Surgical need & capacity in low and middle income countries
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SUMMARY

The intent of this thesis is to lay a foundation for evidence-based methodology and approaches to the improvement of surgical health care delivery systems in underserved countries. The initial focus has been on the development of survey tools to evaluate the need for surgical care and to quantitate as best as possible the available resources in a country, using Sierra Leone as the main subject of our studies. To validate the methods we also examined the use of the survey in Rwanda and relied on available literature, scant as it is. The first part of this thesis discusses the surgical need in Sierra Leone as indicated by this newly developed survey tool, called Surgeons OverSeas Assessment of Surgical need (SOSAS), which has now been used in Sierra Leone and in Rwanda. For the available surgical resource quantification the PIPES survey (Personnel, Infrastructure, Procedures, Equipment and Supplies) was developed and used in Sierra Leone. This and related research on surgical capacity is explored in part two of this thesis.

In Chapter 1 I describe the initial pilot study of SOSAS in Sierra Leone. It quickly became clear that the employment of SOSAS using iPads was relatively straightforward and simple while at the same time facilitated data entry. Quick analysis of the collected data allowed for rapid feedback and appropriate adjustments. Although the survey has over 400 data entry points, the use of conditional formatting, permitted the enumerators to collect household demographics and interview two randomly selected household members in an average of 25 minutes. The survey methodology was acceptable, with a response rate of 96%. Five major sections/questions were amended to facilitate and refine further the use of this tool following the initial pilot use of the survey.

The results of the full country survey of Sierra Leone using SOSAS are outlined in Chapter 2. Of the 1875 targeted households, data were analyzed for 1843 (response rate: 98%). A total of 896 respondents (25%; 95% CI 22.9–26.2) reported a surgical condition needing attention at the time of the interview. We also concluded that 179 of 709 (25%; 95% CI 22.5–27.9) deaths of household members identified during the year prior to the survey might have been averted by appropriate timely surgical care. It is apparent from this part of the study that this large uncovered disease burden warrants more attention than is currently given. We conclude that demographic health surveys applied in any country should include surgically related questions in their questionnaires, as ours did, to obtain a fair and well balanced view of the health concerns.

As part of a special focus on most important surgical disease in the underserved countries and in the world, we describe in Chapter 3, the rate of injuries. Twelve percent of the population in Sierra Leone reported at least 1 traumatic injury in the year preceding the survey; falls were the most common cause of nonfatal injuries (40%) and traffic injuries were the leading cause of injury-related deaths (32% of fatal injuries). Women were less likely to experience a traumatic injury than men (odds ratio [OR], 0.69; 95% CI 0.57–0.83) as determined by data obtained for the year previous to the survey. In urban areas, there were no differences in the mechanisms of injuries when analyzed by gender. However, in rural areas, a higher proportion of men as compared to women had injuries due to falls, motorcycle crashes, and gunshot wounds. This finding may reflect the relative similarity of activities performed by men and women in urban areas; which differs from more distinct roles that men and women assume in rural areas. The most common injury site was the extremity, regardless of age or gender. Our results complement those found by other focused surveys dealing with injury and trauma in low and middle income countries.

Chapter 4 is dedicated to another specialized surgical need, the pediatric surgical need. Pediatric health needs, especially for those under the age of 5, have been high on the global health agenda following emphasis by Millennium’s development of goal number 4, which targets the mortality rate in those patients under 5 years of age. A total of 1,583 children out of 3,645 individuals (43.3%) were interviewed with the assistance of their guardians. Most individuals under the age of 18 (64.0%, n = 1,013) lived in rural areas. At the time of the interview, 279 children (17.6%; 95% CI 15.7–19.5) had a possible surgical condition which needed treatment and/or a consultation. Children in the northern and eastern provinces of Sierra Leone were much more likely to report a surgical problem than those in the urban-west.
Broadening the category of specialized needs to an area of great deficiency and my special interest, I focus in Chapter 5 on surgical needs for obstetrical problems. Of 3,318 women of reproductive age in the households visited, data were collected on randomly selected 1,205 female participants of reproductive age. Twenty percent (95% CI 17.9-22.5) of respondents reported using family-planning methods; injectables (Depoprovera) were the most frequently used method. Fifty-nine percent (95% CI 54.0-63.0) of the recalled deliveries occurred outside of a health facility. Of the total births, 1.9% (95% CI 1.3-2.5) were reportedly delivered by a cesarean section while only 0.4% were performed with instrumental delivery. The interviews with the household representatives revealed 53 maternal deaths in the 12 months prior to the survey, resulting in a maternal mortality rate of 1,600/100,000 females per/year. Of the maternal deaths, 30 women (56.6%) did not receive any type of modern health care, 53% (16/30) of whose families cited financial constraints as a major limiting factor. These results of maternal deaths, a low percentage of instrumental deliveries, and a low rate of cesarean sections found through our survey in Sierra Leone, combined with the reported financial constraints, indicate that the free health care initiative planned for pregnant women does not yet fully cover the reproductive needs of women in Sierra Leone.

As part of testing the reproducibility of the SOSAS survey tool, the same survey with local adaptations, was also used in a national assessment of surgical needs in Rwanda. This country has more funds in general and for health care than Sierra Leone and is therefore listed much higher on the development scale. The results of this survey are presented in Chapter 6. With a 99% response rate the final analysis included a total of 1626 households (3175 individuals) and it resulted that 41.2% (95 CI% 38.8–43.6%) of the population has had at least one surgical condition during their lifetime; 14.8% (95 CI% 13.3–16.5%) had a surgical problem during the year preceding the survey while 6.4% (95 CI% 5.6–7.3%) of the population were found to have a current surgical problem that required attention. Of that last group 55.3% were women and 40.3% were children younger than 15 years of age.

A total of 32.9% of household deaths in the year prior to the survey may have been related to surgical conditions, with 55.0% of responding households reporting lacking funds to transport the patient to the nearest hospital which could provide personnel, be it a general practitioner, to perform an operation.

We concluded in our discussion that using a very rough metric, including the lower limit of the confidence interval for surgical need in Rwanda (which appears to be a major underestimation when compared to Sierra Leone with a much higher need), our findings can be extrapolated to 56 million people in sub-Saharan Africa that are currently in need of minimal a surgical evaluation and most likely will need an intervention.

In light of this newly documented, but most likely long standing, epidemic of surgically treatable conditions, efforts must be made to identify the causes and determinants that can be addressed to solve this problem. It is possible that the high number of conditions which need immediate surgical care in Sierra Leone is solely due to a backlog of cases and may not be reflective of conditions in other Low or Middle Income Countries or even in Sierra Leone once the “backlog” is taken care of. There might also be local environmental, genetic, cultural or occupational reasons for such a great need for surgical care. As was pointed out by the enumerators’ feedback sessions, most people don’t see an umbilical hernia as a surgical problem. Whatever the underlying cause may be for the large number of cases that we describe, the data provide valuable insight and baseline statistics to develop an understanding of the health needs of the population on the basis of data, collected with great emphasis on reliability. These data can also assist the MoHS and non-governmental organizations in effective planning for health care delivery to the population in need and for initiation of surgical programs where and when they are needed. By documenting a baseline denominator, projects can be properly monitored and evaluated. It is hoped that the type of survey that we describe will be also used in the future not only to initiate new programs, but also to evaluate the effectiveness of those that are ongoing or which are completed. Ideally, data concerning surgically treatable conditions will be collected in future demographic health surveys so as to limit the necessity of repeated implementations of SOSAS for many other countries.

In Chapter 7 is the start of Part two of this thesis, in this chapter we switch gears from surgical needs to surgical capacity. The newly developed PIPES survey (Personnel, Infrastructure, Procedures, Equipment and Supplies – assessment) is explained and used to evaluate the available health resources for surgery, in Sierra Leone. We
were also able to compare our findings from 2011 with those which existed from a similar survey done in 2008. Not unexpectedly many facilities lacked most of the items needed to provide safe and appropriate surgical care, with limited numbers of anesthesia machines, oximeters, instrument sets, gowns, drapes, sutures, and eye protection, as well as anesthesiologist, surgeons, and even qualified general practitioners. Most facilities either gained staff or stayed the same in the comparison of 2011 and 2008 data. The total number of hospital beds increased overall, in each facility in 2011 the number of hospital beds ranged from 30 beds to 327 beds per hospital, with a total of 1,490, compared to 1,398 in 2008. Most facilities still had only one operating room, although 4 hospitals had 2 or more functional operating rooms. Although many of the facilities had improved as indicated by the PIPES-index, staffing shortages were still common at all facilities in 2011.

A specific assessment of surgical capacity for the pediatric population is presented in Chapter 8, and indicated that a pediatric hernia could be repaired in 67 % of hospitals while none of the more complex procedures, such as cleft lip and clubfoot repairs could be performed in entire Sierra Leone. It is unfortunate that the congenital deformities of the face/head/neck area (n=16) and of the extremities (n=12) which the surgical needs assessment of the pediatric population showed to be a significant health burden to the children and their families (Chapter 4), currently cannot be repaired in Sierra Leone in the governmental health care system, unless it relies on (international) specialist teams working with the local surgeons and teaching them while working together on the backlog as well as timely repair for new cases.

This does not negate in any way the pediatric surgery practiced successfully with care by local general surgeons as is described in Chapter 9. This Chapter looks specifically at the relation between the increase in pediatric surgeries performed following the announcement of the Sierra Leone Ministries of Health and Sanitation of free health care for all children under the age of 5. The total number of all operations performed at Connaught Hospital in the 20 months before and after the start of the free health-care program increased by 28 %, from 1,435 to 1,840. During this same time period, the number of operations on children under 5 increased by 500 %, from 42 to 210. This increase was significantly larger than the 17 % increase (from 1,393 to 1,630) seen in operations on patients 5 years old and older (p<0.01). Additionally, the percentage of patients under 5 years of age compared to the total number of cases rose from 2.9 to 11.4 %.

There was an obvious connection between our findings through our pediatric data in SOSAS which indicated that pediatric hernias (soft swellings in the groin area) were the most frequently mentioned surgical abnormality in need for repair and the actual number of pediatric hernias repaired in this review of cases. The average age of patients under 5 who underwent surgery was 1.8 years before the program and 2.1 years after the program was started. Overall, males outnumbered females before the start of the program at a ratio of 20:1, but this decreased to a ratio of 6.5:1 after the start of the program. This suggests that this increase in health care for children under five might be associated with a reduction of gender inequity to health care access. Although the free health care initiative was heralded as a success, the reimbursement of the surgeons, the cost of the equipment and materials to the hospital, as well as hospital costs per se, were not taken into account in maintaining this effort and should be reconsidered.

Finally in Chapter 10 we provide a secondary analysis using the WHO Tool for the Situational Analysis of Access to Emergency and Essential Surgical Care to evaluate safety of surgery performed in relation to infectious diseases. In this Chapter we list the availability of daily needs for health care protection equipment including gloves, aprons and eye protections. At the time of our review there were eight publications that documented such data from 164 hospitals: Afghanistan (17), Gambia (18), Ghana (17), Liberia (16), Mongolia (44), Sierra Leone (12), Solomon Islands (9) and Sri Lanka (31). No country had a 100% supply of any item. Eye protection was available in only one hospital in Sri Lanka (4%) and was most readily available in Liberia being still only 56% of the times when the equipment was needed. The availability of sterile gloves ranged from 24% in Afghanistan to 94% in Ghana. Surgical patients in HIV-endemic areas are more likely to have HIV than the general population, and this study highlights the limited resources devoted to protecting healthcare workers from the occupational hazard of HIV infection or other blood borne diseases. Increasing surgical care without special attention to the safety and quality of care would not only be unwise but would also be unethical from the perspective of both the patient
and the health care provider.

It has been clear to us throughout this study that close collaboration with local and international health care workers, non-governmental organization as well as academic institutions and the local governments are needed to analyze and improve surgical health care in LMIC's. Both need and capacity assessments are part of the foundation needed to build a good surgical network. Through my thesis, I have tried to begin to lay such a foundation by analyzing how these assessments can be developed and applied in a methodical and effective manner, not only in Sierra Leone, but also in a broader sense in other countries which have similar needs.