

INCREASING ACCESS TO SURGICAL SERVICES IN  
RESOURCE-CONSTRAINED SETTINGS IN SUB-SAHARAN  
AFRICA

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It is still work in progress and we look forward to further valuable contributions from all participants at the meeting.

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## Summary

This working paper provides some basic information that will form the starting point of our discussions at the Bellagio meeting and closely follows the agenda of the meeting with sections corresponding to meeting sessions. In writing the paper we are keenly aware of the paucity of sound information on which to base our conclusions.

Following a presentation of estimates of surgical disease burden and the cost-effectiveness of surgical care provided in district hospitals, we discuss specific surgical procedures that can be performed in the district hospital setting. Most of these operations are to treat obstetrical complications, injuries from trauma and violence, as well as acute general surgical conditions.

In the following section we define what we mean by access and describe the main determinants of access to surgical services. In addition to educational and cultural factors of the population, they include availability of surgical services and the confidence the local population has in these services; the health-seeking behaviour of the people; and the capacity and willingness of individuals to pay for transportation, services, and the treatment.

We then consider the constraints in providing surgical services at the district level. There are insufficient human resources, particularly because emergency surgery requires the district hospital to be staffed 24 hours, 7 days a week. Transportation of patients to the hospital poses a particular bottleneck. District hospital facilities that now exist are too few and poorly equipped, supplied and staffed. Existing district hospitals must be improved and new ones established. There is a need for increased funding to maintain surgical services at the district hospital not only for the short term but to sustain operations long-term.

Finally we address the critical shortage of qualified surgeons and the impossibility of their being available to serve the rural districts now or any time soon. We support the compelling argument that non-doctors need to be trained to perform the necessary operations. Mozambique, Tanzania, and Malawi have successfully developed cadres of surgically trained medical assistants and their experience will be shared during the conference. What is important to such role-shifting strategy is that training produces competent individuals who can do the prescribed operation with verifiable quality and results, that there is supervision and monitoring of outcome, and a program for continual skill improvement. It is also important to develop strategies to retain staff.

At the end of each section, we pose key questions for consideration in development of the roadmap. The final section outlines areas that the meeting can address once the formal review of the background issues is complete.

## Introduction

Each year injuries kill more than 5 million people and an estimated 500,000 women die from pregnancy related complications. Road traffic injuries are the leading cause of death in all age groups and the second leading cause of death in children aged 4 to 14 years. Death and disability in each of these groups can be corrected and to a certain extent prevented by using timely surgery as part of an overall public health strategy. Most of these essential and surgical services can be delivered at the first-referral level health facility (rural or district hospital, health centre, primary healthcare facilities) provided that the health care personnel possess some basic skills and equipment.

Many rural facilities in countries in sub-Saharan Africa are unable to provide effective basic surgical services because scarce health care resources at this level are mainly directed towards other preventive health programs. Patients with urgent and emergent conditions who are unable to reach specialist referral hospitals in the cities either die or live for the remainder of their lives with disabilities that are socially and economically costly to themselves and their families and to society.

Recent research suggests that it would be cost-effective for these rural facilities to be provided with basic equipment and for non-surgeons to be trained to conduct specific surgical interventions. The result would lead to increased life expectancy and productive lives for millions of poor people who are disproportionately afflicted by treatable surgical conditions. This is particularly important in the care of children and young people and in the prevention of maternal deaths and obstetrical fistulae in women with obstructed labour. When a district hospital is enabled to become a provider of basic surgical care, its overall effectiveness in providing non-surgical care is likely to improve.

This meeting will engage a group of experienced national policy makers and practitioners and representatives of international organizations to identify and promote key strategies to increase the access of poor people to basic surgical services in a cost effective way. The goals of the meeting are:

- 1 to take stock of what is known about the need to improve access to surgical services in sub-Saharan Africa, the cost-effectiveness of specific interventions and existing national and international efforts to support the delivery of these interventions.
- 2 to assess health system and human resource constraints to integrating surgical services at the district level within health systems in sub-Saharan Africa, and identify training programs, resource reallocation and policies required to tackle these challenges.

3 to prepare a roadmap of activities to improve access to surgical services in sub-Saharan Africa and to engage national and international stakeholders to advocate for and implement this roadmap

This paper closely follows the agenda of the meeting with sections corresponding to meeting sessions. The paper is not fully comprehensive but is intended to provide the backbone of information against which participants can raise and discuss issues that will lead to the preparation of a post-meeting roadmap of activities to improve access to surgical services in sub-Saharan Africa. The paper will be updated after the outcome of the meeting.

The following four sections address the first two goals of the meeting which will form the content of the first four sessions of the meeting.

A final section is devoted to addressing the third goal which is to develop the roadmap.

## Session 1: The scale of the problem

### Scale of surgical conditions and cost effectiveness of interventions

Surgery is at the end of the spectrum of the classic curative medical model and, as such, has not been routinely considered as part of the traditional public health model. However, no matter how successful prevention strategies are, surgical conditions will always account for a significant portion of a population's disease burden<sup>i</sup>, particularly in developing countries where conservative treatment is not readily available, where the incidence of trauma and obstetrical complications is high, and where there is a huge backlog of untreated surgical diseases[1]. Indeed the Millennium Development Goal of cutting the maternal mortality ratio by three quarters between 1990 and 2015 cannot be achieved without increasing access to obstetrical surgical services.

#### Global burden of surgical conditions

Unfortunately little evidence is available about the prevalence and incidence of surgical conditions especially for sub-Saharan Africa. It was only in the recently published second edition of Disease Control Priorities (DCP2)[2] that the first estimates of disease burden related to surgical conditions were published and these are considered to be conservative. According to these findings, surgical conditions account for 11% of the world's Disability Adjusted Life Years (DALYs)<sup>ii</sup> - as high as 15% for Europe and as low as 7% for Africa. Globally six conditions account for 81% of surgical DALYs:

- 1 *Injuries* account for 63 million DALYs, or about 4 percent of all DALYs and 38 percent of the world's estimated surgical DALYs.
- 2 *Malignancies* account for 31 million surgical DALYs, 19% of all surgical DALYs or slightly more than 2 percent of all DALYs.
- 3 Approximately one-third of *obstetrical complications*, including hemorrhage, obstructed labour, and obstetrical fistulas, are surgical, and these represent 10 million DALYs, 6% of surgical DALYs, or 0.7 percent of all DALYs.
- 4 Fifty percent of *congenital anomalies* are surgical, including cleft lip and palate, hernias, anorectal malformations, and clubfoot, represent about 14 million DALYs, or 9% of all surgical DALYs, or 1 percent of all DALYs.
- 5 *Cataracts and glaucoma* are major causes of blindness that can be treated surgically, and account for 8 million DALYs.

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<sup>i</sup> See Appendix 2 for leading causes of death, worldwide in 2000

<sup>ii</sup> An explanation of DALYs and their calculation is given in Appendix 1

6 *Perinatal conditions* are the sixth most common cause of surgical disease burden, and account for 7 million DALYs or 4% of all surgical DALYs.

*Surgical infections*, including infected wounds, superficial and deep abscesses, septic arthritis, and osteomyelitis, undoubtedly account for a significant portion of surgical DALYs, but the available data do not permit quantification.

#### Evidence of the burden of surgical conditions in Africa

According to the DCP2 findings, the estimated surgical DALYS in Africa are 38 per 1000 population, higher than other regions of the world, and are accounted for mainly by injuries (15), obstetrical complications (6), malignancies (3), congenital anomalies (3), perinatal conditions (3), and cataracts and glaucoma (2). However, the findings were based on very sparse data because there is little research information available about surgical conditions in Africa. In a literature search conducted for this paper, no population based study was found on the prevalence or incidence of surgical conditions in need of surgery in rural sub-Saharan Africa. Only one article, from 1984, was found that estimated the incidence and estimated need of inguinal hernia repair, and operation for strangulated hernia in rural Africa[3]. These estimates, however, are based primarily on western epidemiologic data on the incidence of these conditions. More precise estimates of prevalence, incidence, and natural history of similar surgical conditions in the African context are lacking.

Table 1 Estimated Surgical DALYS by condition and region

**Table 67.3** Estimated Surgical DALYS by Condition and Region  
(DALYs in millions followed by DALYs per 1,000 population in parentheses)

Condition	Africa	Americas	Eastern Mediterranean	Europe	Southeast Asia	Western Pacific
Injuries	10 (15)	7 (8)	6 (12)	7 (8)	20 (13)	13 (8)
Obstetrical complications	4 (6)	1 (1)	1 (2)	(<0.5)	3 (2)	1 (1)
Cataracts and glaucoma	1 (2)	(<0.5)	1 (2)	1 (1)	3 (2)	2 (1)
Malignancies	2 (3)	4 (5)	1 (2)	8 (9)	6 (4)	10 (6)
Perinatal conditions	2 (3)	1 (1)	1 (2)	(<0.5)	3 (2)	1 (1)
Congenital anomalies	2 (3)	2 (2)	2 (4)	1 (1)	4 (3)	3 (2)
Other	4 (6)	3 (4)	3 (6)	5 (6)	9 (6)	7 (4)

Source: WHO 2002 and authors' estimates.

In sub-Saharan Africa, the incidence of trauma following traffic accidents is increasing[4] but the rates for basic, life saving/morbidity averting trauma surgery are difficult to estimate. While this uncertainty is the case for trauma, the yearly incidence of emergency obstetric needs can be calculated based on the birth rate and the assumption that a minimum of between 3-5% of all

deliveries need emergency obstetric care to avoid mortality or severe morbidity[5]. Studies from Sub Saharan Africa indicate that access to emergency obstetric care is very low and even declining[6, 7]. Estimates of surgical need in Africa range from 1,000 to 5,000 major operations per 100,000 people, compared to actual major operation rates ranging from 150 to 263 in rural Ugandan and Kenyan districts, respectively.[8-10] Surgical rates in rural Malawi are 2.5% of rates in South America 20 years ago and less than 1% of rates in Europe and North America[11]. Importantly, these studies consider surgical output but not outcome or impact. The reasons for these gross differences in surgical output between high and low-income countries have not been explained.

### Cost effectiveness of surgical interventions

From the perspective of experience in the industrialized nations, surgery is viewed as expensive, individualized tertiary care intervention that may not be cost-effective. Recent studies[12] show that hospital surgical services which require no sophisticated care, provided in low-cost district hospitals, can be cost-effective, with a cost per DALY that is much lower than might have been expected, and on a par with other well-accepted preventive measures such as immunization for measles and tetanus and home care for lower respiratory infection.

In terms of cost effectiveness of interventions, the best estimates for cost per surgical DALY averted at a community health center range between US\$212 and US\$241. The cost per surgical DALY gained at a district hospital is cheapest for sub-Saharan Africa at US\$33 (range of US\$19 to US\$102) and most expensive for Latin America and the Caribbean at US\$94 (range of US\$47 to US\$164). Sub-Saharan Africa and South Asia are the cheapest, with estimates of cost per surgical DALY averted ranging between US\$33 and US\$38. This finding indicates that, from the perspective of providing surgical care, a district hospital is an exceptional “buy” in sub-Saharan Africa and South Asia, both areas with high disease burdens. Coupled with evidence that district hospitals are comparatively under-funded compared with national (tertiary) hospitals[13], a prima facie case exists for increasing support for district hospitals in developing countries. By comparison, even in areas with a high prevalence of HIV and very favourable compliance, the provision of antiretroviral therapy for HIV comes to \$300-500/DALY averted, and this therapy will have to be lifelong therapy. While surgery has received meagre funding relative to its potential cost-effectiveness, ARV therapy has been a primary funding priority of most donor agencies in the last several years. As a baseline, measles vaccination, the most cost-effective public health intervention known, is estimated at \$5-7/DALY averted[14]

It should be noted, however, that *DCP2* reaches much higher estimates of cost/DALY for some surgical services, typically those needing to be undertaken at a tertiary or referral hospital. For example, coronary artery bypass graft procedures, under the most appropriate circumstances, were estimated to cost between \$24,000 and \$72,000 per DALY.

## **Specific conditions that can be most effectively addressed at the district level**

Given the above findings, we have identified four categories of surgical conditions whose treatment is optimally conducted within a short travelling distance, whose treatment should be possible to provide at the district level and whose alleviation would reduce significantly disease burden in sub-Saharan Africa. The categories of conditions are: 1) obstetric complications, 2) trauma and violence, 3) acute surgical emergencies, and 4) non-acute conditions (blindness, congenital anomalies, other e.g. malignancies). The majority of these conditions are not preventable by public health measures. Early diagnosis is important as rapid surgical treatment may avert complications due to delay and thereby avert DALYs. If widely accessible, appropriate and affordable surgery may be available successful treatment of these conditions could have a significant cost/effective impact on the health of the populations.

Table 2 summarizes the specific conditions falling in the four categories that 1) are common 2) cause mortality and/or morbidity 3) are cost effectively treatable by basic surgery 4) could be operated and cared for at district hospital level. Studies are needed to determine the prevalence and incidence and the cost of averted DALYs per condition. Crude estimates are provided in Table 1 of incidence of the condition, the percentage of these conditions that need for surgical intervention and a calculation of how many interventions would be required in a population of 300,000. The implications of this table and the gaps in information in it will be discussed at the meeting.

### Obstetric complications

Obstetric complications are without doubt the main burden of disease where accessible basic surgery could cost effectively avert DALYs. Pregnancy is common in rural poor areas. It is estimated that about 15% of all fertile women (aged 15-50) are pregnant in sub Saharan Africa at any given time. Pregnancy is not a disease but the complications related to it are common. Table 2 lists a number of obstetrical complications that could be treated at a district hospital. The incidence of these conditions varies according to a number of factors such as availability of trained mid-wives, coverage of antenatal care, availability of different medicines, whether or not abortions are legal etc. There is clear evidence that between 1- 3% of all deliveries need a major obstetrical intervention to prevent maternal mortality. To avert obstetrical complication, early identification of potential risk pregnancies is vital in combination with referral to hospital where appropriate treatment may be provided, ranging from assisted delivery and blood transfusion to caesarean section. To reduce maternal mortality it is necessary to have an efficient chain of health providers, from the periphery to the hospital.

**Table 1: Incidence/prevalence of common surgical/obstetric conditions that may be treated at a district hospital and where the surgical intervention averts major morbidity or mortality**

	Condition	Estimated incidence of the condition <sup>iii</sup>	Min. need of surgical intervention for the condition	Type of surgical intervention	Minimum no. interventions /year/ 300 000 pop
<b>Obstetrical complications</b>	Abundant postp haemorrhage	5%	5-10%	Hysterectomy	
	Prolonged labour	5%		CS	
	Obstructed labour	1%		CS	
	Eclampsia	0.1-0.5%	5-15%	CS	
	Prolapsed cord	1%		CS	
	Labour with a scarred uterus	5-15%		CS	
	Foetal distress	5-10%		Vac extr, CS	
	Tubal pregnancy	2-3%		Laparotomy	
	Postabortion endometritis-myometritis/sepsis	n.a.		Hysterectomy	
	Postpartum endometritis-myometritis/sepsis	5%		Hysterectomy	
	Intrauterine fetal death	3-5%		Craniotomy	
<b>Total</b>		<b>3-5%</b>		<b>450-750<sup>iv</sup></b>	
<b>Trauma and violence</b>	Major limb fracture/injury			Reduction, PoP, traction, amputation	
	Burns			Debridement, escharectomy, Simple skin grafting	
	Joint dislocation			Reduction	
	Major soft tissue injury			Debridement/Amputation	
	Pneumo/hemothorax			Thoracic drain	
	Ruptured spleen			Splenectomi	
	Injury to the eye			Removal of foreign body/enucleation	
	<b>Total</b>				
<b>Acute surgical emergencies</b>	Strangulated hernia		30/100 000	Lap.tomy	100
	Intestinal obstruction			Lap.tomy	
	Intestinal perforation			Lap.tomy+anastomosis/Colostomy	
	Appendicitis			Appendectomy	
	Liver abscess			Lap.tomy, drainage	
	Major wound infection			Debridement	
	Osteomyelitis/septic arthritis			Drainage/decompression	
	<b>Total</b>				
<b>Non-acute surgical conditions</b>	Congenital Hernia			Hernioraphi	
	Hernia		175/100 000	Hernioraphi	500
	Breast cancer			Mastectomy	
	Chronic osteomyelitis			Curettage	
	Hydrocele			Hydrocelectomy	
	Urethral stricture			Dilatation	
	Prostate enlargement			SupraPubic Catheterization	
	Cataract			Lens enucleation	
Preventive circumcision		All men in fertile age	Circumcision		

<sup>iii</sup> In % of all pregnancies

<sup>iv</sup> Calculated based on fertility rate of 50/1 000 pop/year

	<b>Total</b>				
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Trauma and violence

In low- and middle-income countries the incidence of trauma and violence is increasing. In Africa, injury accounts for 7 of 15, and 5 of 15 leading causes of death in men and women, respectively in the 15-44 age group. Road traffic accidents are common and most probably account for a majority of DALYs in this group[15]. Interpersonal violence due to civil and international conflicts also exact a particularly heavy toll and precise mortality and morbidity data are difficult to obtain. In addition, these vulnerable displaced populations provide extreme challenges in health care provision[16]. Incidence of the conditions listed in Table 2 is unknown. In Nigeria about 50,000 persons die annually in road traffic accidents but little is known of how many of these deaths could have been averted if surgical care had been accessible. Caring for trauma patients is a multidisciplinary challenge. Besides surgical skills, knowledge of intensive care is needed as the severity of these conditions varies considerably. Care may be provided at different levels in the health system. Surgical care, such as wound sutures and treatment of infections may be provided at local levels while access to district hospital is needed to care for the more severe conditions listed in table 1. Studies are needed to estimate the incidence of the different conditions and the service adapted accordingly. A basic and systematic approach to diagnose and care for these conditions should be developed, where access to X-ray and other necessary technical services such as blood transfusion is assured. WHO Essential Trauma Care guidelines provide a template of staffing, skills, and infrastructure for low-income countries which can be adapted to specific contexts in building trauma systems. Despite the burden of injury, when compared to HIV (\$85/DALY) injury is very under-funded in terms of research (\$0.43/DALY)—this comes to approximately 170 times greater funding for HIV[17].

Acute surgical emergencies

Within this category we refer to surgical conditions that are acute but not caused by trauma. We exclude conditions, such as brain haemorrhage and vascular complication that require advanced treatment. The most common acute surgical emergencies are acute abdominal conditions including strangulated hernia and other forms of intestinal obstruction and perforation of the intestine, appendicitis. But also abscesses formations affecting any part or organ of the body, including the bone and joints. Patients with such conditions are often very sick as they tend to arrive late. Clinical experience of treatment for sepsis dehydration and other complication is necessary to save the life of these patients before and after the operation and availability of basic intensive care is required. Most of the conditions may be treated by basic surgical procedures and do not require advanced diagnostic tools.

Non-acute conditions

In this category we include; congenital anomalies, cataracts, and other non-acute surgical conditions. The common congenital anomalies include cleft lip and palate, hernias, anorectal malformations, and clubfoot. Numerous volunteer teams of plastic surgeons travel around the world correcting cleft lip and palate defects. Hernias and clubfoot can be treated most readily in

district hospitals provided appropriately trained surgical workforce is available. Hernias can become strangulated requiring emergency surgery. This complication can be avoided by elective repair of hernias. Clubfoot can be treated successfully non-surgically using corrective casts or braces provided that such intervention is undertaken in the first two years of life. Cataracts In 2002, the WHO estimates that close to 20 million people were blind due to cataracts. Blindness due to cataracts is correctable by extraction of the cataract and insertion of an intraocular lens.

Other common surgical conditions in this category that may be cost effectively treated to avert morbidity are hernia, hydrocele and urethral stricture. If hernias that cause symptoms are systematically operated on, it may be that the incidence of strangulated hernias decreases. Malignancies tend to arrive late and diagnosis may be difficult due to lack of pathologists and bad prognosis. However, it could be argued that breast cancer, which is not uncommon can be operated based on clinical diagnose if strict criteria are used. The incidence for sub-Saharan Africa has been estimated to be around 15 new cases/100 000 populations and year[18]. We have excluded other forms of malignancies as cost effective treatment to avert morbidity and mortality is difficult to claim. Nonetheless the district and lower level would be a key area of the health system to focus efforts at screening, early diagnosis of malignancies and referral for surgical care at a higher level, and this could be integrated with cancer control efforts in these countries.

#### International support for surgery

There are many international initiatives to address surgical conditions - particularly to increase access to care and treatment for obstetrical conditions - but overall surgical conditions are not given the international prominence and financial support required to address the surgical burden of DALYs.

WHO established a Clinical Procedures unit in the Department of Essential Health Technologies with a website designated to 'Surgery' as a health topic. This unit has developed a range of training materials, as part of the WHO *Integrated Management for Emergency and Essential Surgical Care*, and has initiated regional and country training workshops to strengthen local capacities in emergency and essential surgical (including anaesthesia) skills. Several of these training workshops, conducted jointly with Ministries of Health and in collaboration with partner NGOs, highlighted the need for a *Global Initiative for Emergency and Essential Surgical Care* that could integrate and synergize the work of the individual groups, leading to a more effective and widespread standardized training programme meeting the WHO minimum standards. Other major initiatives include the Essential Trauma Care project, FIGO Save the Mothers Initiative, The Canadian Network for International Surgery (CNIS), and the Ptolemy project. In addition there are numerous initiatives targeting specific conditions such as trachoma, cleft lip, club foot etc. There is a need to better coordinate international surgical initiatives including the work of key voluntary humanitarian surgical organizations (which primarily treat non-emergency or elective conditions), to rationalize service provision, and to identify and direct services to areas with the greatest unmet need.

### **Issues for consideration in developing the roadmap**

- 1.1 How do we obtain better data on burden of surgical diseases and cost-effectiveness of surgical interventions? How do we ensure the prospective collection of all relevant data in all future projects?
- 1.2 How do we provide more evidence to strengthen the contention that surgery should be considered an important strategy in public health?
- 1.3 How can international efforts to address surgical conditions be better coordinated between international organizations and with national initiatives?

## Session 2: Access to surgical services

*“Surgery at the hospital in rural Bukavu in western Democratic Republic of the Congo was actually functioning. The hospital had for the last 10 years received nothing from the Ministry of Health, they had only received some sporadic donations of materials and medicines from NGOs. The ward with newly operated women was full, they were all smiling while breastfeeding the newly born. I passed by a small room and asked the hospital director why the three women were sleeping in there. He replied, -they had a C-section three months ago, but they still haven’t paid the bill, so they have to remain here until their relatives can pay the 40 USD required, we cannot afford to provide service for free, then we would have to close down the hospital today. I grabbed into my pocket and found 120 USD. It got the women out, and gave me a painful memory of the harsh reality of poverty” (WHO consultant 2004)*

Despite the estimated high level of DALYs attributable to the above conditions, and although it is known that access to suitable interventions is very poor in most parts of sub-Saharan Africa, little has actually been published describing the extent of unmet need for surgical services. This is partly because no population studies have been conducted and also because there are few studies that describe the services available in rural areas and people’s access to them.

There are few studies on the availability of surgical service in sub Saharan Africa, but it is likely that it is at least ten times below the minimal needs. Most of published papers are hospital based and very little data is collected in the hospital except in operative logs—very little on outcomes. It is likely that few of the patients with emergent conditions make it to the hospital. Community-based prospective studies are critically needed to determine the number of deaths and disabilities that can be prevented with the provision of surgical services. Buruli ulcer, endemic to regions of Africa, is an illustrative example. If diagnosed early and excised, the development of major disabling wounds are prevented and patients returned to productive life. As has been demonstrated in Ghana, the diagnosis can be made by nurses or health attendants at the most basic village level.

Access to surgical services may be defined as the degree to which individuals are inhibited or facilitated in their ability to gain entry to receive surgical care and services from the health care system[19], and may be determined by educational and cultural factors as well as: availability of and level of confidence in surgical service provided, health seeking behaviors, capacity and willingness of the individual to pay for transportation, service and treatment.

### Availability of services

Availability of a service means not only that a surgical facility exists but that the service is also functioning. Even if there are political ambitions to offer such services, under-funded health systems are seldom capable of including surgery within the basic package of public health care activities. Surgery provided through the public system is often more or less “private” meaning that the patient has to pay for the surgical service and the material needed from their own

pocket[20]. In many countries district charity missionary hospitals have long provided the bulk of the secondary healthcare services including surgery. However, as financial support has declined and the situation has changed, most of these hospitals have been forced to charge for health care and many have been closed down.

Even when surgical services are available this will not guarantee access to them. Users of health facilities are not usually representative of the whole population in the catchment area of the facility. Distance, and the cost of transportation are factors that under represent the poor especially those living in remote areas[21, 22]. An unpublished study on health seeking behavior from rural Uganda showed that short distance to the health facility was a main determinant when seeking care. Another study found distance to be a more important factor than the cost of the service[23]. Long distance may delay patients from seeking care leading to increased severity of the condition. In a study from Sierra Leone[24] a patient delay of 2-5 days for strangulated hernia was noted and long distance to the service was considered a main reason. Long distance may also prevent patients from seeking care. An unpublished study on unmet obstetrical needs in Kenema, Sierra Leone, showed a linear relation between distance and rates of major obstetrical interventions done[25]. All emergency obstetrical interventions were done on women living in close proximity of the district hospital, while no woman living further than 50 km from the hospital had access to such operations.

#### Health seeking behavior

One of the major delays in obtaining treatment relates to the decision to seek care. Patients requiring either elective or acute surgery may initially seek care from a provider who has neither the knowledge nor the capacity to treat a surgical condition, one that may even be a faith-healer. Other treatments may be substituted and this “health care provider delay” may lead to a worsening of the condition. When such incidents are combined with having to travel long distances to obtain surgical services, patients’ conditions are severely negatively impacted. The outcome of good surgery is obvious if conducted with respect for the patients. Good quality surgery quickly wins the confidence and trust of the population perhaps in preference to traditional or other forms of medical care.

#### Capacity and willingness to pay

Cost of transportation and the availability of health care service including treatment are important factors in determining access to health care. Surgical care is different since it can only be provided by trained personnel and it requires specific equipment and supplies. The demand for surgery in poor areas will mainly be for acute illnesses when the individual does not have much choice but to pay the price asked for.

The concept of willingness to pay has been used to determine the level of health service fee that a population is willing to pay. The amount will depend on the availability of services, number of providers, the knowledge and attitude of the population about the services, the severity of

disease/injury and the quality of the service provided. A 1994 study[26] on willingness to pay showed that 33% of patients undergoing hernia operations at one hospital paid less than they were willing to pay, while 67% paid more than they were willing to pay. The concept of capacity to pay was developed later when it turned out that many poor people were willing to pay more than their capacity to pay[27].

With increased provision of market adapted health care more varied care is offered. This has been shown to cause poverty, - health care cost induce poverty, or iatrogenic poverty[28]. Such poverty may be induced by consumption of health care due to chronic disease or by sudden diseases/events, such as trauma or obstetric emergencies, requiring emergency surgery. Such often dramatic events force the patient and his/her family to pay large sums of money for “catastrophic” health care costs[29, 30]. In some countries patients are imprisoned until they have obtained financial means to pay such hospital bills, for example women having undergone acute caesarian section at rural hospitals in both rural Sierra Leone and the Democratic Republic of the Congo[31].

#### Prevention associated with surgery

Clearly if the surgical conditions were prevented in the first place this would reduce the problems of access. There is little solid information on cost-effective preventive measure for surgical conditions. However for some individual conditions some information is available. For example, elective repair of hernia has been shown in East Africa to be a cost-effective preventive measure; antenatal care is similarly effective in identifying those likely to have complications of pregnancy and so refer them as appropriate. Yet personnel capable of undertaking such procedures are few or inaccessible, or simply not available.

Traffic accidents constitute the new silent epidemic in developing countries. The most important approach is prevention of accidents. Massive increases in the number of motorized vehicles has occurred without concomitant improvement in roads, street lighting, traffic lights, road signage, and traffic regulation to curb driving under the influence of alcohol and drugs. However, once an accident happens, emergency medical services, ambulances, and timely and appropriate surgical intervention are crucial to save lives and prevent costly residual deformities in those that survive the accidents[32]. Domestic violence is another important cause of death and injury. Prevention of domestic violence should also be a priority.

Most recently there is public debate about the use of circumcision to prevent HIV/AIDS ie the use of a surgical condition to prevent another condition. It is inappropriate and unnecessary for Western countries to send doctors to perform circumcision on Africans. Circumcision is a simple surgical procedure that should be made available in all district hospitals as one of the means to reduce the spread of HIV/AIDS. There are a number of ongoing studies to evaluate how this service should be best offered (i.e. by whom, how, which technique, at what level of the health

care system) given the recent overwhelming evidence that showed unprecedented decreases in rates of HIV associated with circumcision in sub-Saharan Africa.

In addition, better epidemiologic surveillance of surgical conditions and treatment of key surgical conditions at the district and lower levels of the health care system may provide data to guide prevention efforts. However, no matter how effective prevention programs are, there will always be a need for surgery.

### **Issues for consideration in developing the roadmap**

There is need to map the availability of surgical services at district hospitals and the degree and quality of services provided. This could be done as a component of the World Health Organization's Service Availability Mapping.

There is little to no qualitative research on health seeking behavior related to surgery in developing countries except for some specific conditions, such as caesarian sections.

We need a more robust research on iatrogenic poverty would raise surgical problems higher on the donor agenda.

How may surgical services be better linked with prevention efforts, for example for road accidents?

### **Session 3: Constraints to providing surgical services at the district hospital**

*“Baseline assessments carried out in Uganda, Kenya, Southern Sudan, and Rwanda in 2003 found that the coverage of basic Emergency and Obstetric services ranged 0—1.1/ 500,000 population compared to the UN-recommended level of 4/ 500,000. .... Shortage of trained staff especially mid-level providers, poor basic infrastructure such as lack of electricity and water supplies, inadequate supply of drugs and essential equipment, poor working conditions and staff morale, lack of communication and referral facilities, cost of treatment, and lack of accountability and proper management were identified as the main obstacles in providing 24-h quality EmOC services especially in remote and rural areas”.[33]*

#### **Provision of surgical services at district hospitals**

Specialised surgical services are available at the major referral or tertiary hospitals which are usually staffed by qualified and specialised surgeons. However, because referral hospitals are not accessible to most rural poor populations especially for conditions requiring emergency treatment, the district hospital is central for the delivery of surgical treatment. Costs are low (about US\$3-4 per patient day), and with the right staff and equipment such a hospital can care for 90% of the conditions that can be effectively treated by surgical procedures. Most of these are emergencies requiring transport to the hospital, and transport problems are less severe in these more widely dispersed units. Because emergencies can come at any time, surgical facilities must be available 24 hours a day, 7 days a week. District hospitals, if properly equipped, are almost always able to provide this service, although often at the price of considerable strain on the available staff.

The high incidence of surgically curable conditions, that are usually emergencies, which present at low cost district hospitals, creates a situation in which surgical treatment is remarkably cost effective[34, 35] This is illustrated by an analysis of operations performed in three months at a 50 bed NGO hospital in rural Bangladesh (Table 2). The estimated DALYs preserved was very high, so that when the hospital cost was calculated, the cost per DALY was lower than the cost of immunization programs and comparable to most other public health and primary care interventions. Similar results have been found in Uganda.[36]

In the absence of war or certain epidemics, the pattern of conditions presenting at a district hospital doesn't change much, even between continents. The composition of surgical procedures described in Table 2 is very similar to the composition at small hospitals in Mozambique, Tanzania, and other countries at a comparable level of economic development. Sixty two percent of the operations were emergencies, and more than 90% of the DALYS preserved were due to emergency operations. The mix of surgical conditions presenting at a hospital is determined by a fairly complex interaction between the need for surgery, cost, the possibility of referral or self referral, and public perception of how effective hospital treatment can be. Usually, the public perception is accurate.

**Table 2**  
**DALYS SAVED BY KIND OF SURGERY**  
**3 months at Gonoshasthaya Kendra Hospital, 1995**

	Number of Ops	Total DALYs	DALYs per Op
<b>OB/GYN:</b>			
Cesarean Section	40	1588	40
D&C (incomplete abortion)	24	44	2
Ectopic Pregnancy	2	72	36
Extraction of Placenta	4	26	7
Cervical Tear	1	3	3
Other Gynecological	20	149	7
<b>ALL OB/GYN</b>	<b>91</b>	<b>1882</b>	<b>21</b>
<b>GENERAL SURGERY:</b>			
Appendectomy	10	49	5
Cancer	1	13	13
Gall Bladder	4	30	8
Hernia	6	47	8
Other Acute Abdomen	4	64	16
Chest (tube drainage)	3	76	25
I&D Infection	13	91	7
<b>ALL GENERAL SURGERY</b>	<b>41</b>	<b>370</b>	<b>11</b>
<b>TRAUMA:</b>			
Closed Fractures	11	43	4
Major Wounds	6	81	14
Burns	5	53	11
<b>ALL TRAUMA</b>	<b>22</b>	<b>177</b>	<b>8</b>
<b>ALL SURGICAL PROCEDURES</b>	<b>154</b>	<b>2,429</b>	<b>16</b>

There is usually a preponderance of obstetrical and gynaecological procedures (as in Table 2) because almost all obstetrical complications allow enough time to reach a hospital and save the mother, given any kind of reasonable transport. Most babies will also survive. People come to know this wherever there is an accessible hospital, and most will make great effort to reach a hospital when a complication occurs, even though 80% or more of deliveries are still at home. But there are less trauma patients (as in Table 2) because there are few effective systems for early care or transport of trauma patients and self referral is often impossible after a serious injury. In part because they don't see as many trauma patients in small hospitals, the technical capacity to deal with major trauma is often not well developed, and the public is aware of this. Community surveys from rural areas of developing countries have confirmed that only a third of injured patients in rural areas of developing countries ever reach a health facility[37].

Appendix 2 lists the resources required to provide surgical services at different levels of care.

## **Human resource constraints<sup>v</sup>**

Since most operations are emergencies, and everyone will be asked to cover on occasion, it is important for all surgeons, whether specialists, medical officers, or assistant medical officers (AMO) to be able independently manage the clinical situations described in Table 1. Everything on the list can be treated at the district hospital level by anyone, including an AMO, with the right training. Programs to expand and upgrade district hospitals will need to include in-service training to increase the skills of existing staff. Patient management must include not only the ability to do the surgical procedure, but also non-operative management and mature judgement about when to operate and what operation is needed. There is an acute shortage of surgical skills in any of these cadres of staff and even those that have the skills give higher priority to management responsibilities such as running primary care and malaria programs. A separate cadre of health worker may need to be trained to devolve some of the management responsibilities of clinicians at the district level.

### The need for anaesthetists

Surgical services cannot be provided without adequate and appropriate anaesthetic services. District hospitals require trained personnel and equipment to administer general anaesthesia. Spinal and epidural anaesthesia is adequate for most obstetrical, lower abdominal and lower limb operative procedures. Regional anaesthesia, particularly brachial block, is most suitable for procedures on the upper limb. Regional anaesthesia also has the advantage of reduced need for post-operative monitoring compared to general anaesthesia—this could be critically important in settings with limited workforce and resources to Well-planned training programs are needed to produce nurse anaesthetists, anaesthetic technicians competent in giving general, spinal, regional, and local anaesthesia. For example, a prospective study of two central and 23 district hospitals in Malawi showed a significantly higher morbidity and mortality in patients undergoing C-Section who had general rather than spinal anaesthesia, making the case that wider use of spinal anaesthesia may help to decreased maternal mortality[38].

### Use of non-doctors to perform surgery

There is good evidence from several countries that AMOs with good training can produce excellent results[39-41], and there are many advantages to using AMOs for this work: They are almost always willing to stay in the rural areas where they are assigned, they usually establish close relations with these communities, and, of course, training and salary costs are much

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<sup>v</sup> A note on surgical skills: It is important to note that not all surgical conditions do require an operation for the patient to get well, but it takes surgical experience to decide to await an operation. If a surgeon uses too wide indications for surgery, the patients will be exposed to unnecessary risks caused by excess operations. If the surgeon uses too narrow indications for surgery he/she will be responsible for excess morbidity and mortality that could have been averted by an operation. The challenges lie in correctly diagnosing and deciding if and when to operate. Some surgeons consider this to be the most important part of their profession. In addition to the work in the operation theater, the surgeon is also responsible for assuring that a patient is optimally medically prepared for the operation and that the post operative care is functioning. This is important to remember when discussing surgery, as the focus tends to be on the technical work in the operation theatre. There are numerous examples of bad outcome of surgery despite skilled operators. The surgeon in a resource scarce setting has much wider responsibilities compared to those working in a rich country and cannot only rely on technical skills.

less[42]. In Tanzania, Mozambique, and Malawi, 90% of the surgery done outside of major cities is done by AMOs.

Some African countries (Ghana and Kenya, for example) have rejected the idea that AMOs or nurses can be trained to do major surgery, and insist that operations must be performed by medical doctors. If these doctors can have adequate training for the district hospital situation, they can certainly function effectively, but in most countries rejecting the use of alternative medical personnel will seriously limit the possibilities for expansion of surgical service because:

- 1 medical doctors assigned to district hospitals usually go there under duress and rarely stay more than 2 or 3 years. This means that, to do the job properly, new batches will need to be trained continuously to replace those who have done their tour of duty;
- 2 training cost plus salary cost makes the cost of a medical doctor in a district hospital about five times higher than the cost of an AMO doing the same work;
- 3 in most countries, a simple calculation of the expansion needed to meet the need will show that there are not enough medical doctors to staff the units to be created, even if funds can be found to train them and pay them.

AMOs and others trained to do surgery need not be only a temporary solution due the shortage of medical doctors. In Dar es Salaam and Maputo, it has been possible to increase emergency obstetrical service rapidly through urban district hospitals where medical doctors and AMOs work together. This could become a model for progressive expansion of surgical service at low cost throughout a country, using teams of doctors and AMOs working together.

### Training

Training for this kind of surgery need not be lengthy or complicated, but the standard medical school curriculum plus an internship is not adequate. Doctors assigned to do surgery without supervision should have supervised training before these assignments. The training must cross the usual specialty lines – a general surgeon must learn to perform caesarean operation and a gynaecologist should learn to manage an acute abdomen.

Surgical training must take place in a setting where the spectrum of conditions encountered is appropriate and where the trainee can do the surgery and treat patients under supervision. Active district and regional hospitals with experienced staff will usually be the best place. Experience with anaesthesia training in referral hospitals has been good, though.

Duration of training will depend on the previous training and experience of the trainee. Three to 6 months will be enough for a qualified surgical or obstetrical specialist. AMOs and nurses without considerable previous operative experience will need at least 6 to 12 months.

Mozambique has opted for a 3 year course for AMOs and nurses, which has considerable theoretical content and leads to a university degree. Tanzania incorporates 6 months of surgical and obstetrical training into the 2 year program to upgrade Clinical Officers to become Assistant Medical Officers. This is supplemented by informal on the job training after arrival at the assigned post, for those AMOs who will be doing surgery there. Evidence suggests that the training is a good investment in responding to the health worker shortage[43]. The Tanzanian option makes it possible to expand service more rapidly. Tanzanian AMO surgeons are very well trained for obstetrical surgery, but their capacity for other kinds of surgery is less than the Mozambican's. Another important advantage of the Tanzanian model is flexibility: AMOs are general practitioner surgeons, able to perform many other function and to cross cover. AMOs within a hospital are assigned to specific areas, like paediatrics, general surgery, or obstetrics, but they are able to cover all the common surgical emergencies, so the person assigned to the paediatrics ward can do a caesarean section on the nights he or she is on call.

### Supervision

It is logical to think of a network of hospitals, health centres, and dispensaries treating surgical patients, referring them as needed, and supervised by a senior surgeon who provides in-service training to correct problems and upgrade skills and systems. This is an ideal that doesn't exist anywhere in Africa, although there are models (as in Malawi) in which expatriate surgeons travel on a regular basis to district hospitals to train the clinical officers who do surgery in these hospitals. It will be possible to create networks, but this needs to be done incrementally, keeping in mind the important problems of transport, communication, information systems, existing organization of hospitals, and the independent mind set of those practicing in the hospitals. A major constraint in most countries is funding from the ministry of health to support more regular support and supervision from specialists. In Uganda, specialist surgeons perform their own outreach programs (ie orthopedics, plastics, ophthalmology) as well as larger regional surgical camps (one week duration) several times a year as financial support allows. One major challenge to these programs is follow-up and impact evaluation.

There are reporting systems within districts, which usually focus on finances and overall activity. Operative, maternal, and neonatal mortality results are reported, but these data are rarely discussed within the district. The district medical officer usually does not do surgery and does not take much interest in it. There isn't anyone else with responsibility to organise clinical service delivery. In-service training is externally organized and usually takes place at another location, so has no direct relation to hospital experience.

Despite the lack of coordination, most district hospitals produce good results at remarkably low cost. But better organization at the district level is needed, to establish a functioning referral system, expand service delivery, and upgrade services generally as well as certain specific services (trauma and blood banks). The unmet need for blood banks has not been well developed, aside from the minimum guidelines established for Emergency Obstetric Care. The model of a senior

surgeon with responsibility for surgical service delivery in a region plus the time and authority to do this job does not exist at the present time. It needs to be created.

### **Financing considerations in providing surgical services at district hospitals**

Hospital costs vary widely between countries and within countries. Accurate estimates of these costs are hard to come by, because most places have multiple sources of income, supplies, equipment, and salaries – and perhaps also because many countries are reluctant to admit how great is the disparity between what is spent on central as opposed to peripheral hospitals. Despite the share of expenditure of health service (sometimes up to 70%) on hospital services, few studies have analyzed the efficiency and performance of hospitals[44]. The general trend to a sector-wide approach to health finance in some countries appears to have early documented gains is the use of index services and health outcomes[45].

The annual cost of surgical services in a 100 bed African hospital supplied, equipped, and staffed according to WHO recommendations has been estimated at US\$826,000. Projecting the actual costs in a low budget Bangladesh NGO hospital to a surgical service in a 100 bed African hospital led to a lower estimate of US\$311,766 per year. Measured costs in Mozambican district hospitals have been closer to the lower estimate.

But the annual budget from all sources for all health services in a district of western Tanzania (Kasulu – population 626,000) was US\$1.2 million last year, or \$2.00 per capita. (Tanzania spends \$7.00 per capita per year for all government health services). The 100 bed WHO hospital would consume 70% of the Kasulu district budget for the surgical service alone. Somehow the Kasulu district budget manages to support a 200 bed hospital with an active surgical service, plus five health centres, 15 dispensaries, and an immunization program that achieves 90% coverage with the vaccines recommended by WHO. Results, at least in terms of the outcomes of emergency obstetrical surgery, are very good, but this hospital by itself is not able to meet the need. Most patients with complicated obstetrical problems and serious injuries never reach a hospital.

We need to look carefully at how these existing facilities function and insure that service delivery is efficiently organized to optimise the use of its facilities. The prospects for increased funding need to be explored before the needed expansion of surgical facilities can take place. Targeted outside investment can be very useful, but inappropriate new facilities, equipment, and activities could impose burdens on the recurrent budget that will block expansion by increasing the cost of service. And if funding is to be increased, we need to be sure it can continue. The expansion of surgical facilities is also seen by the public health community at large as a capital intensive endeavour, and as such this infrastructure expansion would need to be well-planned and developed at the local level.

## **Meeting unmet need for surgical services at the district level**

It is difficult to estimate unmet need for most surgical services. The number of trauma patients or patients with intestinal obstruction who never reach an African hospital is not known. One primary problem is that there are no prospectively collected surgical databases in health facilities of rural areas in low-income countries—the average rural hospital will have a case log book, and often not much else. There are usually no outcome data or hospital records. There have been no well-designed prospective community surveys to estimate the precise unmet surgical need in the community, as we know that only a minority of patients ever reach a health facility. But there are reliable methods to estimate the need for emergency obstetrical care in a population. Since emergency obstetrical care is the most common and the most effective part of surgical service delivery in African hospitals, measuring the met need for this kind of surgery provides a useful rough indication of the extent of unmet need for all surgical service.

The percent of deliveries with complications that require hospital treatment is known to be about 15% all over the world. The figure includes abortions and treatments needed to prevent foetal death. Treatment means surgical treatment in 90% of cases. Since the population and the birth rate are known just about everywhere, the extent of the need for hospital delivery can be estimated at about 15% of total deliveries. In rural Africa, unmet need is never less than 60% and it is usually more than 80%, even though surgically equipped hospitals are widely available at the ratio recommended by the World Health Organization is one hospital per 500,000 population. Unmet need for surgical care of trauma, infections, and other problems is probably much greater. Upgrading and expansion of existing hospitals is needed, but hospital capacity is not the only problem:

- 1 Personal cash income is limited, so that even very low “cost recovery” fees have been shown to be barriers to access.
- 2 In places where obstetrical services are free, the cost of transporting the patient and accompanying family members is still a major problem. Most health centres don't have ambulances, and when they do, the budget for fuel usually limits them to two or three trips per month. They get around this by charging the patient for fuel, but this creates another barrier: Diesel for a 50 km. round trip will usually cost about \$25, which is a month's pay for a labourer—when they have a job that pays cash.
- 3 Travel cost is not the only thing limiting access: hospitals are crowded and often unfriendly; family members are needed to provide personal care and food for patients, so the cost of these attendants' food and lodging has to be considered; patients often need to buy medicines, supplies, and blood for transfusion; and there are anecdotal reports of charges for hospital services that should be free. Best studied for c-section and emergency obstetric care, there are also significant cultural and social barriers to access

which have to do with gender, education, and decision-making capacity within households.

A complete solution of the access problem is not possible with available resources, but two measures could improve the situation tremendously:

- 1 existing health centres can be upgraded to provide basic emergency surgery closer to home for obstetrics, most surgical infections, and the early management of trauma,
- 2 all health centres should have a functioning ambulance, with an adequate budget for fuel and maintenance.

It will not be difficult to upgrade health centres in countries that have trained large numbers of AMOs to function as general practitioners with basic surgical skills (Tanzania has more than 1200 for a population of 35 Million). Health centres usually have small inpatient units. Constructing and equipping an operating theatre for such a hospital can be done for less than \$100,000. On the job surgical training can be provided in existing district hospitals before assignment to a health center. Nurses or AMOs can be trained in the same hospitals to give anaesthesia. In a country with an adequate supply of medical doctors, they can be trained in the same way, if they can be persuaded to work in a health center and stay long enough to justify the expense.

Creating a functioning ambulance system will be more difficult. An adequate budget for fuel and maintenance for an ambulance serving 100,000 people need not be great – say \$10,000 per year or \$0.10 per capita, but it must compete within the very limited recurrent cost budget of a health center. And the use of the ambulance will be subject to pressure from local government staff and other influential users. The last point is not a small problem: the ambulance can be the only government vehicle available at the level of a health center.

Analysis of unmet need has shown that the existing network for surgical care must be expanded. The kind of facilities that will be needed will depend on the realistic possibility of referral. Health centres with the ability to refer can function much more effectively as early care units for surgical and obstetrical patients. If referral with transport is not available many patients will bypass the health centers/dispensaries and even more will not receive any hospital treatment.

Increasing referral means a bigger load on district hospitals, which can be partially compensated by increasing the capacity of the peripheral units, but in the end, since unmet need is so great, the overall cost of the system will increase. The amount of the increase has not been reliably estimated, but it is probably not great: an increase in the recurrent budget of US\$ 0.50 per capita could eliminate most of the unmet need.

Two specific problems that need urgent correction: early care for trauma and blood transfusion:

- 1 Resolution of the problems in trauma care is not just a matter of transport. Early care for trauma patients is abysmal. It has been shown that community volunteers and peripheral unit staff in developing countries can be trained to control bleeding, maintain the airway and treat shock, and that utilization of this training can lower pre-hospital mortality by 50%. Introduction of this training in Africa would not be difficult or expensive.
- 2 Blood transfusion is available in district hospitals, but in most places the supply of banked blood is very limited and dependant on collections from patient's families. Using funds from the AIDS program, central units for blood collection and processing are being established. This is fine, but it must be done in such a way as to guarantee an increase in the availability of blood. There are only 4 such centres planned for Tanzania.

### **Issues for consideration in developing the roadmap**

Surgery at the district level in sub-Saharan African countries is remarkably cost-effective. How is it possible to expand the existing network for service delivery beyond the fraction of the need it now meets? How can countries/districts: 1) expand, improve and better organize services in existing hospitals, 2) increase the number of facilities, to bring them closer to the affected population; 3) increase the number of staff (and adequate support, supervision, and continuing education/training) with a capacity to provide this service, and 4) create a functioning referral system, with adequate transport to support it.

Increased funding will be needed for this. In most countries, because surgery is so cost effective and budget levels at present are so low, it should be possible to double Met Need (to 60%, in the case of emergency obstetrical surgery), with an investment of \$1.00 per capita for capital investment, and addition of \$0.50 per capita in the annual recurrent budget.

It is important to look at solutions adopted by different countries. Not all solutions will work in each country or district but there is a great deal to learn South-South.

How can comprehensive demonstration models be created and evaluated at a district level to guide this expansion?

## Session 4: Human resource challenges in providing surgical services

*“There is a marked shortage of surgical manpower all over Africa. .... Current training and recruitment programs are inadequate in correcting existing gross manpower deficiencies. The situation is further aggravated by a gross maldistribution of available manpower in favor of large urban centers. In many parts of rural Africa, minor surgical procedures are carried out by suitably trained, non-physician health workers, but facilities and resources for surgery outside urban centers are generally inadequate”.* (AE Wasunna, 1987[46])

Human resources problems are a major challenge to health systems in sub-Saharan.

Compounding the marked general shortages are poor skill mixes, mal-distribution of available personnel and poor motivation and performance as major influences on service delivery. A high communicable disease burden has placed significant pressure on the limited numbers of skilled workers available but even this is further worsened by the HIV/AIDS pandemic which has further expanded the workload. This section examines some of the challenges faced with human resources for health, in Africa and the impact these have had on access to basic health services including access to life saving surgery and discuss means of ameliorating the situation.

Sub-Saharan Africa on the average has had the lowest concentration of health workers per population of any continent. The Joint Learning Initiative and WHO have estimated a world average of 4 skilled staff per 1000 population (skilled staff including nurses, midwives, doctors) but sub-Saharan Africa averages about 1 for each 1000 population[47]. The World Health Report of 2006 using the total population of health workers again has WHO's Africa region with just 2.3 workers per 1000 population compared with 4.0/1000 for the Eastern Mediterranean region (the next lowest) and a world average of 9.3 per 1000[48]. Supply of new graduates into the workforce has been limited and was at times even below replacement levels (possibly a result of HIV/AIDS infections[49]). Other factors have fostered quite high levels of attrition from the workforce including migration to richer countries within Africa or elsewhere and the shunning of poor and rural locations by health services and professionals. Deaths among health workers have risen because of the HIV/AIDS pandemic and other losses have occurred due to health workers simply choosing alternative sources of livelihood outside health work[50-52].

These health worker shortage and supply problems are amplified by the inability of many sub-Saharan African countries to maintain effective personnel performance management systems resulting in poor deployment and variable productivity of health professionals.

### **Having adequate numbers of health workers**

Doctor to population ratios in Sub Saharan Africa range from 3 to 13 per 100,000 compared to over 300/100,000 in most European countries. Professional nurse ratios range from below 10/100,000 to 90/100,000 (compared to 500-1000/100,000 in Western Europe[53] As indicated earlier, the SSA average density of core workers per thousand population is less than 1 when the

estimated level for attaining basic coverage for core health services is 2.5 per 1000, a level of health worker density shown to have particular impact on maternal mortality[45].

Within countries, staff availability is further worsened by serious mal-distribution which favors urban and relatively rich areas over poorer and mostly rural people. There is also a tendency for skills to be diluted, especially in the case of surgery by the migration of professionals to administrative positions within the ministry of health. In Ghana, there were more doctors working in the MOH Headquarters in the capital than in the 3 northernmost and poorest regions with about 15% of the total population[48]. These 3 regions had only a single qualified OBGYN and 2 general surgeons in 2000 for a population of about 2.5 million.

There are many barriers to recruiting surgeons because pay is modest, resources for surgical care are limited, and the expanding employment opportunities available in public health provided by major international donor organizations are an attractive alternative[54]. In addition, the exceptionally high risk of occupational exposure to infectious diseases such as HIV and hepatitis borne by surgeons in particular are a deterrent to recruitment - which has been to date insufficiently addressed[55].

#### Retention and attrition

The current low supply and poor availability of health workers is exacerbated by high attrition rate. Emigration of skilled health professionals occurs from many sub-Saharan African countries and while some of this emigration happens within the continent, the significant numbers leaves for Europe and the USA. The number of health workers leaving the continent are small when compared with the stock in the advanced economies but still represent major losses for sub-Saharan African countries. Often, the loss of just one or two persons with certain special skills can lead to the closing down of training programs and referral services[56]. The loss of such critical staff affects training and mentoring of new graduates and causes supervision and referrals systems to collapse. Therefore, significant cost can arise from even numerically small amounts of emigration.

The causes of health worker emigration are quite well documented[57-60] and generally these relate to wage, social-political and organizational issues. The “push” factors from home countries and “pull” factors from rich countries to these influence the personal threshold decision to emigrate.

#### **Health workers must have appropriate competences**

Workforce problems in sub-Saharan African countries are also linked to the way skill mixes of health workers are constituted and to the way the mix is designed to reflect true service delivery needs. Providing life saving surgical interventions start with having a good network of “close-to-

client” service providers, who are the first link in a chain going up to referral levels that deal with cases of increased complexity. Early identification of high risk clients saves lives (e.g. potential obstetric risks), and quick local intervention either resolves the problem early on or at least, stabilizes the patient for more appropriate interventions higher up the referral chain. Each care level therefore requires certain skills that complement each other and the ability at the periphery to recognize critical surgical conditions early can do much more for surgical services than having top surgeons without a back up system. There is often a tendency to concentrate resources on the training and establishment of higher level surgical specialists while more basic cadres such as emergency care technicians, midwives, and operating theatre and intensive care nurses are relegated to low priority in the countries’ training programs. In addition human resource planners must consider other essential support staff development – anesthetists, laboratory technicians, bio-technicians, who are needed for both patient and equipment care for coherent comprehensive care to be successfully provided.

Many sub-Saharan African countries trained their surgeons abroad and the high costs of doing this, limited the numbers trained per year. Even after local training programs were started in some countries, training formats have usually continued with the methods established by former colonial powers and may have still produced “specialists” not well suited for the local environment. Their training of these specialists is largely focused on complex and sometimes exotic case types and while these skills are useful at the top of the referral tree, they leave serious gaps in provision of care for the vast majority of surgical clients at peripheral service delivery points. The inheritance of western surgical training systems have at times constrained local innovation (for example, combining general surgery and OBGYN courses for primary care physicians and insisting that obstetrics and general surgery be provided by two surgeons in one location when one could have provided both services. Some surgical training programs have over-emphasized theory over practical “hands on” methods that rapidly give operating room skills. However, several SSA medical schools have adopted problem-based curricula that include practical community based training concepts with significant portions of learning taking place at community level rather than in tertiary care facilities.

In many countries, general practice physicians can acquire and use core surgical skills especially when working in rural areas but the process is usually informal and training is unstructured, uncoordinated and left entirely to the willingness and ability of more senior doctors to transfer these skills. Often bad practices may be passed on as well. This problem can be solved by providing a certified training program in surgery for all general practitioners who wish to practise rural surgery.

### **Delegating surgical tasks**

Skill and task shifting to non-physician cadres has been successfully carried out in several African countries (examples are - Tanzania, Mozambique and Malawi and more recently Zambia and Ghana). This scheme often faces significant resistance from the medical profession, and the resistance persists even in countries where task shifting has been successfully practiced for a while. Concern with the absence of effective support for and supervision of the AMOs who provide surgical services has been expressed. It has been pointed out that surgical skill delegation requires well-structured supervision, continued support and skill-upgrading by well-trained specialists. While this is true, several advantages of surgical task shifting must be cited including a very high retention rate of these cadres within the country and in rural areas' the ability to produce them after shorter training periods and at less cost, and to pay them significantly less than physicians for their services.<sup>60</sup>

### **Adequate management and support systems are needed**

Poor planning and management of human resource for health in many sub-Saharan African countries has created instances of poor deployment and utilization of available skills. In many countries, scarce physicians with time and seniority, are moved into positions as managers and policy makers aggravating the severe shortage that already exists. Planning for surgical services also requires that thought is given to the entire range of staff needed for the system to function well. For example, the lack of support staff mentioned previously is a major reason why services may fail even in the presence of qualified surgeons. The tendency of countries to opt for high end specialist surgeons may mean that such persons are unable to operate without the usual sophisticated equipment and support staff. They may not have the skills to innovate in resource-deprived settings. Lack of basic supplies – gloves, sutures, anesthetic drugs, resuscitation kits, etc ,can render the best surgical skills non-functional.

Referral systems do not work well and the absence of a coherent system, with good feedback and joint care mechanisms, frustrates service providers. Poor planning and networking of referral centres and their catchment areas compound service delivery problems.

Overall governance and management of the health sector helps to ensure that health worker are optimally utilized and are productive. A lack of adherence to regulations on staff distribution, and rules that bind new graduates to serve in deprived areas undermines effectiveness of service providers and creates low morale. Health professions may see rural practice as having a low status and providing poor career prospects. Clear and effective incentives must be offered if countries are to attract staff into these less desirable rural settings.

## Strategies and solutions

There are examples of successful strategies that Sub Sahara African countries have used to address their immense HR problems[61]<sup>-46,58,1</sup> Many of these are generic to the overall workforce situation but others are more specific to surgical life saving interventions. Some of these specific strategies are:

### Task Delegation, Cadre Substitution

As has been alluded to previously, delegating life saving surgical care skills to cadres other than physicians has been an innovation used by several countries. Assistant Medical Officers, Clinical Officers, Licentiates, Técnicos de Cirugia are some of the terms used to describe them. Each country has its own methods for training the cadres, with some trained as completely new and separate cadres while others constituting upgrading of professional nurses.<sup>60</sup> Some countries provide training at two stages, a basic training stage followed by specialized training.

As previously mentioned, some indirect delegation occurs within the medical profession, giving general practice physicians the needed skills for performing life saving surgery. Private practice surgeons in rural parts of Namibia, for example, are contracted to provide surgical services in public sector hospitals lacking surgeons. Anesthetists are also in short supply and “Nurse Anesthetist” and “Anesthetist Assistant” training programs produce the necessary workforce to support surgery performed in rural districts. In Ghana, with physician anesthesiologists being quite few, nurse anesthetists can be found working in referral hospitals.

Training of support staff such as operating room nurses, nurse anesthetists, laboratory technicians, and intensive care nurses have opened new career opportunities and enhanced basic surgical capacity. Physicians have also been trained for 18 months to receive diplomas in anesthesia and critical care. While these efforts have been encouraging, they fall short of providing the necessary surgical workforce to address the needs of rural districts.

### Localizing specialized training

The establishment of local specialist training programs in some SSA countries was aimed at increasing the numbers of surgeons through shorter training periods at reduce the cost of training. Nigeria, and more recently Ghana, have established national post-graduate medical colleges and have reduced substantially the numbers of specialists trained abroad. The OBGYN faculty in Ghana, for example, has also established mid level specialist programmes (1.5 to 2 years Diploma in OBGYN) to train district-based physicians.

### Retention, deployment and productivity

A variety of incentives and motivators have been applied in many countries to help retain health workers and deploy them in deprived areas. In Ghana, senior surgeons are enrolled in a scheme that takes them to regional hospitals at regular intervals to train and deliver services. The

coverage provided by such visits is limited, and there is significant time lag between visits. There is no clear process for transferring needed skills to local physicians.

### **Issues for consideration in developing the roadmap**

- 4.1 Providing adequate life-saving surgical services requires a major human resources mobilization by increasing the surgical training of physicians and also by shifting tasks to non-physician health workers who are more available and willing to work in deprived areas..
- 4.2 It is critical to train other types of support personnel needed for the delivery of surgical services. Systems must be set up to provide effective back-up and support. The strategy to supply this type of surgical workforce requires the agreement and support of individual governments.
- 4.3 There is need to improve referral systems with effective means of communication, transportation, basic blood transfusion services. In a system in which non-qualified surgeons are delivering surgical care, a system of continuous monitoring, supervision and skill-upgrading training is necessary.
- 4.4 Much has been talked about regarding stemming 'brain – drain' especially of health professionals from poor countries to the rich economies. Sub – Saharan Africa continues to lose large numbers of such professionals. Despite the explicit recognition of the problem by WHO, the affected countries (on both sides of the divide),no plan of action has been formulated or agreed upon. Poor countries need to make it attractive for their trained manpower to stay and work at home, while richer nations indeed are able to train their own professionals. National and international policies need to be formulated and adopted on this very critical issue.

## Developing the roadmap

The previous sections of the paper provided the background for our discussions - during the first four sessions of the meeting - of the first two goals of the meeting.

- Goal 1: to take stock of what is known about the need to improve access to surgical services in sub-Saharan Africa, the cost-effectiveness of specific interventions and existing national and international efforts to support the delivery of these interventions.
- Goal 2: to assess health system and human resource constraints to integrating surgical services at the district level within health systems in sub-Saharan Africa, and identify training programs, resource reallocation and policies required to tackle these challenges.

### By this stage in the meeting

We will have agreed on:

- Session 1: the prioritization of the problems and conditions that the roadmap will address, that we will target the provision of surgical services the district hospital level,
- Session 2: the major constraints in access to surgical care and the major bottlenecks to increased access
- Session 3: the basic requirements for delivering basic life saving general and obstetrical surgery, the extent of unmet need and the major challenges in addressing them at district hospitals
- Session 4: the major human resource challenges to delivering basic life saving and obstetrical surgery with some possible solutions

We will have heard from:

- Session 5: the representatives of the countries participating in the meeting (Kenya, Tanzania, Uganda, Eritrea, Mozambique and Southern Sudan) about the specific challenges and success stories in providing surgical services in their countries.

### The next stage of the meeting is to develop the roadmap

This final section of the background paper addresses the third goal of the meeting and will provide the outline for the discussions that will take place during sessions 6, 7 and 8 of the meeting:

Goal 3:           to prepare a roadmap of activities to improve access to surgical services in sub-Saharan Africa and to engage national and international stakeholders to advocate for and implement this roadmap

At the end of each section, we listed a number of issues to consider during development of the roadmap.

### **Why a roadmap is necessary**

The meeting has been justified on the basis that:

1.       surgical conditions account for a significant proportion of the burden of disease in sub-Saharan Africa and that, even though they disproportionately affect poor people who cannot access specialist tertiary level services, few attempts have been made to integrate the treatment of these conditions into the services offered at district hospitals.
2.       certain surgical conditions can be treated cost effectively at first-referral facilities, in particular through: a) provision of competent, initial surgical care to injury victims, not only to reduce preventable deaths but also to decrease the number of survivable injuries that result in personal dysfunction and impose a significant burden on families and communities; b) skilled management of obstructed labor to prevent maternal and infant mortality and obstetrical fistulas; c) timely and competent surgical management of a variety of abdominal and extra-abdominal emergent and life-threatening conditions; and d) elective care of simple surgical conditions such as hernias, clubfoot, cataract, hydroceles, and otitis media.
3.       policies and programs need to be established nationally and internationally to ensure that health systems are strengthened to properly integrate access to surgical care within preventive health care programs. A crucial component of this will be the introduction of innovative training of doctors, nurse, midwives, surgical technicians, clinical officers and medical assistants to undertake basic surgical procedures.

The meeting brings together a unique group of surgeons, economists and public health specialists from sub-Saharan African countries and international agencies with the capacity to set

an agenda to improve the provision of surgical services and to begin to harness resources for a major international program. Unless the meeting concludes with concrete next steps that national and international agencies will be willing to adopt and support, it will have been a waste of time.

### **What a roadmap might look like**

*Vision and time horizon* The roadmap will be a means of moving forward the vision for the group and of bringing many other players in board. The time horizon is likely to be long term, say ten years for the overall vision, five years to see some outputs and outcomes and one year to raise funds and instigate some concrete projects.

*The overall goal* will be agreed by the meeting but is likely to seek to address the heavy burden of surgical conditions that disproportionately afflict some of the poorest people in sub-Saharan and to increase the length and quality of their lives.

*Specific objectives* will be agreed that determine the strategies and activities that are contained in the roadmap. They are certainly likely to include the need to increase the availability and accessibility of surgical services at the district level, and to improve the outcome of the surgical services provided. These objectives may apply at the global level and at national and specific district level.

*Acknowledgement of what is already being done*: will include a summary of national success stories and international initiatives, particularly under the leadership of the World Health Organization.

*Potential strategies are at the national level*: are likely to include the development of national demonstration projects, including training programs and building infrastructures, for example:

- 1 Scaling-up AMO training experience in a few interested countries.
- 2 Development of a model trauma system.
- 3 Development and evaluation of model surgical services at some selected district hospitals
- 4 Development of an instrument to measure surgical output, and/or outcome, coverage at the district level just as for other essential public health indicators
- 5 Development of model referral systems for surgical care with the necessary communication capacity and transportation.
- 6 Exploration of the use of technology to improve surgical care. (e.g. distance learning and consulting, smart cell phones, simple ultrasound)

*Potential strategies are at the international level*: are likely to include the identification of research priorities, building networks to share materials and techniques, advocacy and dissemination, (including the hosting of a follow-up meeting for Senior level politicians and practitioners in sub-Africa) and fund-raising.

The organizers of the meeting are committed to working with participants and others to obtain funding for the implementation of the roadmap. It is therefore particularly important that participants at the meeting come up with concrete projects that they would like to promote and raise funds for. The two major strategies will be the 1) the development of demonstration projects as the most tangible way of creating change, and 2) ensuring that surgery is placed higher on the agenda of international and national decision-making bodies

## Appendix 1: Calculation of Global Burden of Disease and of intervention cost-effectiveness for Surgical Conditions

In 1993 the World Bank published, through Oxford University Press, two closely related volumes on health policy – *World Development Report 1993: Investing in Health (WDR93)* and *Disease Control Priorities in Developing Countries (DCP1)*. *WDR93* reported an initial attempt to measure the burden of disease, globally and by age, sex and region, for approximately one hundred conditions (see also Murray, Lopez and Jamison, 1994 and Murray and Lopez, 1996). *DCP1* attempted to assess intervention cost-effectiveness or how much health a fixed amount of money could ‘buy’ for the interventions available to confront the largest sources of disease burden in developing countries. These assessments of the global burden of disease (GBD) and of intervention cost-effectiveness provided important inputs into health policy discussions in the ensuing years. Unfortunately neither document addressed the importance of surgery.

The disability-adjusted life year (DALY)<sup>vi</sup> serves as the metric for both disease burden and intervention effectiveness. Think of a completely healthy year of life as being given a value of ‘1’. Essentially (although there are technical variants due to discounting and age-weighting) a death that occurs when a person is of an age to expect to live 10 additional healthy years is said to incur a loss of 10 DALYS. A person who is disabled – by being bilaterally blind, say – has a DALY loss due to disability. If the ‘disability weight’ for bilateral blindness is 0.4 then 10 years lived while bilaterally blind would yield a disability loss of 4 DALYS. The total number of DALYS lost from a condition is the sum of DALYS lost to premature mortality from that condition plus those lost to disability from that condition. If a health intervention, for example a surgical intervention to prevent maternal death during childbirth, results in a gain of 20 DALYS at a cost of \$1,000 its cost-effectiveness (in that particular context) is said to be \$50/DALY. Even though DALYS as a measure have the virtues of taking into account both disability and age of death, which simply recording the number of deaths by cause does not, it will often communicate more effectively to talk about burden or cost-effectiveness in ‘real’ terms, e.g. number of maternal deaths or the cost per HIV infection averted.

Although the WHO has provided updated estimates of GBD (although usually without age breakdowns) there had been by the early 2000s no systematic updates of the cost-effectiveness estimates reported on *DCP1*. To provide updates, and to extend coverage (including to surgery and emergency care) the U.S. National Institutes of Health (Fogarty International Center) joined with WHO, the World Bank and the Bill and Melinda Gates Foundation to generate new estimates of intervention cost-effectiveness and of disease burden. This resulted in publication of two volumes by Oxford University Press in 2006:

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<sup>vi</sup> The DALY is a close relative of the QALY, or quality-adjusted life year, widely used in the U.S. and Europe

*Disease Control Priorities in Developing Countries*, 2<sup>nd</sup> edition (*DCP2*) (Jamison, et al, editors); and *Global Burden of Disease and Risk Factors* (Lopez, et al, editors).

In the absence of accurate data, the methodology used in the SURGERY chapter in *DCP2* to estimate the burden of surgical diseases was based on the following approach:

1. Data from the *World Health Report 2002: Reducing Risks, Promoting Healthy Life* and the global burden of disease study (*Murray and Lopez 1996*). [It is important to note that a more recent and comprehensive assessment of the burden of disease and risk factors is now available – A. Lopez, et al, 2006 (*Lancet*) and Mathers, Lopez and Murray in A. Lopez, et al, *Global Burden of Disease and Risk Factors* (Oxford University Press, 2006, pp 45-240). Revised estimates of surgical DALYs from this source would provide improved estimates without substantially altering conclusions.]
2. Listing all the conditions in which surgery might be indicated into three groups as follows: Group I, communicable diseases; Group II, non-communicable diseases; and Group III, injuries.
3. A comprehensive literature review for each condition to determine the proportion of the total burden of disease attributable to it and the proportion of the burden that could be treated or prevented by surgery. Except for some data on cataracts, we found no reliable data.
4. A small survey of the opinion of surgeons in various parts of the world as to their estimate of the proportion of each condition that would require surgery.

## Appendix 2:

**Table 1. Leading Causes of Death, Both Sexes, 2000**

Rank	0-4 years	5-14 years	15-29 years	30-44 years	45-59 years	≥ 60 years	All Ages
1	Lower respiratory infections 2 134 248	Childhood cluster diseases 200 139	HIV/AIDS 855 406	HIV/AIDS 1 249 048	Ischaemic heart disease 931 267	Ischaemic heart disease 5 694 495	Ischaemic heart disease 6 894 057
2	Diarrhoeal diseases 1 315 412	Road traffic injuries 118 212	Road traffic injuries 354 692	Tuberculosis 368 501	Cerebrovascular disease 573 065	Cerebrovascular disease 4 312 376	Cerebrovascular disease 5 101 446
3	Childhood-cluster diseases 1 108 666	Drowning 113 614	Tuberculosis 238 021	Road traffic injuries 302 922	Tuberculosis 413 851	Chronic obstructive pulmonary diseases 2 285 834	Lower respiratory infections 3 866 321
4	Low birth weight 1 025 488	Lower respiratory infections 112 739	Self-inflicted injuries 216 661	Ischaemic heart disease 224 986	HIV/AIDS 332 996	Lower respiratory infections 1 225 643	HIV/AIDS 2 942 901
5	Malaria 905 838	Diarrhoeal diseases 88 430	Interpersonal violence 188 451	Self-inflicted injuries 215 263	Trachea, bronchus, lung cancers 275 895	Trachea, bronchus, lung cancers 886 787	Chronic obstructive pulmonary diseases 2 522 983
6	Birth asphyxia and birth trauma 787 179	Malaria 76 257	War injuries 95 015	Interpersonal violence 146 751	Cirrhosis of the liver 226 975	Hypertensive heart disease 754 495	Diarrhoeal diseases 2 124 032
7	HIV/AIDS 419 480	HIV/AIDS 46 022	Drowning 78 639	Cerebrovascular disease 145 965	Lower respiratory infections 226 105	Diabetes mellitus 612 725	Tuberculosis 1 660 411
8	Congenital heart anomalies 281 751	War injuries 43 671	Lower respiratory infections 65 153	Cirrhosis of the liver 135 072	Road traffic injuries 212 040	Tuberculosis 536 303	Childhood-cluster diseases 1 385 455
9	Protein-energy malnutrition 172 530	Tuberculosis 36 362	Poisonings 61 865	Lower respiratory infections 102 431	Diarrhoeal diseases 210 994	Stomach cancer 529 461	Road traffic injuries 1 259 838
10	STD's excluding HIV 142 176	Tropical cluster diseases 31 845	Fires 61 341	Liver cancer 84 279	Chronic obstructive Pulmonary diseases 181 458	Colon and rectum cancers 441 961	Trachea, bronchus, lung cancers 1 212 625
11	Drowning 115 922	Fires 30 599	Maternal haemorrhage 59 456	Poisonings 78 060	Liver cancer 180 263	Diarrhoeal diseases 400 705	Malaria 1 079 877
12	Anencephaly 85 247	Interpersonal violence 24 668	Rheumatic heart disease 48 062	War injuries 72 314	Self-inflicted injuries 165 412	Cirrhosis of the liver 385 886	Low birth weight 1 025 584
13	Meningitis 76 870	Leukaemia 23 808	Leukaemia 44 740	Nephritis and nephrosis 71 654	Stomach cancer 160 140	Nephritis and nephrosis 357 074	Hypertensive heart disease 940 818
14	Road traffic injuries 75 710	Poisonings 23 293	Nephritis and nephrosis 41 300	Diarrhoeal diseases 68 098	Breast cancer 145 200	Liver cancer 341 157	Self-inflicted injuries 814 778
15	Tuberculosis 67 372	Self-inflicted injuries 21 967	Diarrhoeal diseases 40 392	Breast cancer 61 480	Hypertensive heart disease 135 894	Oesophagus cancer 284 252	Diabetes mellitus 809 685

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Source: Global Burden of Disease Project for 2000, Version 1

## Appendix 3:

**Table 67.4** Resource Requirements for Surgical Services and Surgical Procedures by Level of Care

Category of requirement	Community clinic	100-bed district hospital	Tertiary hospital
Infrastructure	Weatherproof building (100 square meters) Storage space Clean water supply Power supply	Inpatient facility of 100 beds including several wards and an isolation ward Outpatient facility including an emergency room Operating rooms (at least two: one clean, one contaminated) Labor and delivery rooms Recovery room or intensive care unit Blood bank Pharmacy Clinical laboratory Radiology and ultrasonography suite	A major facility providing: <ul style="list-style-type: none"> <li>• Full emergency services with advanced diagnostic services;</li> <li>• Inpatient wards for complex general medical and surgical care</li> <li>• Various types of specialty services</li> <li>• Several delivery rooms and operating rooms</li> <li>• One or more recovery rooms and intensive care units</li> <li>• Rehabilitation and occupational therapy facilities</li> </ul>
Equipment and supplies	Furniture Refrigerator Blood pressure machine Minor surgical trays Sterile and burn dressings Autoclave Intravenous sets and solutions Bandages and splints Drugs: local anesthetics, nonsteroidal anti-inflammatory drugs, antibiotics, tetanus toxoid, silver nitrate ointment, oxytocin, magnesium sulfate Wireless communication equipment Materials for recordkeeping	Anesthetic machines and inhalation gases Monitors (electrocardiogram, blood pressure, pulse oximetry) Fully equipped operating room Fully equipped delivery room Fully equipped recovery room or intensive care unit Respirators and oxygen supply Blood products and intravenous fluids Basic microbiology equipment Pharmaceuticals (anesthetics, analgesics, antibiotics) Surgical materials (drapes, gowns, dressings, gloves) and other consumables (disposable equipment and devices)	All required equipment and supplies to undertake the range of routine and complex services provided
Human resources <sup>a</sup>	Nurse or nurse equivalent Skilled birth attendant Orderly	Nurses (20) Midwives (2–3) Anesthetists (2–3) Anesthesiologist (1) <sup>b</sup> Primary care physicians (4) <sup>f</sup> Obstetrician/gynecologist (1–2) General surgeons (2) Pharmacy assistants (2) Pharmacist (1) <sup>h</sup> Radiology technician (1) Radiologist (1) Physiotherapist (1)	Nurses (50) Midwives (5) Anesthetists (5) Anesthesiologists (3) Primary care physicians (10) Obstetricians/gynecologists (5) General surgeons (5) Orthopedic surgeon (1) Pharmacy assistants (2) Pharmacist (1) Radiology technicians (5) Radiologists (2) Physiotherapists (5) Neurosurgeon (1) <sup>h</sup> Cardiac surgeon <sup>b</sup> Reconstructive surgeon <sup>b</sup>

**Table 67.4** Continued

<b>Category of requirement</b>	<b>Community clinic</b>	<b>100-bed district hospital</b>	<b>Tertiary hospital</b>
Services provided	Simple suturing and dressing of wounds Incision and drainage of abscesses Care of simple burns Control of hemorrhage Splinting Deliveries Vacuum extraction and manual vacuum aspiration	Emergency abdominal, thoracic, head injury  Uncomplicated general surgical operations for hernias, anorectal conditions, and biliary tract disease Surgical infection treatment and control Obstetrical (including surgery for complications) Simple orthopedic care: extremity fractures, dislocations, and amputations Burn care Physiotherapy and occupational therapy Education and training	Full emergency service Management of all complex general surgery Full range of services in orthopedics, trauma, urology, otolaryngology, ophthalmology, and obstetrics and gynecology Basic (and, if resources permit, advanced) neurosurgery and cardiovascular surgery Intensive care services Major burn service Radiology services including CT and MRI imaging and angiography Full service clinical laboratory Physiotherapy Occupational therapy Training of doctors, nurses, and midwives

Source: Authors.

a. Because of the variability in size and the complexity of services provided by tertiary hospitals, it is difficult to describe a standard tertiary hospital; the human resource needs given in the table represent what we think are minimally adequate.

b. Desirable, but not absolutely necessary.

c. Can be a general internist, general practitioner, or general pediatrician.

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