* 1981; 19 (suppl): 4-27
7. Donabedian A. Models for organising the delivery of personal health services and criteria for evaluating them. *Milbank Memorial Fund Quarterly* 1972; 50: 103-154
8. Pechansky R, Thomas W. The concept of access. *Medical Care* 1981; 19: 127-140
9. Mechanic D. *Illness behaviour*. In: *Medical sociology. A comprehensive text*, 2nd edn. New York: The Free Press, 1978: 249-289
10. Lundberg L, Johannesson M, Dag I, Borgquist L. Effects of user charges on the use of prescription medicines in different socioeconomic groups. *Health Policy* 1998; 44: 123-134
11. Rogers A, Flowers J, Pencheon D. Improving access needs a whole systems approach. And will be important in averting crises in the millennium winter. *BMJ* 1999; 319: 866-867
12. Millman ML. *Access to health care in America*. Washington, DC: Institute of Medicine, National Academy Press, 1993
13. Goddard M, Smith P. *Equity of access to health care*. York: University of York, 1998
14. van Doorslaer E, Wagstaff A, van der Burg H, Christiansen T, De Graeve D, Duchesne I et al. Equity in the delivery of health care in Europe and the US. *Journal of Health Economics* 2000; 19: 553-583
15. Mooney GH. And now for vertical equity? Some concerns arising from aboriginal health in Australia. *Health Economics* 1996; 5: 99-103

Mortality due to low-quality health systems in the universal health coverage era: a systematic analysis of amenable deaths in 137 countries



Margaret E Kruk, Anna D Gage, Naima T Joseph, Goodarz Danaei, Sebastián García-Saisó, Joshua A Salomon



Summary

Background Universal health coverage has been proposed as a strategy to improve health in low-income and middle-income countries (LMICs). However, this is contingent on the provision of good-quality health care. We estimate the excess mortality for conditions targeted in the Sustainable Development Goals (SDG) that are amenable to health care and the portion of this excess mortality due to poor-quality care in 137 LMICs, in which excess mortality refers to deaths that could have been averted in settings with strong health systems.

Methods Using data from the 2016 Global Burden of Disease study, we calculated mortality amenable to personal health care for 61 SDG conditions by comparing case fatality between each LMIC with corresponding numbers from 23 high-income reference countries with strong health systems. We used data on health-care utilisation from population surveys to separately estimate the portion of amenable mortality attributable to non-utilisation of health care versus that attributable to receipt of poor-quality care.

Findings 15·6 million excess deaths from 61 conditions occurred in LMICs in 2016. After excluding deaths that could be prevented through public health measures, 8·6 million excess deaths were amenable to health care of which 5·0 million were estimated to be due to receipt of poor-quality care and 3·6 million were due to non-utilisation of health care. Poor quality of health care was a major driver of excess mortality across conditions, from cardiovascular disease and injuries to neonatal and communicable disorders.

Interpretation Universal health coverage for SDG conditions could avert 8·6 million deaths per year but only if expansion of service coverage is accompanied by investments into high-quality health systems.

Funding Bill & Melinda Gates Foundation.

Copyright © 2018 The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY 4.0 license.

Introduction

Universal health coverage (UHC) has been embraced by global organisations such as WHO and the World Bank as a means to improve health and reduce the financial burden from receiving care. UHC is a central plank of the Sustainable Development Goals (SDGs), the ambitious new development targets that were signed by 193 UN member states to improve health and development by 2030.¹ Although financing and implementation of UHC will differ by country, the common definition is the ability of all people to obtain good-quality services when they need them without facing financial hardship.²

Supporters of UHC have promoted it as a means for improving population health.³ These supporters theorise that expanding health insurance would promote the utilisation of health services that reduce mortality and morbidity. However, although insurance generally increases use of services, evidence on mortality reductions is mixed. Escobar and colleagues⁴ found that health insurance was associated with improved health status in only three of nine studies in low-income and middle-income countries (LMICs; from Vietnam, China,

and Brazil). In the USA, coverage has been associated with better self-reported health status and in one recent study,⁵ with reduced mortality. The lack of consistent evidence on health benefits from insurance coverage might be in part due to methodological challenges because mortality is multifactorial and subject to factors outside of health care; people purchasing insurance are more unwell on average, and deaths are relatively rare and require large studies to measure their prevalence. However, insurance expansion might also be unsuccessful in improving outcomes if no effective treatment is available for a given condition or if quality of care is poor.

In low-income countries, evidence is emerging that expanding health care coverage does not necessarily result in better outcomes, even for conditions highly amenable to medical care. A large programme called Janani Suraksha Yojana, that was set up 13 years ago in India, has provided cash incentives for women to deliver their children in health facilities and has increased coverage of facility birth for more than 50 million women, but these incentives have not improved maternal or newborn survival.^{6,7} Many of the births in this

Published Online
September 5, 2018
[http://dx.doi.org/10.1016/S0140-6736\(18\)31668-4](http://dx.doi.org/10.1016/S0140-6736(18)31668-4)
See Online/Comment
[http://dx.doi.org/10.1016/S0140-6736\(18\)32075-0](http://dx.doi.org/10.1016/S0140-6736(18)32075-0)

Department of Global Health and Population, Harvard T H Chan School of Public Health, Boston, MA, USA (M E Kruk MD, A D Gage MSc, G Danaei SD); Department of Gynecology and Obstetrics, Emory University School of Medicine, Atlanta, GA, USA (N T Joseph MD); Ministry of Health, Mexico City, Mexico (S García-Saisó MD); and Center for Health Policy, Stanford Medical School, Stanford, CA, USA (Prof J A Salomon PhD)

Correspondence to:
Dr Margaret E Kruk, Harvard T H Chan School of Public Health, Boston, MA 02115, USA
mkruk@hsph.harvard.edu

Research in context

Evidence before this study

Although amenable mortality has been estimated and discussed in high-income countries for several decades, the concept has only recently been extended to low-income countries. We searched PubMed for the terms “amenable mortality” and “quality” for studies published in English from 1990–2018 and reviewed citations in relevant articles. Nolte and McKee have developed the concept of amenable mortality to estimate the number of deaths that could be averted by health care in Organisation for Economic Co-operation and Development countries. In 2016, the Global Burden of Disease (GBD) group extended this concept to low-income and middle-income countries (LMICs) and developed an access and quality index to compare performance. Multicountry studies, such as those by Souza and colleagues and Biccand and colleagues, have shown that in some LMICs mortality is higher for people receiving care in facilities than in high-income countries, even after adjusting for morbidity. Alkire and colleagues found that worldwide 8 million deaths were amenable to health care, resulting in estimated welfare losses of US\$6.0 trillion to LMICs in 2015.

Added value of this study

This study reports the number of deaths amenable to health care in LMICs and is the first to estimate the proportion of these deaths due to poor quality of care versus non-utilisation of care. This finding has important policy implications for countries pursuing universal health coverage as increased access to poor quality of care is unlikely to improve health outcomes. Our study found that nearly 8 million people die every year because of a lack of access to high-quality care. We found a higher proportion of amenable deaths are among health system users than non-users in LMICs. Deaths caused by poor-quality health care spanned the conditions included in the Sustainable Development Goals, including cardiovascular diseases, neonatal conditions and road traffic accidents. Although the 2016 GBD study did not report numbers of amenable deaths or partition these deaths into the separate contributions of quality of care and utilisation, it did observe substantial disparities in amenable

mortality across regions and related to levels of development.

Implications of all the available evidence

Although our findings cannot be directly compared to the study by Nolte and McKee because the conditions they reported were different in high-income settings, the authors made different adjustments for public health interventions, and the settings of care were much better resourced than in many countries in our study, and they found that mortality in 21% of men and 30% of women under the age of 75 years is amenable to good health care; the corresponding figure from our study is 56% (all amenable deaths/avertable deaths).

The 2016 GBD paper concluded that despite progress since 1990, improved access to care and quality of care received has a large potential for improving outcomes in low-income and middle-income countries, although there is a large and growing heterogeneity of performance across countries. Specifically, although many countries lag behind peers in their income group, some middle-income countries with recent health system reforms appear to be realising outsized health gains. Our estimate that 55% of all avertable mortality for Sustainable Development Goal conditions can be addressed by good health care is somewhat higher than the Nolte and McKee study estimates and suggests that health systems are just as crucial for overall mortality reduction in lower-income countries as they are in high-income countries. Our paper uniquely estimates the portion of amenable mortality due to non-utilisation of available care versus utilisation of poor quality of care. We conclude that access is no longer the only binding constraint for improving survival in LMICs—health system quality must be improved simultaneously. This is particularly trenchant as countries embark on universal health coverage, which has been characterised in terms of improved coverage and reduced financial risk. Our work, in combination with past research, shows that improving health system quality is an immediate priority if countries hope to succeed in reaching the third Sustainable Development Goal.

programme occurred in primary care centres that did not have sufficiently skilled staff to address maternal and newborn complications.⁸ Similarly, low quality of care for mothers and children has been documented in primary care facilities in Africa and in India.^{9–11} Researchers have also found large deficiencies in quality of hospital care for surgical conditions, obstetric care, and care of tuberculosis,^{12–14} whereas other studies¹⁵ have shown large differences between treatment and successful control of blood pressure.¹⁵

The evidence of poor-quality health care challenges the assumption that increasing utilisation of health services will be sufficient to reduce mortality in lower-income countries. However, to date, there have not been any studies quantifying the potential role of better-quality services versus greater coverage in reducing mortality for

conditions amenable to medical care. This report will estimate the excess deaths amenable to health care in LMICs and the relative contributions of non-utilisation of health-care services and receipt of poor-quality care to these deaths.

Methods

Overview

Broadly, we estimated excess mortality for SDG conditions amenable to health care, after excluding deaths that could be prevented through public health and other interventions outside the health system. To estimate amenable mortality in LMICs, we compared mortality by age and sex groups in each country with corresponding mortality from a reference group of 23 high-income countries with strong universal health coverage and good health

outcomes (appendix p 17). We then apportioned amenable mortality into two components: deaths due to poor quality of care (in those who used health-care services) and those due to non-utilisation of health care.

Parameter selection

We first identified conditions for which personal health care plays an important role in reducing mortality. We began with the list of conditions identified by Nolte and McKee¹⁶ as amenable to health care, and further included conditions in SDG Target 3 (improved health)¹⁷ for which risk of death can be reduced by use of personal health care and does not require advanced technology, resulting in identification of 61 conditions in total. Because low-income countries might not have the resources to guarantee care for all 61 conditions, we also analysed a more limited subset of 41 highest priority conditions that require relatively basic interventions (appendix p 3). We applied established age ranges for which the health system could reasonably avert deaths from each condition.^{18–20} Table 1 lists the 61 included conditions and age ranges.

In assigning amenable deaths to poor quality versus non-utilisation, we assumed that once users seek care in the health system, correct management and retention in care is the system's responsibility. Retention in care (ie, repeat utilisation) is a frequently used measure of health system quality for conditions that require a course of continuous care, such as HIV and non-communicable diseases as well as immunisation.^{21–23} Because condition-specific utilisation measures were not available for all 61 conditions in LMICs, we used population utilisation data for conditions with similar clinical features and level of acuity.²⁴ For conditions such as neonatal HIV and vaccine preventable diseases, the health system can prevent all incidental cases when people seek preventive care. We used receipt of at least one vaccine as the utilisation measure for most vaccine preventable conditions. For conditions that arise acutely and can be treated or cured with episodic care (eg, pneumonia, appendicitis, or road injuries), we used care-seeking for the corresponding acute illness. Birth with a skilled attendant was used for maternal and newborn complications. Finally, for chronic conditions such as diabetes mellitus that should be screened for or detected when people at risk seek routine care we used health facility visit in the past year. We used condition-specific utilisation data for tuberculosis, HIV, cancer, and mental health (appendix pp 6–7).

Data sources

Incidence, prevalence, and mortality by cause were obtained from the Global Burden of Disease study (GBD) 2016 in 5-year age groups by sex for each country.^{20,25,26} Population sizes were obtained from the World Bank.²⁷

Health care utilisation data were obtained from household population surveys and global estimates including

the World Health Surveys, Demographic and Health surveys, UNICEF Multiple Indicator Cluster Surveys, World Mental Health Surveys, and Joint United Nations Programme on HIV/AIDS and World Development Indicators databases in the most recent years available (appendix p 5). For countries for which utilisation data were not available, we imputed values on the basis of known factors that affect utilisation.^{28–31} We regressed utilisation for each condition by gross domestic product per capita, percent of population living in rural areas, female literacy rate, land area, numbers of doctors and nurses or midwives per patient, and GBD study region on the basis of geography and epidemiology.³¹ On average, these variables explained 59% of the variation in utilisation across conditions. We then predicted missing utilisation values using a generalised linear model with a binomial link to constrain the values to between 0 and 100%. Additional details on imputation are reported in the appendix (p 8).

Statistical analysis

Avertable mortality was defined as the sum of preventable deaths—ie, those that could be averted through public health and other population-level health or intersectoral policies that prevent the disease or condition in the first place—and amenable deaths—ie, those deaths that could be averted by health care once a condition occurs. This distinction is approximate, as well-functioning primary care can also contribute to primary prevention (eg, by treating hypertension before it causes ischaemic heart disease). In some cases, such as vaccine-preventable diseases, health systems are the predominant means of primary prevention.

To estimate amenable mortality, we compared case fatality (CF) for LMICs against a reference case fatality (CF^{ref}) from best performing countries. The CF was calculated as the cause-specific deaths divided by individuals at risk or incident or prevalent cases of that condition as applicable (appendix p 5). To reduce the influence of spurious values on our results, observations were dropped in countries that had fewer than ten deaths across all age groups by sex except those in the best performer reference group. When a CF was greater than 1 for a particular age group by sex, we replaced it with the disease's country average CF. Finally, CFs three SDs over the age mean for that sex were treated as outliers and truncated.

Countries in the best performer reference group were 23 high-income countries that scored 90 or greater on a recent UHC index that combines coverage of interventions and risk-standardised mortality for conditions amenable to personal health care (appendix p 15),^{32,33} and the reference CF was computed as the average across the reference countries. For conditions for which deaths were entirely preventable within the health system, case fatality was calculated as deaths divided by total population at risk.

See Online for appendix

	Age range
HIV or AIDS	0-74
Tuberculosis	0-74
Vaccine preventable diseases	
Hepatitis B	0-74
Meningitis	0-14
Diphtheria	0-14
Otitis media	0-74
Varicella and herpes zoster	0-74
Whooping cough	0-4
Meningococcal meningitis	0-14
Measles	0-14
Tetanus	0-74
Neglected tropical diseases	
Cystic echinococcosis	0-74
Cysticercosis	0-74
Schistosomiasis	0-74
Yellow fever	0-74
African trypanosomiasis	0-74
Intestinal nematode infections	0-74
Chagas disease	0-74
Leishmaniasis	0-74
Dengue	0-74
Encephalitis	0-74
Other infectious diseases	
Malaria	0-74
Intestinal infectious diseases	0-74
Diarrhoeal disease	0-49
Upper respiratory infections	0-74
Lower respiratory infections	0-74
Maternal disorders	15-44
Neonatal disorders	0-4
Cardiovascular diseases	
Rheumatic heart disease	0-44
Ischaemic heart disease	0-74
Hypertensive heart disease	0-74
Ischaemic stroke	0-74
Intracerebral haemorrhage	0-74
Congenital heart anomalies	0-14
Chronic kidney disease due to hypertension	0-49

(Table 1 continues in next column)

Amenable mortality was computed as mortality in excess of what would be expected relative to the reference case fatality level, after first accounting for preventable mortality—ie, excluding deaths among incident or prevalent cases that should have been prevented by population level interventions. We adjusted deaths for prevention by comparing incidence or prevalence in LMICs with incidence or prevalence in the reference group. The proportion of cases that could be prevented was indicated by calculating the ratio of incidence or prevalence of a given condition in the reference group compared with each country. If the incidence or prevalence

	Age range
(Continued from previous column)	
Gastrointestinal disorders	
Peptic ulcer disease	0-74
Appendicitis	0-74
Inguinal and femoral hernia	0-74
Gallbladder and biliary diseases	0-74
Paralytic ileus and intestinal obstruction	0-74
Diabetes	
Diabetes mellitus	0-49
Chronic kidney disease due to diabetes	0-49
Cancers	
Breast cancer	0-74
Cervical cancer	15-44
Colon and rectum cancer	0-74
Uterine cancer	0-74
Malignant skin melanoma	0-74
Non-melanoma skin cancer	0-74
Testicular cancer	0-74
Thyroid cancer	0-74
Hodgkin's lymphoma	0-74
Leukaemia	0-74
Chronic respiratory diseases	
Asthma	0-14
Chronic obstructive pulmonary disorder	0-74
Neurological and mental health disorders	
Epilepsy	0-74
Self-harm	10-74
Alcohol use disorders	15-74
Drug use disorders	15-74
Road injuries	0-74
Exogeneous causes	
Poisonings	0-74
Adverse effects of medical treatment	0-74

Table 1: Conditions amenable to health care

ratio was less than one (ie, lower incidence in reference group than in the case group) as expected, we multiplied the ratio by the number of cases to calculate the adjusted (lower) number of cases. When the ratio was greater than 1, cases were unadjusted. Deaths due to conditions preventable within the health system rather than through public health measures (ie, neonatal HIV, vaccine-preventable conditions, and tuberculosis) were unadjusted. Formally, excess mortality in LMICs amenable to personal health care was calculated as follows:

$$Mortality_{ijk}^{amenable} = CF_{ijk} \times Cases_{ijk}^{adj} - CF_{ijk}^{ref} \times Cases_{ijk}^{adj}$$

for age group *i*, sex *j*, and country *k*, where *CF* is case fatality, *Cases^{adj}* is the cases that remain after excluding those that could be prevented through public health intervention, and *CF^{ref}* is the reference case fatality level.

To estimate the relative contributions of poor quality of care and non-utilisation of health care to amenable mortality, we did a second analysis that partitioned mortality into deaths among health system users and among non-users.

To estimate the counterfactual mortality that would be expected if all people who currently utilise health services received high quality care, we assumed that service users would have CF equivalent to the reference CF levels. Non-user CF is likely to be greater than the country's average CF but non-user CFs are not observed and are not directly inferable from GBD study results. Therefore, to estimate a CF for non-users we sought a plausible upper bound observed CF from the same epidemiological region (those considered poor performers). First, we computed the average CF across age group and sex groups for each cause in every country. Next, we identified the 75th percentile CF within each region for each cause. For any country with a CF below the 75th percentile, we computed a ratio of the 75th percentile CF to the CF of the country, and then multiplied this ratio by each of the country's age-group specific CFs by sex to yield the estimated CF for non-users specific to age and sex. Ratios above 3 were deemed implausible and capped, affecting 5.2% of observations. Subtracting this counterfactual from total mortality (less the portion preventable through public health intervention, as above), we derived the excess mortality among people utilising the health-care system (ie, mortality due to poor-quality services):

$$\text{Mortality}_{ijk}^{\text{quality}} = CF_{ijk} \times \text{Cases}_{ijk}^{\text{adj}} - [CF_{ijk} \times CF_k^{\text{ratio}} \times \text{Cases}_{ijk}^{\text{adj}} \times (1 - \text{util}_{ijk}) + CF_{ijk}^{\text{ref}} \times \text{Cases}_{ijk}^{\text{adj}} \times \text{util}_{ijk}]$$

for which *util* is the utilisation of services, CF^{ratio} is the ratio of the 75th percentile CF mortality in the region to the country's average mortality for each age group by sex, and all other variables are as defined above. Mortality caused by non-utilisation is calculated as:

$$\text{Mortality}_{ijk}^{\text{amenable}} - \text{Mortality}_{ijk}^{\text{quality}}$$

We divided poor-quality mortality by the country's total population to calculate the proportion of mortality due to poor-quality services. We multiplied the poor-quality mortality within each age group within sex by the corresponding GBD study standard life expectancy for that group to estimate years of life lost (YLL), assuming that the average age at death was at the midpoint of a given interval. We calculated preventable mortality and mortality caused by non-utilisation of services or by use of poor-quality services in LMICs by GBD region and condition type by summing across countries and age bands by sex. Uncertainty intervals were estimated by using the upper and lower bounds on the uncertainty intervals for death estimates from the 2016 GBD study. As a simplifying approximation for the aggregate uncertainty

in the presence of unknown correlations between estimation errors for age groups by sex, causes, and countries, we estimated uncertainty bounds for mortality totals by treating estimation errors as fully correlated between age and sex groups for a given cause in a country, but treating errors as independent across countries and diseases.

We conducted several sensitivity analyses. As a high-income reference group might not be a feasible standard of comparison for some LMICs, we used four countries identified by the Commission on Investing in Health as best performing middle-income countries (China, Cuba, Costa Rica, and Chile) as the reference group.³⁴ The incidence ratio approach to account for mortality that could be prevented by public health (ie, outside the health system) also removes deaths that can be averted through primary care (eg, proper hypertension management can reduce myocardial infarction risk). As an alternative approach, we adjusted mortality for different underlying frequencies of risk factors by applying the joint population attributable fraction of behavioural, environmental, and occupational risks for disease. This approach standardises disease risk across countries.³³ Because the data on service utilisation from World Health Surveys were from 2002–03, we conducted a sensitivity analysis in which we increased utilisation prevalence to the next highest income group to more closely approximate current service utilisation (eg, low-income countries were given the average utilisation prevalence for lower-middle income countries). Finally, as an alternative to using so-called poor performer CFs for the mortality among non-users of the health system we assumed that non-users would simply face the country's observed prevailing CF.

All analyses were done in Stata version 14.1. We mapped mortality due to poor-quality services across LMICs using QGIS version 2.14.

Role of the funding source

The study sponsors did not have any role in the study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication. All authors reviewed the final manuscript and approved submission.

Results

Of the 19.3 million total deaths in 2016 in LMICs from the 61 specific causes and age groups considered in this study, we estimated that there were 15.6 million avertable deaths in LMICs (95% uncertainty interval [UI] 15.4–15.9 million), including 7.0 million deaths preventable through public health intervention (UI 6.8–7.2 million), and 8.6 million amenable to health care (UI 8.5–8.8 million). The amenable deaths should be viewed as a conservative estimate because some deaths currently counted under preventable could have been

	Avertable deaths		Amenable deaths		Years of life lost to poor quality (per 1000 population)
	Deaths preventable by public health interventions	Deaths amenable to health care	Deaths due to use of poor-quality services	Deaths due to non-utilisation of health services	
Andean Latin America	18 156	36 809	21 408 (58.2%)	15 401 (41.8%)	1129
Caribbean	37 167	43 742	29 861 (68.3%)	13 881 (31.7%)	1221
Central Asia	85 651	118 595	74 880 (63.1%)	43 715 (36.9%)	3322
Central Europe	41 689	53 014	41 779 (78.8%)	11 235 (21.2%)	1138
Central Latin America	40 102	208 265	143 847 (69.1%)	64 418 (30.9%)	6432
Central sub-Saharan Africa	291 999	273 717	142 044 (51.9%)	131 674 (48.1%)	8429
East Asia	875 835	1 335 030	664 893 (49.8%)	670 137 (50.2%)	23 023
Eastern Europe	428 032	294 519	187 790 (63.8%)	106 729 (36.2%)	6009
Eastern sub-Saharan Africa	804 363	721 395	349 785 (48.5%)	371 610 (51.5%)	19 668
North Africa and Middle East	440 319	521 815	325 743 (62.4%)	196 072 (37.6%)	17 590
Oceania	19 707	20 721	12 742 (61.5%)	7 980 (38.5%)	559
South Asia	1 900 170	3 016 686	1 944 044 (64.4%)	1 072 641 (35.6%)	81 540
Southeast Asia	515 460	788 335	481 259 (61.0%)	307 075 (39.0%)	19 657
Southern Latin America	10 010	39 488	29 229 (74.0%)	10 258 (26.0%)	1118
Southern sub-Saharan Africa	258 889	152 119	85 709 (56.3%)	66 410 (43.7%)	4825
Tropical Latin America	78 825	210 086	157 573 (75.0%)	52 513 (25.0%)	6155
Western sub-Saharan	1 154 824	812 987	354 744 (43.6%)	458 243 (56.4%)	22 566
Total	7 001 198	8 647 323	5 047 330 (58.3%)	3 599 993 (41.6%)	224 381

Avertable mortality was defined as the sum of preventable deaths (averted through public health and other population-level intersectoral policies or interventions that prevent the disease or condition in the first place) and amenable deaths (averted by health care once a condition occurs). Amenable deaths comprised deaths due to use of poor-quality services and deaths due to non-utilisation of health services.

Table 2: Avertable and amenable mortality and mortality related to non-utilisation of services versus use of poor-quality services by region

averted through primary prevention in the health system. Of the excess deaths amenable to health care, an estimated 3.6 million were due to non-utilisation of health care services (UI 3.5–3.7 million), and 5.0 million were due to poor quality of available care (UI 4.9–5.2 million). 224 million YLL (UI 219–230 million) were due to poor quality of available care.

South Asia had the greatest mortality due to use of poor-quality health care at 1.9 million deaths (39% of global poor-quality service access mortality; table 2). Central Europe and Latin America had the highest percentage of amenable mortality due to receipt of poor-quality health services, whereas sub-Saharan Africa had the lowest, where a greater percentage were due to non-utilisation of services. Country results are available in the appendix (pp 9–13). Figure 1 maps mortality due to poor quality per 100 000 population. Poor-quality health care contributed to the most deaths per unit population in South Asia and central and west Africa. The total LMIC poor-quality mortality was 82 deaths per 100 000 population.

Figure 2 presents the mortality due to access to poor-quality services and non-utilisation of health services by condition type. Cardiovascular disease deaths made up 33% (2 817 000) of the amenable deaths in the total health system, of which 84% (2 358 000) were caused by use of poor-quality health services. After cardiovascular disease, deaths from neonatal conditions, tuberculosis, and road injuries comprised the most amenable deaths, with a

total of 1.5 million deaths due to use of poor-quality services and 1.2 million deaths due to non-utilisation of health services. Only 11% (53 000 of 477 000) of amenable cancer deaths and 15% (69 000 of 455 000) of amenable mental and neurological deaths were due to use of poor-quality health care, reflecting the low utilisation of health services for these conditions (appendix p 14).

In our sensitivity analyses, adjusting mortality by the population attributable fraction due to environmental and behavioural risk factors to exclude deaths preventable by public health or other upstream interventions as opposed to our reference base case approach based on adjusting incidence or prevalence to reference levels in high performing countries, yielded 7.0 million amenable deaths of which 4.4 million were due to use of poor-quality health services and 2.6 million were due to non-utilisation of health services (appendix pp 3–4). Considering the full disease burden that health systems face today—ie, without subtracting deaths that were potentially preventable outside the health system—13.3 million deaths were amenable to health care, 7.6 million from use of poor-quality health care and 5.7 million from non-utilisation of any health service. Comparison with a best performing middle-income country reference group, rather than our base case reference standard from high-income countries, resulted in 3.2 million deaths due to use of poor-quality services and 2.4 million to non-utilisation of health care. Restricting the UHC package to a narrower set of conditions reduced the number of avertable deaths to

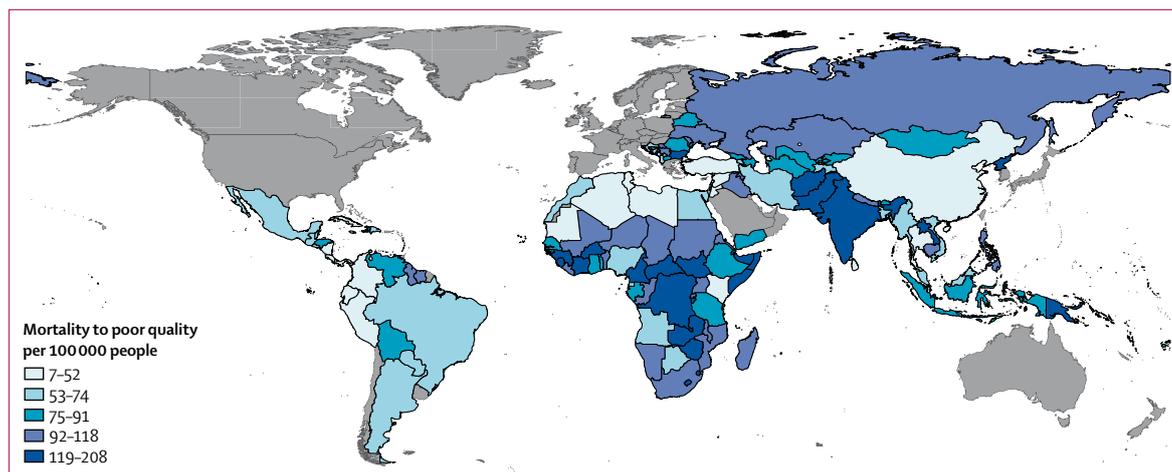


Figure 1: Mortality due to poor-quality health care by country

14.4 million (4.7 million due to poor-quality services and 2.8 million due to non-utilisation of services). Adjusting the World Health Surveys data on service utilisation to account for increases since 2002–03 resulted in a larger difference between non-utilisation of services (3.3 million, UI 3.2–3.4 million) and access to poor-quality services (5.3 million, UI 5.2–5.4 million). Assuming that the non-utilisation population and the population that utilised services had the same CF, we found that 5.7 million deaths were due to use of poor-quality services and 2.9 million deaths due to non-utilisation of services.

Discussion

8.6 million people in LMICs die from causes amenable to health care; of these, 5 million are people who have used the health system but received poor-quality health care. This is five times higher than all global deaths from HIV or AIDS and over three times higher than all deaths from diabetes. Deaths attributable to receipt of poor-quality health care constitute 58% of all amenable mortality in these countries. Because deaths in LMICs occur at younger ages, poor quality of health care takes a large toll on YLL: 224 million in the study countries. The estimate of amenable mortality is conservative since some deaths currently counted under preventable could have been averted in the health system through primary prevention of the condition.

Few comparison studies are currently available. A 2017 paper by the GBD collaborators³³ compared health systems by use of a similar approach but did not report on deaths. The authors noted large gaps between observed health system performance in many countries and the best performing comparators. Alkire and colleagues³⁶ reported amenable mortality of 8 million deaths for 38 conditions in 198 countries, 96.3% of which occurred in LMICs, using somewhat different methods (reducing amenable mortality by attributable risk factors rather than differences in incidence). They estimated that this mortality would result

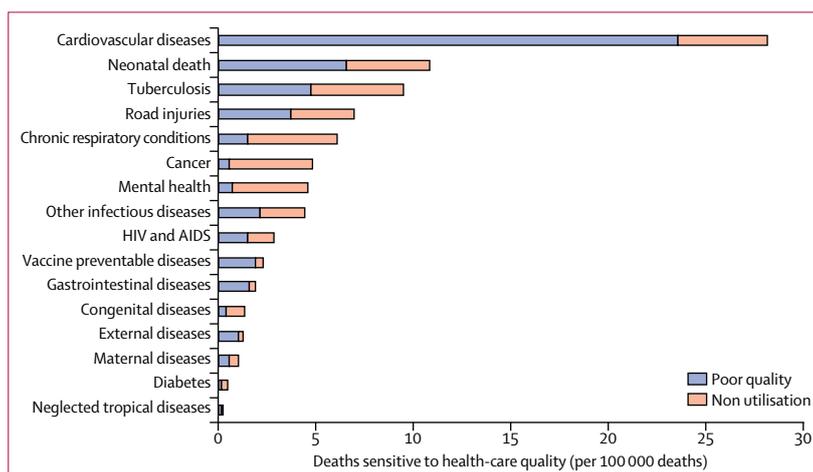


Figure 2: Mortality due to poor quality versus non-utilisation of health care by condition type

Reproduced from Kruk and colleagues,³⁵ by permission of Elsevier. External factors deaths are those due to poisonings and adverse medical events. Other infectious diseases deaths are those due to malaria, diarrhoeal diseases, intestinal infections, and upper and lower respiratory infections.

in US\$11.2 trillion in lost economic output between 2015 and 2020 in LMICs.³⁶ Nolte and McKee have tracked deaths due to conditions amenable to timely and effective health care in Europe and other Organisation for Economic Co-operation and Development countries for the past 15 years.^{37–39} Our findings cannot be directly compared with their work because we adjusted incidence or prevalence for all conditions to exclude deaths that could have been prevented outside the health system, whereas Nolte and McKee only exclude a portion (50% of cardiovascular deaths). However, they found that 21% of mortality under age 75 for men and 30% for women is amenable to good-quality health care; the corresponding figure from our study is 55% (all amenable deaths of those that were avertable), suggesting that poor-quality health systems are a greater impediment to improved population health in poor than in rich countries.

Given the global focus on UHC, we designated deaths in people who presented to the health system but were not properly managed or retained in health care as deaths due to receipt of poor-quality health care and deaths in those who did not use care for each illness as deaths due to non-utilisation of services. We found that across LMICs, poor quality contributed to more deaths than non-utilisation of services, (5·0 million poor-quality health care vs 3·6 million non-utilisation of services). Poor quality was a larger driver of mortality than non-utilisation of services in 14 of 17 geographic regions and 115 of 137 countries, including in many of the poorest regions with high mortality. Countries at different levels of development will adopt different UHC packages that might not include all of the conditions assessed here. However, this does not lessen the importance of quality of care: our modeling shows that if low-income countries fund only less advanced care, poor-quality services will account for almost two-thirds of the amenable deaths. Multicountry studies support the finding that mortality in LMICs for people using health-care services substantially exceeds that in higher-income countries.^{13,40}

Poor quality was an important driver of amenable mortality across conditions, including 84% of cardiovascular mortality; 81% of vaccine preventable diseases; 61% of neonatal conditions; and half of deaths from maternal causes, road injury, tuberculosis, HIV, and other infectious diseases. Averting deaths from cancer, congenital defects, mental health, and chronic respiratory conditions will require major efforts to boost utilisation of services along with improved quality. These figures can provide insights about potential policy directions for countries. The breadth of conditions for which poor-quality health care contributes to excess mortality suggests that health system-wide improvement is needed rather than disease-specific quality interventions.

As lower-income countries undergo demographic and epidemiological transitions, they will need to implement public health measures and strengthen the quality of health systems to continue to reduce mortality. After several decades of health gains in infectious diseases and child health, the residual mortality in LMICs is comprised of more complex and multimorbid conditions. Our study provides evidence that even in settings where progress has been made on UHC, deaths due to poor-quality services represent a substantial challenge. From a financing standpoint, underperforming health systems reduce the returns on UHC investments. However, when coupled with investments in health system quality, expanding insurance can result in major health gains as shown by Thailand, Rwanda, and Costa Rica, which have pursued this dual strategy and achieved substantial improvements in survival in child and maternal health.^{34,41,42}

Our study has several limitations. The incidence, prevalence, and mortality specific to cause, age, and sex come from the GBD, which has known limitations in

estimates, particularly for causes of death in LMICs with weak or non-existent vital registration systems.³³ Even in systems with strong vital registration systems, records can misidentify the underlying causes of death. The GBD group conducts extensive corrections to underlying data to address these. Comorbidity and disease history could be different between LMICs and high-income countries, which can result in some bias. Our approach for adjusting for primary prevention, which subtracts these deaths before the reference CF is applied, maximises preventable mortality while reducing amenable mortality. We did this to prioritise primary prevention, which is cheaper and often more effective than treatment. Some deaths that are currently categorised as preventable could have been averted through primary prevention in the health system. Our analysis does not measure morbidity so underestimates the effects of poor-quality health care on overall health. The last three points suggest that our conclusions about the health impact of poor-quality health systems are a conservative assessment.

An important limitation of our analysis is that data on health care utilisation were not complete for all conditions and countries. For conditions in which utilisation of service data were not available we used information for similar conditions and in countries where data were missing we imputed values based on factors known to affect utilisation of services. This is an imperfect approach but consistent with current literature.⁴³ These data gaps mean that for some conditions, particularly those that have only recently been recognised as global health priorities, such as mental health, cancer, and road injury, our estimates of the roles of quality and utilisation of services should be considered as provisional and need to be updated when better data become available. Mortality for non-users of health services was not directly available in the data—we applied a correction to address this. However, all sensitivity analyses supported the conclusion that poor-quality health care is a larger driver of amenable mortality than utilisation of services. Finally, our characterisation of uncertainty around estimates is imperfect, given that some sources of uncertainty were not included, and aggregate level uncertainty depends on correlations between estimation errors for constituent parts, which were difficult to quantify. Collectively, these limitations call attention to the need for better data on mortality and health system use in LMICs, which will be essential for countries' efforts to track progress on UHC and other health goals.

What do the results mean for countries pursuing UHC? Each country will chart its own course on UHC, with benefit packages reflecting health priorities and available resources. However, the central role of quality is not yet sufficiently recognised in the global discourse on UHC and is underappreciated in many countries. An important starting point is better measurement of health system quality. Some countries are attempting to incorporate this

into their UHC efforts. For example, South Africa has begun a nationwide Ideal Clinic programme and Tanzania has used a star-rating system to measure quality of primary care.⁴⁴ These results are being used to identify entry points for health-system improvement. Our analysis shows that at all levels of development and across different scopes of insured services, poor quality of care will limit the mortality reduction possible from greater coverage. Countries pursuing UHC must put better quality on par with expanded coverage if they are to substantially improve health.

Contributors

MEK developed the concept for this analysis with input from all coauthors and wrote the first draft. ADG and NTJ conducted data analysis and drafted sections of the paper. All authors revised the paper for intellectual content and approved the final version for submission.

Declaration of interests

We declare no competing interests.

Acknowledgments

This work was supported by the Bill and Melinda Gates Foundation. The content is solely the responsibility of the authors and does not represent the official views of the Gates Foundation. The authors would like to thank Catherine Arsenaault, Denizhan Duran, Dennis Lee, Hannah Leslie, Emilia Ling, Daniel McKenna, Mathilda Regan, Sanam Roder-Dewan, and Jigyasa Sharma for their assistance in this analysis. We are grateful for helpful comments from Malebona Matsoso, Barry Bloom, Peter Hansen, and Madhu Pai.

References

- United Nations. Sustainable development goals. 2015. <http://www.un.org/sustainabledevelopment/sustainable-development-goals/> (accessed Aug 28, 2017).
- Evans DB, Hsu J, Boerma T. Universal health coverage and universal access. *Bull World Health Organ* 2013; **91**: 546–46A.
- WHO. The World Health Report. Health systems financing: the path to universal coverage. Geneva: World Health Organization, 2010.
- Escobar M-L, Griffin CC, Shaw RP. The impact of health insurance in low-and middle-income countries. Washington, DC: Brookings Institution Press, 2011.
- Sommers BD, Gawande AA, Baicker K. Health insurance coverage and health—what the recent evidence tells us. *N Engl J Med* 2017; **377**: 586–93.
- Powell-Jackson T, Mazumdar S, Mills A. Financial incentives in health: new evidence from India's Janani Suraksha Yojana. *J Health Econ* 2015; **43**: 154–69.
- Ng M, Misra A, Diwan V, Agnani M, Levin-Rector A, De Costa A. An assessment of the impact of the JSY cash transfer program on maternal mortality reduction in Madhya Pradesh, India. *Glob Health Action* 2014; **7**: 24939.
- Chaturvedi S, Upadhyay S, De Costa A. Competence of birth attendants at providing emergency obstetric care under India's JSY conditional cash transfer program for institutional delivery: an assessment using case vignettes in Madhya Pradesh province. *BMC Pregnancy Childbirth* 2014; **14**: 174.
- Kruk ME, Leslie HH, Verguet S, Mbaruku GM, Adanu RM, Langer A. Quality of basic maternal care functions in health facilities of five African countries: an analysis of national health system surveys. *Lancet Glob Health* 2016; **4**: e845–55.
- Kruk ME, Chukwuma A, Mbaruku G, Leslie HH. Variation in quality of primary-care services in Kenya, Malawi, Namibia, Rwanda, Senegal, Uganda and the United Republic of Tanzania. *Bull World Health Organ* 2017; **95**: 408–18.
- Mohanam M, Vera-Hernandez M, Das V, et al. The know-do gap in quality of health care for childhood diarrhoea and pneumonia in rural India. *JAMA Pediatr* 2015; **169**: 349–57.
- Dare AJ, Ng-Kamstra JS, Patra J, et al. Deaths from acute abdominal conditions and geographical access to surgical care in India: a nationally representative spatial analysis. *Lancet Glob Health* 2015; **3**: e646–53.
- Souza JP, Gülmezoglu AM, Vogel J, et al. Moving beyond essential interventions for reduction of maternal mortality (the WHO Multicountry Survey on Maternal and Newborn Health): a cross-sectional study. *Lancet* 2013; **381**: 1747–55.
- Cazabon D, Alsdurf H, Satyanarayana S, et al. Quality of tuberculosis care in high burden countries: the urgent need to address gaps in the care cascade. *Int J Infect Dis* 2017; **56**: 111–16.
- Lozano R, Soliz P, Gakidou E, et al. Benchmarking of performance of Mexican states with effective coverage. *Lancet* 2006; **368**: 1729–41.
- Nolte E, McKee M. Variations in amenable mortality—trends in 16 high-income nations. *Health Policy* 2011; **103**: 47–52.
- WHO. World Health Statistics 2016: monitoring health for the SDGs. Geneva: World Health Organization, 2016.
- Nolte E, Scholz R, Shkolnikov V, McKee M. The contribution of medical care to changing life expectancy in Germany and Poland. *Soc Sci Med* 2002; **55**: 1905–21.
- Holland WW. European community atlas of "avoidable death". Oxford: Oxford University Press, 1988.
- GBD 2016 Causes of Death Collaborators. Global, regional, and national age-sex specific mortality for 264 causes of death, 1980–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* 2017; **390**: 1151–210.
- Di Cesare M, Khang Y-H, Asaria P, et al. Inequalities in non-communicable diseases and effective responses. *Lancet* 2013; **381**: 585–97.
- Siril HN, Kaaya SF, Fawzi MKS, et al. Clinical outcomes and loss to follow-up among people living with HIV participating in the NAMWEZA intervention in Dar es Salaam, Tanzania: a prospective cohort study. *AIDS Res Ther* 2017; **14**: 18.
- Zürcher K, Mooser A, Anderegg N, et al. Outcomes of HIV-positive patients lost to follow-up in African treatment programs. *Trop Med Intern Health* 2017; **22**: 375–87.
- Simonato L, Ballard T, Bellini P, Winkelmann R. Avoidable mortality in Europe 1955–1994: a plea for prevention. *J Epidemiol Community Health* 1998; **52**: 624–30.
- Forouzanfar MH, Alexander L, Anderson HR, et al. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2015; **386**: 2287–323.
- Vos T, Allen C, Arora M, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet* 2016; **388**: 1545–602.
- World Bank. World development indicators. Washington, DC: World Bank, 2014.
- Chang CY, Abujaber S, Reynolds TA, Camargo CA Jr, Obermeyer Z. Burden of emergency conditions and emergency care usage: new estimates from 40 countries. *Emerg Med J* 2016; **33**: 794–800.
- Countdown to 2030: tracking progress towards universal coverage for reproductive, maternal, newborn, and child health. *Lancet* 2018; **391**: 1538–48.
- Anand S, Barnighausen T. Health workers and vaccination coverage in developing countries: an econometric analysis. *Lancet* 2007; **369**: 1277–85.
- Kruk ME, Prescott MR, de Pinho H, Galea S. Are doctors and nurses associated with coverage of essential health services in developing countries? A cross-sectional study. *Hum Resour Health* 2009; **7**: 27.
- Abajobir AA, Abate KH, Abbafati C, et al. Measuring progress and projecting attainment on the basis of past trends of the health-related Sustainable Development Goals in 188 countries: an analysis from the Global Burden of Disease Study 2016. *Lancet* 2017; **390**: 1423–59.
- GBD Collaborators. Healthcare access and quality index based on mortality from causes amenable to personal health care in 195 countries and territories, 1990–2015: a novel analysis from the Global Burden of Disease Study 2015. *Lancet* 2017; **390**: 231–66.
- Jamison DT, Summers LH, Alleyne G, et al. Global health 2035: a world converging within a generation. *Lancet* 2013; **382**: 1898–955.
- Kruk M, Gage A, Arsenaault C, et al. High-quality health systems in the Sustainable Development Era: time for a revolution. *Lancet Glob Health* 2018; published online Sept 5. [http://dx.doi.org/10.1016/S2214-109X\(18\)30386-3](http://dx.doi.org/10.1016/S2214-109X(18)30386-3).

- 36 Alkire BC, Peters AW, Shrimo MG, Meara JG. The economic consequences of mortality amenable to high-quality health care in low- and middle-income countries. *Health Aff (Millwood)* 2018; **37**: 988–96.
- 37 Nolte E, McKee M. Measuring the health of nations: analysis of mortality amenable to health care. *BMJ* 2003; **327**: 1129.
- 38 Nolte E, McKee CM. Measuring the health of nations: updating an earlier analysis. *Health Aff (Millwood)* 2008; **27**: 58–71.
- 39 Nolte E, McKee CM. In amenable mortality—deaths avoidable through health care—progress in the US lags that of three European countries. *Health Aff (Millwood)* 2012; **31**: 2114–22.
- 40 Biccadd BM, Madiba TE, Kluys HL, et al. Perioperative patient outcomes in the African Surgical Outcomes Study: a 7-day prospective observational cohort study. *Lancet* 2018; **391**: 1589–98.
- 41 Vapattanawong P, Hogan MC, Hanvoravongchai P, et al. Reductions in child mortality levels and inequalities in Thailand: analysis of two censuses. *Lancet* 2007; **369**: 850–55.
- 42 Rajaratnam JK, Marcus JR, Flaxman AD, et al. Neonatal, postneonatal, childhood, and under-5 mortality for 187 countries, 1970–2010: a systematic analysis of progress towards Millennium Development Goal 4. *Lancet* 2010; **375**: 1988–2008.
- 43 Hogan DR, Stevens GA, Hosseinpoor AR, Boerma T. Monitoring universal health coverage within the Sustainable Development Goals: development and baseline data for an index of essential health services. *Lancet Glob Health* 2018; **6**: e152–68.
- 44 Egbujie BA, Grimwood A, Mothibi-Wabafor EC, et al. Impact of ‘ideal clinic’ implementation on patient waiting time in primary healthcare clinics in KwaZulu-Natal Province, South Africa: a before-and-after evaluation. *S Afr Med J* 2018; **108**: 311–18.