



**To cite:** Dawka S. The emergence of surgery as a major force in the public health arena. *Arch Med Biomed Res.* 2016;3(1):24-31. doi: 10.4314/ambr.v3i1.4

#### Publication history

Received: April 24, 2016

Revised: April 25, 2016

Accepted: April 26, 2016

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#### CrossRef Link

<http://dx.doi.org/10.4314/ambr.v3i1.4>

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## The emergence of surgery as a major force in the public health arena

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#### ABSTRACT

Surgery has hitherto never been considered seriously in matters of public health as it is seen as being reliant upon highly trained personnel and expensive infrastructure. Moreover, the general perception of global health programs has been as ideally community-based, with emphasis on communicable diseases, nutrition, hygiene and prevention. Surgery has unfairly been seen as elitist, adhocist, demand-based and beneficial to individuals, not populations. However, with the publication of the World Bank's Disease Control Priorities, 3rd Edition (DCP3), the immense scope and potential of surgical intervention in dealing with the global disease load is widely becoming apparent. Also, newer quality-of-life parameters are proving beyond doubt that the benefit-cost ratios of surgical interventions far exceed those of many conventional public health measures. This paper refutes some of the misconceptions surrounding the role of surgery in public health, and explores the key messages of DCP3. In conclusion, it suggests that the provision of essential and emergency surgical services be considered a benchmark for public health standards. There is a pressing need for surgeons themselves to reposition surgery in the global health scenario by advocating and implementing principles that project the discipline as a powerful tool in the worldwide campaign for human health.

**KEY WORDS:** *Surgery; Public health*

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#### INTRODUCTION

Traditionally, surgery has not been considered a global health priority; it has been sidelined or ignored in matters of public health programming, governmental policy prioritization, resource allocation, donor sponsorship, and budgetary funding. Being at the far extreme of the spectrum of modern medical care, surgery has been looked upon as a therapeutic option of last resort, almost as damage control when all else has failed. Policy makers and administrators have seen it more appropriate to focus upon the proverbially better preventive aspects of health care, and plan towards a utopia where they see little need for surgery. Regrettably, surgery has a long history of being overlooked, undervalued and discounted by humanitarian and faith-based service organizations working in the field of global health.

## MYTHS ABOUT SURGERY AND PUBLIC HEALTH

This mindset that brands surgical services elitist has been fostered by a number of misconceptions around the following areas:

### Unmet disease burden versus underutilized potential of surgery

It is commonly held that surgical interventions can address only a small proportion of the global burden of disease. The world health community is only now beginning to realize that surgical intervention can ease a much larger quantum of the global disease load than was hitherto believed. The World Bank estimates that 11% of the onus of global disease can be remedied by surgery<sup>1</sup>; it is, after all, the only redress for most trauma, whether from road traffic or industrial accidents, falls, burns, and criminal or domestic violence, as also for obstetric complications, abdominal conditions, cataract, clubfoot, congenital anomalies and malignancies.

In human terms, injuries kill one in 10 people, accounting for over five million annual deaths worldwide. Half of these deaths occur in young productive individuals between 15-44 yrs. Road traffic accidents are the second leading cause of death in children aged 4-14 yrs. Trauma care systems, as exist in developed countries, can decrease all trauma fatalities by upto a fifth and avert close to half of all medically preventable deaths.<sup>2</sup>

According to the Bellagio Essential Surgery Group<sup>3</sup> (BESG), a multi-disciplinary, multinational group strategizing to expand essential surgical services across sub-Saharan Africa, an estimated half million women die each year from pregnancy-related complications that would require surgical intervention. Annually, 100,000 babies are born with clubfoot: 80% of these are in the third world and most are poorly treated, if at all. The BESG underlines the

fact that most essential surgical interventions can be delivered at the first referral (district hospital) level, with basic equipment and by purpose-trained general practitioners or even paramedical personnel. Tellingly, of all surgeries performed worldwide, only 3.5% are done in the poorest countries where 35% of the world lives.<sup>4</sup>

### Overestimation of costs

In addition to gross undervaluation of their scope and reach, surgical services are unfairly perceived as being expensive, requiring a high level of technical expertise with necessarily cutting-edge instrumentation and facilities. Only recently has it become evident that focus and planning can optimize the availability of both equipment and personnel beyond conventional expectation. It is becoming apparent that most emergency and essential surgical services can be delivered effectively at the primary level with purpose-curated equipment and skills. While surgical interventions do require support in terms of an operation room with an anesthesiologist, nurses and ancillary staff, pathological services, and a modicum of equipment, these represent a long-term resource that, in addition to being largely non-expendable, can serve as a core for expansion and dissemination of locally appropriate surgical and obstetric services. Traditionally, public health experts have favored population-based programs over expansion of the surgical base, because of the belief that valuable resources would be diverted from projects they unconsciously consider more cost-effective. For this reason, most funding gravitates towards treating infectious diseases with a preventive and educational focus, while surgery bears the stigma of being an on-demand service predicated upon individual access.

However, surgical interventions can be surprisingly cost-effective. The WHO metric of global burden of disease is the disability adjusted life year (DALY). It sums up the number of productive years lost due to disability with the estimated number of years of life lost due to premature death. To provide perspective in terms of DALYs, the cost of averting one DALY by surgery ranges from USD 19-102 whereas the costs in terms of oral rehydration therapy for diarrheal diseases is USD 1062 per DALY averted, and for antiretroviral therapy (ART) for HIV ranges from USD 350 – 1494 per DALY averted.<sup>5</sup> Thus, first level hospital surgical care can be ten times more cost effective in averting DALYs than ORS for diarrhea or ART for HIV.

#### The 'public image' of surgery

One reason why the role of surgery in public health seems unclear is that disease and infirmity cannot be neatly classified as surgical or non-surgical. Neither does surgical disease fall into a tidy category, nor does it affect a defined demographic. While trauma is unequivocally seen as surgical, it is often not considered a disease. Emphasis on the preventive aspect of public health, while appropriate, has unfortunately contributed to the sidelining of surgery; surgical disease is seen as non-communicable and unlikely to pose a general public health hazard, and often has no well-defined or quantifiable preventive measures below the tertiary level. Surgery is seen as saving individual lives, while public health prevention programs are seen to benefit entire populations.

#### DISEASE CONTROL PRIORITIES, THIRD EDITION (DCP3)<sup>6</sup>

While global health experts have, for over a decade now, seen the immense scope and potential of surgical intervention if recast and delivered as a public health measure, only recently has the apparent

contradiction between public health services and surgery begun to wear away in the mindset of most health care personnel. This change in perception is, in large measure, due to the publication and promulgation of the *Disease Control Priorities, Third Edition*, by the World Bank in nine volumes over 2015-2016. Volume 1, entitled *Essential Surgery*<sup>7</sup> and freely available for download, sets out five key areas of findings or concern and it is instructive to assess them in detail.

In the first edition of the DCP in 1993, Javitt pioneered analysis of cost-effectiveness of surgery, with reference to cataract surgery.<sup>8</sup> A decade later, McCord and Choudhury evaluated the cost-benefit ratio of emergency obstetric care in a small hospital and demonstrated that surgery was not as expensive or resource-sapping as was commonly believed.<sup>9</sup> The second edition, *Disease Control Priorities in Developing Countries* (DCP2), published in 2006, expanded upon this concept and devoted a chapter to the preliminary evaluation of the cost of surgery *vis-à-vis* benefit when inducted into a public health service system. Activists such as Paul Farmer, the guru of public health, who referred to surgery as “the neglected stepchild of global public health,” have contributed to this recognition of surgery as an unappreciated and underutilized tool in the global health armamentarium.<sup>10</sup> The ‘Global Initiative for Emergency and Essential Surgical Care’ of WHO<sup>11</sup> and Lancet’s ‘Commission on Global Surgery’<sup>12</sup> are concrete steps in this direction.

#### KEY MESSAGES AND FINDINGS OF DCP3

##### 1. The favorably competitive benefit-cost of surgery

One and a half million deaths can be prevented annually in low- and middle-income countries if fundamental surgical services are made universally available. This works out to 6.5% of all

avoidable deaths (3.3% of all deaths) in these countries. The figures for DALYs averted are similar, with 87 million DALYs averted representing 6.6% of the avertable burden and 3.6% of the total burden.<sup>1</sup> Over and above the size of the addressable burden, benefit–cost ratios are emerging from several estimates and they compare favorably with traditionally endorsed public health processes. For example, vitamin A supplementation costs USD 10 per DALY averted, ORS 1000, and ART 900. Cleft lip repair or inguinal hernia repair costs USD 10–110 per DALY averted, cataract surgery about USD 50 per DALY averted, and emergency caesarean section USD 15–380 per DALY averted.<sup>13,14</sup> Cleft surgery at about USD 300 per DALY averted has a huge benefit–cost ratio of 12:1.<sup>15</sup>

Platforms for delivery of surgical services too need evaluation in the loco-regional context. The first level/district hospital is the most cost effective since it deals with most essential and emergency surgery, and therefore the available skill set should be broad-based rather than specialized. Referral hospitals dealing with non-emergencies, such as for obstetric fistula or cataract, can optimize resources and maximize quality by scheduling and should aim for sustainability by ensuring a trickle-down of training and expertise to local professionals. The focus of surgical contribution to global health has been through short-term *ad hoc* programmes or ‘missions’ including mobile hospitals. These platforms, as voluntary international initiatives, have focused on delivering excellent care to a limited number of patients sporadically over time and space, but are context specific, ‘seasonal’ and of limited applicability. Again, given that most trauma deaths

occur in the pre-hospital setting, first-aid training of paramedical first responders as well as improvement of ambulance services can rank among the most cost-effective of interventions.

## 2. Stratification of essential and emergency surgical procedures

The basic or fundamental surgical services referred to in the scope statement above have been codified as 44 essential procedures. Of these 28 would be deliverable at the first-level hospital (district level) and expansion of this surgical platform would ensure a huge return on investment. Procedures deliverable at the primary health center level include basic dentistry, normal delivery, superficial abscess drainage, BLS, suturing, undisplaced fractures and male circumcision (which has the potential to reduce heterosexual HIV transmission by 60%). With specialized or referral hospitals taking care of cleft surgery, club foot and congenital anorectal malformations, cataract and IOL insertion, eyelid trachoma surgery, obstetric fistula and shunts for hydrocephalus, the bulk of emergency obstetrics and abdominal surgery, trauma surgery devolve to the first level or district hospital. Access, both geographical and financial, needs to be enhanced. Sixty percent of operations take place in high-income countries that hold 15% of the world’s population. A census across 23 low and middle-income countries counted from 0.13–1.57 general surgeons and 0–4.9 anesthetists per 100,000 people.<sup>16</sup> Matched data for the US are 9 and 11.4. Operation rooms too vary widely, numbering from 25 per 100,000 in Eastern Europe to 1.2 in sub-Saharan Africa.<sup>17</sup>

## 3. Improvisation and innovation

While funding and investment take time, expansion and diffusion of

existing capacity and resources can fill the gap. Redefining and reallocation of resources and strategies such as task sharing can prove to be very effective.

Extension of access to rural areas in lower income countries is limited by the availability of trained surgeons and anesthetists. While this lacuna will persist into the near future, innovative task sharing or role-redefining solutions have emerged. In Mozambique and Tanzania for example, 90% of major obstetric emergencies are surgically dealt with by technicians. These mid-level functionaries have been specifically trained and validated, and possess the advantage of not being tempted to leave the country as they are not qualified for work elsewhere. General practitioners too can, with focused training and validation, bridge this gap till such time as the long-term goal, that of fully trained specialists, is achieved. Innovations like distance learning, twinning programs with institutions in richer countries, hands-on workshops for non-specialists etc. can help achieve this.

#### 4. Making surgery safer

Safety during surgery has been emphasized; the adoption of simple protocols or checklists and heightened awareness of iatrogenic hazard can reduce the wide gulf between the safety of surgical interventions as performed in developed and developing countries. The mortality from caesarean section ranges widely across countries with the rate in sub-Saharan Africa being 100 times higher than that in Sweden. The dangers of surgery result from those of anesthesia, the procedure itself and the disease. A major portion of these deaths are the result of anesthetic mortality. Whereas in the developed world this approximates 25 per million procedures, in lower and

middle income countries it is as high as 141.<sup>18</sup> This difference can be minimized by the use of checklists, better monitoring and overall assessment of surgical care in terms of quality standards. Introduction of the WHO Surgical Safety Checklist in eight countries reduced postoperative mortality by 47% (from 1.5% to 0.8%), and complications by 35% (from 11% to 7%).<sup>19,20</sup> The adoption of safety protocols needs to be supported with better monitoring and safer equipment, but requires foremost a culture of safeguarding against human error. Quality improvement programs need to be instituted and evaluated, and communication protocols with patients improved.

#### 5. Making access to surgery universal

Universal coverage of essential surgery (UCES) should be prioritized as a cost effective means to realize universal health coverage. This would entail an estimated 3 billion USD annually, and the cost-benefit ratio is in the order of 10 times. There are three dimensions to this challenge. Extension of access (geographical, social and financial), needs to face-off against expansion of range of services provided (from basic to specialist) and elevation of quality levels. The greatest impact of essential surgical interventions on global health will be achieved most optimally by widening access or coverage in the plane of high quality. Increase in the range of services will follow as infrastructure and expertise improve.

#### CONCLUSION

Historically, the global health community has largely ignored the role of surgery as a means to address the public health aspects of disease. Surgery was seen as an expensive and resource-heavy option requiring an elevated skill set and trained

personnel, one that addressed non-communicable or non-preventative elements in the spectrum of disease. In the first decade of this millennium, it has become increasingly apparent that surgery can be a cost effective tool for public health, and that universal coverage of essential surgical services can be attained at much less expense than hitherto thought, especially when compared with other public health interventions (as quantified in terms of DALYs averted).

In their seminal book *Global Surgery and Public Health: A New Paradigm*, deVries and Price<sup>21</sup> predict decreasing deaths from communicable causes like acute respiratory infections, AIDS and malaria, and increasing deaths from non-communicable causes such as cardiovascular disease, cancer, trauma and congenital defects and the increased disease load of an aging population. They also redefine surgery within the public health scenario by emphasizing avertable surgical conditions such as spina bifida, which can be prevented by folic acid supplementation, and trauma, which kills, more than AIDS, tuberculosis and malaria combined. Governments should invest in expanding the coverage of fundamental surgery, if need be by purpose training general physicians or paramedical personnel while adopting checklists and protocols to ensuring high quality. Upgrading and dispersing surgical services will automatically result in better and wider overall health care services. The time has come for surgery to be seen as both a driver and a yardstick of community healthcare standards.

The surgical community itself has neglected the broad picture, concentrating on surgical intervention as an *ad hoc* solution to individualized problems without projecting it widely to the community. A chapter on public health in a surgery textbook will seem a misplaced anomaly, even today, and

the literature, especially penned by surgeons, is as yet tenuous. Just as Medicine—the discipline—comprises much more than medicine—drugs, so also Surgery—the discipline—must be seen as comprising much more than surgery—operations. It is for surgeons to recognize and realize the role that universal extension of emergency and essential surgical services can play in ameliorating human suffering. While surgery does have its champions in the public health arena, it is the everyday practicing surgeon who can help change this by thinking and talking about it, and choosing to act. Indeed, the burgeoning of academic courses over the last few years that link surgery with public health is gratifying. With a new generation of surgeons conditioned to this viewpoint as spokespersons and movers, the stage is set for surgery to realize its full potential as a component and complement of all global health endeavors.

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