Access to emergency and surgical care in sub-Saharan Africa: the infrastructure gap

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Background The effort to increase access to emergency and surgical care in low-income countries has received global attention. While most of the literature on this issue focuses on workforce challenges, it is critical to recognize infrastructure gaps that hinder the ability of health systems to make emergency and surgical care a reality.

Methods This study reviews key barriers to the provision of emergency and surgical care in sub-Saharan Africa using aggregate data from the Service Provision Assessments and Demographic and Health Surveys of five countries: Ghana, Kenya, Rwanda, Tanzania and Uganda. For hospitals and health centres, competency was assessed in six areas: basic infrastructure, equipment, medicine storage, infection control, education and quality control. Percentage of compliant facilities in each country was calculated for each of the six areas to facilitate comparison of hospitals and health centres across the five countries.

Results The percentage of hospitals with dependable running water and electricity ranged from 22% to 46%. In countries analysed, only 19–50% of hospitals had the ability to provide 24-hour emergency care. For storage of medication, only 18% to 41% of facilities had unexpired drugs and current inventories. Availability of supplies to control infection and safely dispose of hazardous waste was generally poor (less than 50%) across all facilities. As few as 14% of hospitals (and as high as 76%) among those surveyed had training and supervision in place.

Conclusions No surveyed hospital had enough infrastructure to follow minimum standards and practices that the World Health Organization has deemed essential for the provision of emergency and surgical care. The countries where these hospitals are located may be representative of other low-income countries in sub-Saharan Africa. Thus, the results suggest that increased attention to building up the infrastructure within struggling health systems is necessary for improvements in global access to medical care.

Keywords Infrastructure, developing countries, access, emergency care, surgical care
Introduction
The lack of access to emergency and surgical care in developing countries has been identified as a critical gap in the development of health systems. Since the historic 1978 World Health Organization (WHO) conference at Alma Ata, primary health facilities have been prioritized as the main delivery mechanism for achieving good health outcomes, with an emphasis on immunization services. Increasing resources have also been placed at the hands of individuals and organizations doing work with infectious diseases, particularly HIV, tuberculosis and malaria. Yet even experts in those fields have recognized the paucity of services available for those afflicted with surgical conditions, calling surgery the ‘neglected stepchild of global public health’ (Farmer and Kim 2008).

While traditionally, primary health centres have delivered preventive care (e.g. vaccinations) and hospitals have delivered more labour and cost-intensive curative care, surgical care can be integrated at all levels in a tiered way, with early referral from primary health centres to higher levels of care for more complex cases. This is consistent with the overall goal of developing a health system to improve health, and strengthening the system’s ability to respond to the needs of its population.

The need to develop adequate emergency and surgical services is increasingly evident as surgically treatable diseases, such as hernia repair, become a greater public health burden (Spiegel and Gosselin 2007; Galukande et al. 2010). The WHO acknowledged the need to provide essential surgical services when it began the Emergency and Essential Surgical Care project. As part of this project, a guide was developed in 2003 outlining minimum district hospital standards in the area of surgical care: personnel with appropriate education and training, practical continuing education programmes, appropriate physical facilities, suitable equipment and instruments, a reliable system for supply of drugs and medications, and a quality system including standard operating procedures and clinical guidelines (WHO 2003). If the minimum standards outlined by WHO are to be met, facility-level needs must be considered. This study evaluates the capabilities of the health care facilities in several sub-Saharan African countries in order to provide a baseline understanding of the infrastructure gaps that must be overcome to expand access to emergency and surgical care in the context of developing countries.

Methods
We based our study on the Demographic and Health Surveys (DHS), which is a worldwide project funded by the United States Agency for International Development (USAID), in conjunction with local governments (ministries of health and bureaus of statistics). Service Provision Assessments (SPA) are submodules available for some DHS surveys that provide information based on surveys conducted in health facilities and communities regarding their quality, infrastructure, utilization and availability. SPA data are derived from four main types of collection tools: (1) facility resources questionnaires, in which interviewers collect information on resources, support systems and facility infrastructure elements needed to meet international health standards; (2) observation protocols, in which observers assessed adherence to standards of care for specific medical services; (3) provider interviews; and (4) exit interviews with clients who had been observed receiving a medical service. Surveys are conducted consistently across different countries. Additional details on the methods of SPA data collection are available on the DHS website under the SPA Final Reports for each country (Ghana Statistical Service et al. 2003; National Coordinating Agency for Population and Development [Kenya] 2005; National Bureau of Statistics [Tanzania] and Macro International Inc. 2006; Tanzania National Bureau of Statistics 2007; Uganda Ministry of Health 2007; National Institute of Statistics [Rwanda] and 2008; Ministry of Health [Uganda] and Macro International Inc. 2008).

Below we describe the variables chosen and their methods of measurement, as well as data sources (including data collection and processing). The infrastructural elements chosen are based on both structure and process in the classic Donabedian ‘structure-process-outcome’ framework (Donabedian 1966; Qu et al. 2010) for assessing the effectiveness of health care delivery.

Variables and methods of measurement
Based on our experience, recommendations by the WHO (WHO 2003), and availability from recent DHS country surveys, we chose to evaluate six key components (aside from personnel) required for a functioning district surgical service: basic infrastructure, equipment, medicine storage capability, infection control, quality systems, and education. Details of the specific components for each of these inputs are shown in Table 1, as defined by the DHS. Below we outline the role these elements play in supporting surgery and emergency care.

Basic infrastructure is a measure that encompassed elements of physical infrastructure, such as running water and electricity, and overall capacity to support 24-hour emergency services. It is important to note here that it was the capacity to provide 24-hour emergency care, rather than the actual availability of this service, that was assessed. Not all health facilities (such as clinics) are expected to provide 24-hour emergency care, but because emergency care can be life-saving, it is important to...
assess the ability to provide this care (Kobusingye et al. 2005; Jagim 2007; Kruk 2008).

Of the variety of DHS measures under the equipment category, we selected two indicators that are particularly relevant to emergency and surgical care. First, did the health facility have a system in place to repair buildings or other infrastructure? Second, did the facility have the ability to process equipment for reuse either through sterilization or disinfection? The second measure was judged by availability of resources necessary for processing equipment for reuse and staff’s basic knowledge of equipment maintenance procedures (e.g. protocols for appropriate sterilization techniques) (Cheng 1995).

Medicine storage capability, which is vital to the ability of a health facility and health system to provide safe and timely

| Table 1  Definitions of infrastructure elements for survey |
|-----------------|-----------------------------------------------------------|
| **Infrastructure element** | **Definition** |
| **Basic infrastructure** |  |
| Physical infrastructure | • Functioning latrine  
• Protected waiting area  
• Basic level of cleanliness  
• Year-round water supplied in facility by tap or available within 500 metres of facility  
• Routinely available electricity during service hours or backup generator with fuel |
| Components to support 24-hour emergency services | • Adequate physical infrastructure (as described above)  
• On-site emergency treatment  
• Capacity to monitor a seriously ill patient overnight until transfer  
• Two qualified providers  
• 24-hour duty or on call schedule  
• Available overnight bed  
• 24-hour emergency communication |
| **Equipment** |  |
| Building or infrastructure repair | • System for maintenance and repair of building or infrastructure |
| Equipment processing | • Staff knowledge of processing time for at least one method of equipment processing (e.g. autoclave, dry heat sterilization, boiling/steaming, or chemical disinfection)  
• Passive timer |
| **Medicine storage capability** |  |
| Good storage conditions | • Medicines stored in dry location, off the ground and protected from sun, water, pests and rodents |
| Adequate stock monitoring | • No expired items  
• Items stored by expiration date  
• Up-to-date inventory available |
| **Infection control** |  |
| Availability of infection control items | • Availability of soap, running water, sharp box, latex gloves and disinfectant in assessed areas |
| Adequate disposal system for infectious waste | • Collection and disposal of infectious waste, either externally, incinerated, burned in a protected area or pit, or dumped in a protected area or covered pit  
• No unprotected infectious waste observed in any service site or waste disposal area on day of survey |
| **Education** |  |
| Training | • At least 50% of interviewed providers report having received pre- or in-service training within past 12 months |
| Personal supervision | • At least 50% of interviewed providers report personal supervision within past 6 months |
| **Quality systems** |  |
| Management capability | • Management committee meetings at least every 6 months  
• Documentation of recent management committee meeting |
| Quality assurance | • Report of quality assurance activities  
• Documentation of at least one quality assurance activity |
| Referral systems | • Observation of referral notes or patient records routinely given to patients for referral |
care, was assessed by evaluating supply and monitoring of medication (Froese 1991; United Kingdom Department for International Development 2005). Facilities were checked to determine the percentage of assessed items that were stored in dry locations off the ground and protected from water, sun, rodents and pests. The percentage of medications that were up-to-date and categorized by expiration date was also established.

functional health facilities of all levels of care should have basic infection control materials (e.g. soap, gloves) available, as well as a system for infectious waste disposal (Nettleman 1993; Shears 2007; Pittet et al. 2008). The availability of soap, running water, sharps boxes, disinfectant and latex gloves was assessed in all facilities (except the immunization area and sick child areas). Facilities were also checked for safe methods of infectious waste disposal and absence of unprotected infectious waste on the day of the survey. Accepted methods of disposal were external disposal and incineration or dumping in a protected area or pit.

The fifth element assessed was systems of quality control (Walker 1983; Reerink 1989; Veldhuyzen van Zanten 1996). Is there a system in place—with management, quality assurance and referral systems—to carry out the complicated co-ordination and delivery of care to patients, and self-monitoring for improvement? While a great deal of emphasis has been placed on the importance of collecting data on quality, rather than simply having this data available, personnel should be allocated to ensure that hospital processes and quality measures are evaluated in a systematic fashion, with a mechanism for feedback to improved patient care.

The last element assessed was that of education for health workers in health facilities. Continuing education and training for health care providers is crucial to the development of programmes geared towards improved access to surgical and emergency care (Wallerstein and Weinger 1992; Becker and Morawetz 2004; Dovlo 2004a; Basri et al. 2009). We assessed education with two variables: (1) did at least 50% of interviewed providers report having received pre- or in-service training within the past 12 months; and (2) did at least half of interviewed providers report personal supervision of their work within the past 6 months?

Study setting and data sources
We chose to study hospitals and health centres in the five countries of Ghana, Kenya, Rwanda, Tanzania and Uganda due to availability of DHS data for the variables of interest. We abstracted data on facility-level needs from the SPA of each country which are available in PDF format online. No data used in this study were obtained by authors on site. Each SPA survey is based on a nationally representative sample of at least 400 health service sites, ranging from dispensaries to hospitals, covering both public and private (including non-governmental and faith-based) facilities. All hospitals (national referral, regional and district or district-designated hospitals) were purposely included in the sample, and the rest of the facilities were sampled to obtain both national and zonal estimates. The sampling strategy was intended to provide nationally and regionally (sub-nationally) representative data. While the number of eligible functioning facilities depended on the country (e.g. 5633 for Tanzania; 3000 for Uganda), the final sample of facilities in each country covered approximately 10–15% of all facilities in the country. Data were then weighted to represent the actual distribution of facilities in each country.

A rigorous data-verification process was used in the survey process, where all questionnaires were checked after data entry. A sample of questionnaires was also compared with the sample design. The data were then entered twice, and then re-verified. Any discrepancies or missing data were resolved through a strict editing or imputation process standardized by the DHS. Paper data were entered electronically using CSPro, a software package designed and implemented by Macro, the US Census Bureau and others (US Census Bureau 2010). The following countries were studied (year of study in parenthesis): Ghana (2002), Kenya (2004), Rwanda (2001), Tanzania (2006) and Uganda (2007). We used the most recent data available for each country at the time of analysis. When data were not available from the SPAs, supplemental information from other sources such as WHO were used.

Data analysis
After data from each country’s SPA were compiled, results from hospitals and health centres were compared as well as results across the five countries. Descriptive analyses were conducted and we calculated the percentage of hospitals and health centres that have met minimum standards for surgical care in six different categories described by WHO (WHO 2003). For each of the six areas of analysis—basic infrastructure, equipment, medicine storage capability, infection control, managing quality control, and education—the minimum standards set according to WHO recommendations are detailed in Table 1.

Results
More than 2000 facilities were surveyed by DHS in total across the five countries, but specialist facilities (e.g. private maternity homes) or those with particular target client populations (e.g. stand-alone HIV voluntary and counselling centres) were excluded. Mobile units and health offices that did not provide clinical care were also excluded from the study. In the final sample, there were 691 facilities, comprised of 21.6% hospitals and 78.6% health centres. Details about specific methodologies in each country have been described in the respective SPA reports of each country (Ghana Statistical Service et al. 2003; National Coordinating Agency for Population and Development [Kenya] 2005; National Bureau of Statistics [Tanzania] and Macro International Inc. 2006; Tanzania National Bureau of Statistics 2007; Uganda Ministry of Health 2007; Ministry of Health [Uganda] and Macro International Inc. 2008; National Institute of Statistics [Rwanda] 2008).

Table 2 illustrates the number and distribution of facilities sampled across the surveyed countries. Facilities surveyed ranged from those that were governed wholly by the government, wholly by the private sector (or faith-based organizations), or a combination of public–private management.

Figure 1 shows the wide variation of availability of basic physical infrastructure across countries and facilities. It might be expected that a smaller percentage of health centres have dependable electricity, for example, but even a significant
number of hospitals (as many as 78% in Tanzania) are not equipped with basic building resources. When we evaluated existing capabilities to provide 24-hour emergency care, even the country with the highest percentage of hospitals (Rwanda) has only 50% of hospitals with the components necessary for provision of acute 24-hour care.

Figure 2 illustrates that while a majority of hospitals have a system established to help repair large infrastructure or building problems, fewer facilities had equipment and staff who could competently utilize the equipment at their facility. In hospitals, this ranged from 41% in Tanzania to 61% in Kenya.

Figure 3 shows that while in each country all facilities have a similar proportion that can store medicines away from heat, water, rodents and pests (46–59% in Uganda to 89–91% in Kenya), when the inventory was actually checked for accuracy and expired medication by an observer, a significantly lower proportion of health facilities had adequate monitoring: as low as 14% in health centres and 18% in hospitals in Tanzania.

Figure 4 shows that the proportion of facilities with adequate infection control materials was dramatically low, even in hospitals (0% of hospitals in Tanzania had these materials available in assessed areas). Uganda had the highest coverage of facilities with the availability of these materials as well as proper disposal (verified by observation) of infectious waste.

Figure 5 shows the results of health facilities in the countries we studied in the areas of management practices, quality assurance activities and referral systems. Management committee meetings and documentation of these meeting seemed present in the majority of countries at least on the hospital level, but were less prominent in health centres across countries (except in Rwanda, where health centres outperformed...
hospitals in this area). This pattern was similar in the area of quality assurance as well as referral systems (except referral systems in Uganda, where 39% of clinics had observation of the existence of a referral system and only 5% of hospitals).

Figure 6 shows the results of the percentages of facilities, by type and across countries, which have some type of education programme in place for their health workers.

Discussion

Our results revealed dramatic deficiencies in infrastructure and health worker training in all countries studied. Shortfalls in all six categories—basic infrastructure, equipment, medication storage, infection control, quality control and education—are evident. Most literature in emergency and surgical access in
**Figure 4** Availability of infection control materials and disposal of infectious waste across health facilities. Key: Availability = availability of soap, running water, sharp box, latex gloves and disinfectant in assessed areas. Waste = appropriate collection and disposal of infectious waste and no observed unprotected infectious waste (please see Table 1 for further definitions). Hospital-level data for Tanzania and health centre-level data for Uganda is ‘0%’, not missing data.

**Figure 5** Health care management systems (management committees, quality assurance and referral systems) across health facilities. Key: MM = management committee meetings at least every 6 months and documentation of a recent meeting. QA = quality assurance activities in place and documentation of at least one QA activity. RF = referral system in place, where patients are sent with records or referral note (please see Table 1 for further definitions). No data available for Rwanda in QA and RF sub-elements.
sub-Saharan Africa is focused on shortages of health workers (Hagopian et al. 2004; Dovlo 2004a; Dovlo 2004b; Bergstrom 2005; Hagopian et al. 2005), following the Donabedian ‘structure-process-outcome’ model (Qu et al. 2010) for assessing health care delivery on which the conceptual framework of this study is based. However, in this study we concentrate on facility infrastructure and training gaps.

Fewer than half of all hospitals in the five countries have the capacity to provide 24-hour emergency care, and less than 65% of all hospitals have even basic infrastructure components such as reliable sources of water and electricity. In clinics, the availability of basic infrastructure is even lower, ranging from 7% to 35% of facilities. As mentioned in the WHO Safe Surgery Saves Lives Initiative, operating theatres must be adequate in size and lighting, and be sourced with dependable electricity and water (Van Vonderen 2008). For any facility such as a district hospital that is expected to provide anything more than minor surgery, there should be a back-up electrical generator. These results indicate a lack of basic infrastructure that prevents availability of adequate emergency services.

While more than half of hospitals across countries have building repair systems, less than half have equipment repair and maintenance services. Promoting awareness of the importance of equipment may be necessary to spur health centres and hospitals that provide surgery to consider investing in equipment maintenance. For example, incorporating mechanisms of delivering oxygen, either via cylinders or centrally through pipelines, at the initial phase of facility construction is necessary to ensure the availability of essential equipment. Peripheral rural health centres would benefit from mobile equipment, such as mobile oxygen concentrators.

Ensuring the availability of functioning equipment and supplies relies on a planning and procurement process that is essential to proper functioning of a health care system. Beyond the physical infrastructure and equipment, the systems designed to support these structures are essential. Funders and managers must consider the need for maintenance personnel and funds for maintenance, repair and replacement of machines or their parts. While each site (e.g. health centre, district hospital) will not necessarily need to hire its own team of engineers, plans must be made for periodic equipment maintenance and routine checks for impending failure/technology updates which may be conducted by outside teams. We show that these support systems—whether they are repair, medicine inventories, infection control or quality systems—are grossly lacking in hospitals and health centres in the five countries.

In addition to equipment, provision of emergency and surgical procedures also requires basic infection control measures. It is striking that so few facilities (from health centres to hospitals) have basic materials to control infection (e.g. soap, running water, sharps box, gloves and disinfectant). Any services offered in a facility beyond the most basic of surgical procedures warrant equipment, for example, that types and screens blood to ensure safe blood transfusion. The WHO Global Strategic Plan for Universal Access to Safe Blood Transfusion has presented a goal that more than 75% of hospitals have an operational transfusion committee (Krug 2008). In order to meet this goal, the severe lack of infection control material in developing countries shown in this study must be addressed. As emergency and surgical equipment needs to be sterilized before each patient use, it is important to consider how the facility plans to sterilize its equipment: should an autoclave be built, or will chemicals (e.g. hydrogen peroxide plasma, formaldehyde) be used?

In the same vein, health care management systems—which we evaluate by assessing the presence of management committees, quality assurance and referral systems—are critical to helping health facilities provide better care. Not only are records...
and health information systems crucial to providing safe surgical care, but systems must also be established that allow administrators to assess the care they currently provide and to track their progress in delivering good care. Given our findings of the wide range of components of management systems (a referral system as low as 5% in hospitals in Uganda), this is a critical area where investment must be made to strengthen the health care system’s ability to deliver surgical care.

Finally, professional development for practitioners is often lacking in resource-limited settings, as we show in our survey. Yet continuous education is important not only for the safety of patients, but also for motivating providers in more rural areas, who often complain of professional (and social) isolation. Continuous education can take different forms including periodic visits to or from referral hospitals. In Uganda, for example, some surgeons working in regional or national hospitals are expected to make 2–3 day visits to district hospitals to provide supervision and real-time feedback of the surgical skills of the providers in the district hospital. Other options exist, such as telemedicine consultations (increasingly common in middle-income countries but less so in low-income countries) or even the mailing or distribution of educational materials. There should be a mechanism to make or encourage health care workers to actively seek continuous medical education (CME); one possibility is to introduce re-registration (which exists in many countries) and make proof of CME attendance a prerequisite for re-registration.

The significant infrastructure gaps in sub-Saharan Africa found in this study are consistent with results from recent literature on surgical and emergency services in other developing countries (Kushner et al. 2010a). To conceptualize these health system needs holistically, one can compare the results of this study to the well-publicized idea of the ‘surgical safety checklist’, intended to reduce medical errors during surgery (Haynes et al. 2009). We propose that a similar basic checklist should be made for health facilities in developing countries to ensure that facility deficiencies on a systems level can be reduced. While the surgical checklist requires minimal resources, it has been shown to increase the provision of basic surgical safety and can be deployed incrementally. In the same fashion, we propose that we can increase the ability of health systems to deliver emergency and surgical care in incremental ways by ensuring health facilities meet a checklist of minimum facility standards.

Improvement in any of the six areas that are evaluated in this study is desirable and has potential to lead to substantial improvements. Because the foundational elements of quality medical services are interconnected, deficiencies in one area can undermine adequacy in numerous other aspects of care. One could imagine, for example, that not having a reliable source of electricity or water could threaten the ability to deliver quality health care because it directly affects competency in at least four measures of competency that were considered in this study: ability to provide 24-hour care, equipment use, storage of medication and infection control. While this means it is important to prevent shortages of the vital resources analysed in this study, it also means advancements in one area can lead to widespread progress. Investing in resources and projects that lead to improvements across several areas is possible and cost-effective. For example, measures such as maintaining essential hospital equipment (Cheng 1995) and training health care workers (Cheng 1995; Bickler and Spiegel 2010; Kushner et al. 2010b) have already shown that small investments in developing nations can lead in the short-term to minor systemic changes that in the long-term result in widespread improvements in health care functionality.

Limitations

One of the limitations of this study is that the health facilities surveyed are not homogenous, and even within categories of ‘hospital’, ‘health centre’ and ‘clinic’, there are likely wide-spread variations in ownership, funding, providers, staffing, urban/rural settings and availability of services. All hospitals (national referral, regional and district) are included in the sample, which makes our hospital estimates conservative in the sense that the WHO recommendations for the capabilities of district-level hospitals require that all hospitals have basic facilities. On the other end of the spectrum with the clinics, however, some of these smaller health centres in our sample, particularly in Rwanda and Tanzania, were dispensary providers or health posts that may not need certain elements (such as basic physical infrastructure, medicine storage capability) that we assessed.

Another limitation is that these data were collected at different points in time (as early as 2001 in Rwanda, and as late as 2007 in Uganda) and therefore may not be comparable since availability of these support structures could have changed. Nevertheless, we believe that given the lack of knowledge in these areas, the fact that these data are generated from the same survey questions, trained personnel and sample methodology suggests that our methods provide adequate evidence of resource gaps.

Furthermore, we did not conduct analyses at the individual clinic or hospital level. For example, the number of clinics that were consistently able to meet minimum standards of preparedness is unknown. Facilities that met the minimum standards described in Table 1 for each of the six categories we analysed could be considered capable of providing adequate emergency and surgical medical services. Because our analysis was conducted at the country level, we only looked at aggregate data from SPA on the number of facilities reporting certain activities and characteristics. Our study did not identify hospitals that were able to provide quality care in all six areas of analysis. Further research with additional geographical or individual facility levels of analysis are necessary to more narrowly define areas with significant shortfalls in infrastructure. Comparing private and public facilities may also help in designating areas with the most significant resource gaps. Value can still be found, however, in considering the overall quality of surgical and emergency services, and identifying the health service deficiencies in the five African countries we chose to compare.

The DHS data enables assessment of national health care resources and their ability to perform the basic function of providing notes or patient records for patients who are referred to a higher-level of care. For this critical metric, only at two
facilities did half of the patients receive a note or record. Referral systems in Africa are known to function poorly, not only because actual referrals do not occur (as our findings show) but because patients bypass the system (Lowe et al. 2001). It could be, however, that patients bypass the system because the existing systems are poorly managed. More research and action in this area is necessary to improve patient transport, both pre-hospital and inter-hospital.

Overall, documentation of these structural barriers is essential to the accumulation of knowledge and action for emergency and surgical care in sub-Saharan Africa. The establishment of systematic methods to evaluate emergency and surgical facilities is needed to improve the quality of medical services. Additionally, incorporating the results of evaluations into national vital statistics and considering them in the context of infrastructure gaps within health systems is critical to improving health outcomes in sub-Saharan Africa.

Conclusions

Just as in any health initiative, the basic infrastructure required for surgery and emergency care must be in place before those services can be scaled up. While human resource challenges receive most attention from governments, efforts to address these should be implemented in tandem with systems-level changes like investment in facilities, establishment of quality systems and determination of processes of care (e.g. equipment repair and maintenance; storage of medicines; infection control).

While there is growing acknowledgement of the emergency and surgical needs of populations, and the striking ability to decrease morbidity and mortality from addressing these needs with increased resources, our findings highlight gross deficiencies in current infrastructure to provide these services. Previous literature has shown the importance of each of the components we studied in relation to improving access, but our study highlights the spectrum of areas (from physical infrastructure to quality systems such as referrals and education) that are required for scale-up (or even start-up) of interventions that can begin to address the emergency and surgical needs of people in the developing world.

The findings in this study do not imply that care of patients needs to wait until optimal infrastructure is established. Not long ago, donors, bilateral and multilateral organizations and other technical bodies realized that to stem the tide of HIV/AIDS, for example, an enormous initial investment was required—and was, in the long-term, more cost-effective—in the fight to stem the tide of the rapidly spreading virus. A sizeable proportion of these funds was precisely for strengthening infrastructure support, ranging from blood supply adequacy and laboratory infrastructure (Centers for Disease Control and Prevention 2008; Abimiku 2009). Rather than sitting idly by, awareness of the lack of infrastructure to provide a wider array of services such as surgery as well as more definitive care should be a call to action to build and rebuild infrastructure and systems as emergency and surgical care is scaled up across sub-Saharan Africa (Farmer 2005).

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References


