

Surgical care in the developing world-strategies and framework for improvement

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Abstract

The purpose of this study was to identify the various problems with surgical care in the developing world and enumerate identified strategies or propose solutions. We also sought to rank these strategies in order of potential impact. The MEDLINE database was sought. Studies published in English, reporting currently employed solutions to identified barriers or problems to surgical care in developing countries or potential solution(s) and published between 2000 and 2012 were eligible for inclusion. 2156 articles were identified for possible inclusion. MeSH terms include *surgery, general surgery, developing countries, health services accessibility and quality improvement*. Forty-nine full articles with a primary focus on the solutions to the challenges to surgical care in the developing world were included in the final review. Many articles identified problems with infrastructure, workforce shortage, inadequate or inappropriate policies, and poor financing as major problems with healthcare in the developing world. Solutions addressing these problems are multifactorial and would require active participation of local authorities and collaboration with providers from the developed world. The burden of surgical care is increasing. There is poor access to surgical services in the developing world. If and when surgical care is received, the quality could be less than the standard in developed nations. Solutions exist to tackle these problems but require a multidimensional approach to be successful.

Introduction

Surgical conditions affect all age groups in all populations, and cut across various aspects of the health system including maternal health, trauma and emergency services.¹ The

development of modern surgical equipment and techniques, as well as potent antibiotic therapy, has greatly improved outcomes of surgery. Yet, surgically treatable diseases remain a major component of global morbidity and mortality, with the greater proportion of deaths from surgical procedures, and surgically treatable diseases occurring in less-developed countries.¹⁻³ Access to surgical care remains a significant contributor to the disease burden, particularly in developing countries which, though accounting for ~70% of the world's population and 80% of deaths from surgically-treated conditions,⁴ contribute only about 26% of the surgical procedures carried out worldwide.⁵ Paradoxically, developing countries account for greater proportion of the global burden of adverse surgical outcomes, despite contributing a lesser proportion of the total surgical procedures carried out worldwide.⁶ In addition, developing countries face a chronic health worker shortage, in spite of their greater proportion of the global burden of disease.⁷ The distribution of the available health workers within many developing countries closely mirrors the distribution of their health services and infrastructure, with higher concentrations of skilled health workers including surgeons in urban regions, though a greater need often exists in the rural regions.² Also, many of the health facilities in rural areas have poor infrastructure and lack essential equipment needed for surgical care.⁸ Surgical procedures carried out by less-trained health workers, under sub-standard conditions are less likely to be successful and further contribute to adverse surgical outcomes.⁸ Surgical care available in rural regions thus tends to be of lower quality, often falling short of international standards of care, and frequently associated with complications.⁹

Increasing acknowledgement of the significance of poor surgical outcomes in developing countries has generated greater focus and discourse on this issue. Several interventions, which identify differing sections of health systems as the ideal intervention point for reducing the incidence of surgical complications in developing countries, have been proposed. However, to the best of the authors' knowledge, no framework exists prioritizing these interventions in order of potential impact. This review was therefore carried out to identify and integrate strategies that have been proposed for the improvement of the quality of surgical care delivered in developing countries and to provide a framework to guide in the selection of the most effective strategies in the developing world.

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Materials and Methods

Eligibility criteria

Studies published in English, reporting currently employed solutions to identified barriers or problems to surgical care in developing countries or potential solution(s) and published between 2000 and 2012 were eligible for inclusion. Quantitative studies as well as qualitative studies were eligible for review.

Data sources

An extensive search was conducted within the MEDLINE database. Articles were identified and retrieved using the following search terms: *surgery, general surgery, developing countries, surgical care improvement, and health services accessibility*. Relevant World Health Organization (WHO) Reports and Publications were also identified and included in the search results.

The authors reviewed the articles independently and then discussed and agreed on the eligibility of each study.

Data extraction

From each article reviewed, solutions to the existing challenges of surgical care in developing countries were noted. For completeness, the barriers which the solutions were targeted at were also identified, if enumerated. Barriers

and solutions were then categorised into domains by the authors, based on degree of relatedness.

Results

From the MEDLINE search, 2156 articles were identified for possible inclusion. One hundred and thirty-one articles were excluded because they were not written in English. Other articles with solutions not specific to surgical care in developing countries or vague in their proposal for surgical improvement were also excluded (Figure 1). Forty-nine full articles with a primary focus on the solutions to the challenges to surgical care in the developing world were included in the final review (Table 1).

The [barriers (Table 2) and] strategies (Table 3) proposed by these articles were classified under 5 broad and interrelated domains: personnel; equipment and infrastructure; methods/process; data systems and performance measurement; environment. These five domains are inter-related and together, constitute a pathway to the improvement of surgical care outcomes (Figures 2 and 3).

Personnel

Human resources are the most critical of the components of surgical care provision. Many developing countries struggle with a shortage of surgical personnel,¹⁰⁻²² and regionalization of available surgical services.^{23,24} Therefore factors to be considered include excellent and appropriate training of the workforce; proper payment structure and incentives for providers with the ultimate aim of improving the retention of workers through the avoidance of internal or external brain drain.

Staff must be appropriately trained to provide safe effective care and yet motivated enough to remain in the region after receiving this training. To retain surgical providers in the country, incentives must be well aligned to prevent concentration of services in urban areas or *external* brain drain whereby these trained surgical personnel could relocate to developed countries in search of greener pastures or other fulfilment.^{25,26} These incentives should be both professional - giving the surgeons opportunities to compete with and be recognized by peers worldwide,²⁷⁻²⁹ and financial,^{10,13,27-31} particularly as financial incentives alone cannot adequately control the emigration of providers from developing countries. A combined approach of incentives along with

mentoring of young physicians to embrace the field of surgery can help ensure the much needed providers remain in these regions to deliver the most needed care.⁸

Surgical care is highly specialized. However to quell this workforce shortage of over 2 million,⁷ other generalists and/or mid-level staff should be trained to provide surgical services such as anaesthesia.^{10,17,26,32-35} Already in many developing countries, non-surgeons provide most of the anaesthesia and other surgical roles with the quality of care given being similar to that provided by trained anaesthesiologists or surgeons.^{36,37} Volunteer surgeons and surgical residents from developed countries may periodically help to alleviate the surgical health worker shortage on a short-term basis.^{2,11,38-40} However, this would not eliminate the longstanding problem of shortage of surgeons.²⁷

Surgeons and other supporting staff in these countries must be trained to constantly deliver standard and safe practices. Surgical skills should be improved through continuous medical education and workshops, visiting lectureships by surgeons from developing countries, collaboration between providers in rural regions and specialists in the urban area, and/or academic partnerships (otherwise

Table 1. Studies included in review (n=49).

Author(s), year of publication	Country (if specified)	Author(s), year of publication	Country (if specified)
Archampong, 2006		Leow <i>et al.</i> , 2011	Sierra Leone
Arnold, 2012		Linden <i>et al.</i> , 2012	Uganda
Aswani <i>et al.</i> , 2012		Loefler, 2004	
Bickler <i>et al.</i> , 2002		Luboga <i>et al.</i> , 2009	
Bickler <i>et al.</i> , 2010	(LMIC)	Luboga <i>et al.</i> , 2010	Uganda
Calisti <i>et al.</i> , 2010	Eritrea	Meo <i>et al.</i> , 2006	Sudan
Cameron <i>et al.</i> , 2010	Guyana	Mock <i>et al.</i> , 2012	
Chirdan <i>et al.</i> , 2010	(Africa)	Natuzzi <i>et al.</i> , 2011	Solomon Islands
Contini, 2007		Ozgediz <i>et al.</i> , 2008	
Daar <i>et al.</i> , 2007		Ozgediz <i>et al.</i> , 2009	(LMIC)
Derbew <i>et al.</i> , 2006	(East Africa)	Perkins <i>et al.</i> , 2010	
Duda, 2007		Petroze <i>et al.</i> , 2012	Rwanda
Dunne <i>et al.</i> , 2011		Quansah <i>et al.</i> , 2008	Ghana
Farner <i>et al.</i> , 2008		Riviello <i>et al.</i> , 2010	
Figus <i>et al.</i> , 2009	Various developing countries	Rogers, 2006	
Gosselin <i>et al.</i> , 2011		Shilpakar, 2011	Nepal
Haglund <i>et al.</i> , 2011	Uganda	Spiegel <i>et al.</i> , 2007	
Haynes <i>et al.</i> , 2009		Syed-Abdul <i>et al.</i> , 2012	
Higginson <i>et al.</i> , 2012		Tollefson <i>et al.</i> , 2012	
Jacobs, 2010		Udwadia <i>et al.</i> , 2008	India
Kingham, 2009	Sierra Leone	Vos, 2009	
Kruk <i>et al.</i> , 2007		Weiser <i>et al.</i> , 2008	
Kushner <i>et al.</i> , 2010	Sierra Leone	Zafar <i>et al.</i> , 2011	Pakistan
Kwon <i>et al.</i> , 2012	Sierra Leone	[No authors listed], 2012	
Leow <i>et al.</i> , 2011			

LMIC, Low- and middle-income countries.

called Twinning) with hospitals from developed countries.^{2,8,10,12-16,18,23,26-29,32,34,38,41-45}

Equipment and infrastructure

Many surgical units in developing countries lack the basic equipment- such as anaesthetic machines, diagnostic equipment; proper maintenance of available equipment; availability of basic amenities: portable water, electricity; building of basic infrastructure: operating rooms, ancillary structures: blood banks etc. needed to provide quality care.^{13,14,19,20,23,35} These also contribute to the poor diagnostic ability in many hospitals in developing countries.¹⁹ When equipment are available, some of them are also poorly maintained leading to breakdown.^{18,20,24}

The availability of basic supplies and equipment is crucial to the functioning of a surgical unit.³⁸ Infrastructure to support surgical services such as operating rooms, blood banks and laboratories should also be built to support the smooth operation of the unit.^{2,13,17,22} Regular supply of electricity or alternative power source should also be prioritized.^{2,23}

To ensure equipment are useful for their expected lifetime and to save costs, local staff should be trained in the care and maintenance of available equipment.^{2,26}

Methods/processes

Factors critical to quality are: standardization of care processes; accountability: existing quality assessment program; good emergency and referral systems; use of innovative tools including checklists and simulation programs.

The methods and processes applied in the healthcare system affect the quality of care. Home-hospital, as well as hospital-hospital communication and transfers should be as smooth as possible. Thus good referral systems and emergency services are a necessary constituent of surgical care improvement in

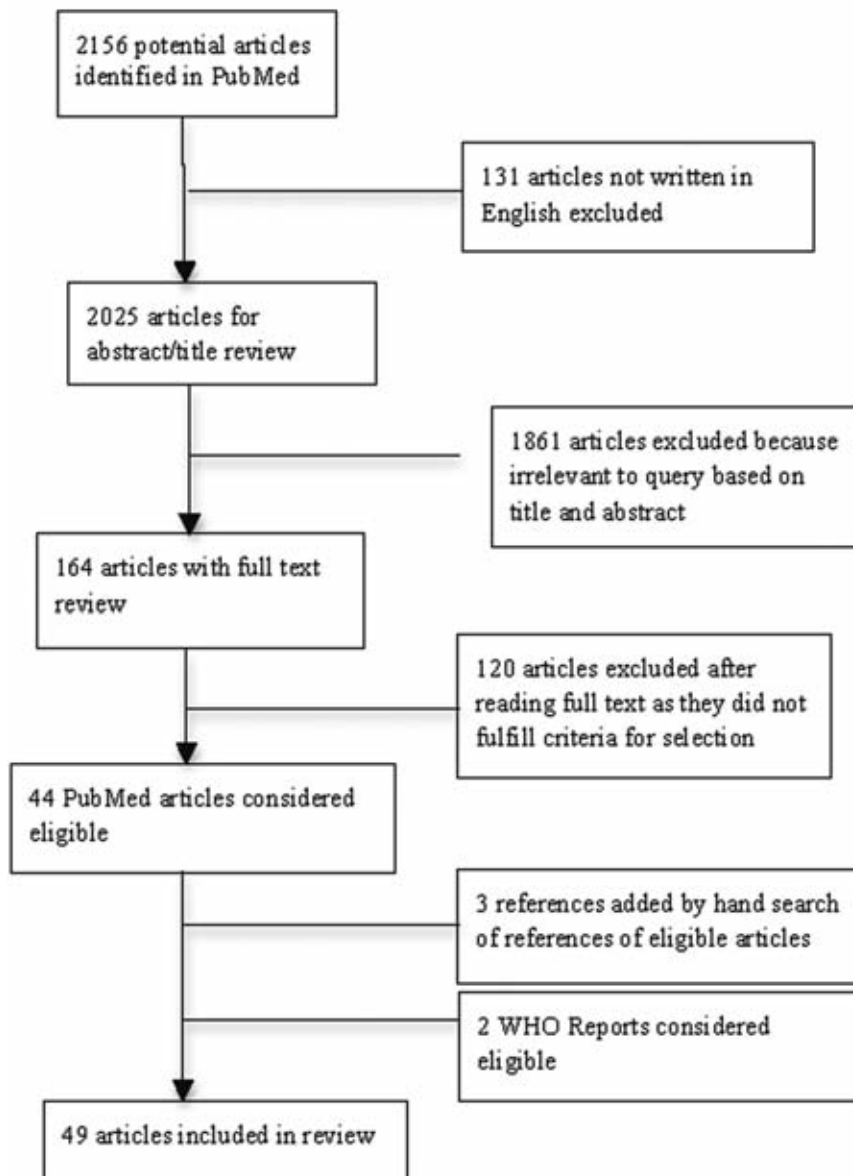


Figure 1. Flow-chart of search strategy.

Table 2. Relevant studies highlighting challenges to surgical care delivery.

Domain	Challenges	References
Personnel	Shortage of manpower	Zafar <i>et al.</i> , ¹⁰ Leow <i>et al.</i> , ¹¹ Shilpakar, ¹² Natuzzi <i>et al.</i> , ¹³ Cameron <i>et al.</i> , ¹⁵ Meo, ¹⁷ Archampong, ¹⁸ Bickler <i>et al.</i> , ¹⁹ Kingham, ²⁹ Arnold ²⁵
	Regionalization of surgical services	Zafar <i>et al.</i> , ¹⁰ Petroze <i>et al.</i> , ²³ Loeffler ²⁴
Equipment and maintenance	Lack of basic equipment	Shilpakar, ¹² Natuzzi <i>et al.</i> , ¹³ Calisti <i>et al.</i> , ¹⁴ Bickler <i>et al.</i> , ¹⁹ Aswani <i>et al.</i> , ²⁰ Petroze <i>et al.</i> , ²³ Linden <i>et al.</i> , ³⁵ Figus ⁴¹
	Poor maintenance	Archampong, ¹⁸ Aswani <i>et al.</i> , ²⁰ Loeffler ²⁴
Data systems and performance measurement	Lack of data on performance and patient safety monitoring Poor research facilities	Zafar <i>et al.</i> , ¹⁰ Vos, ⁵⁰ Ozgediz <i>et al.</i> , ⁵¹ Udwardia <i>et al.</i> , ¹⁶ Derbew <i>et al.</i> ⁵³ Vos, ⁵⁰ Ozgediz <i>et al.</i> , ⁵¹ Udwardia <i>et al.</i> , ¹⁶ Derbew <i>et al.</i> ⁵³
Environment	Mismanagement and corruption	Shilpakar, ¹² Loeffler ²⁴
	Lack of referral facilities	Loeffler, ²⁴ Duda ³¹

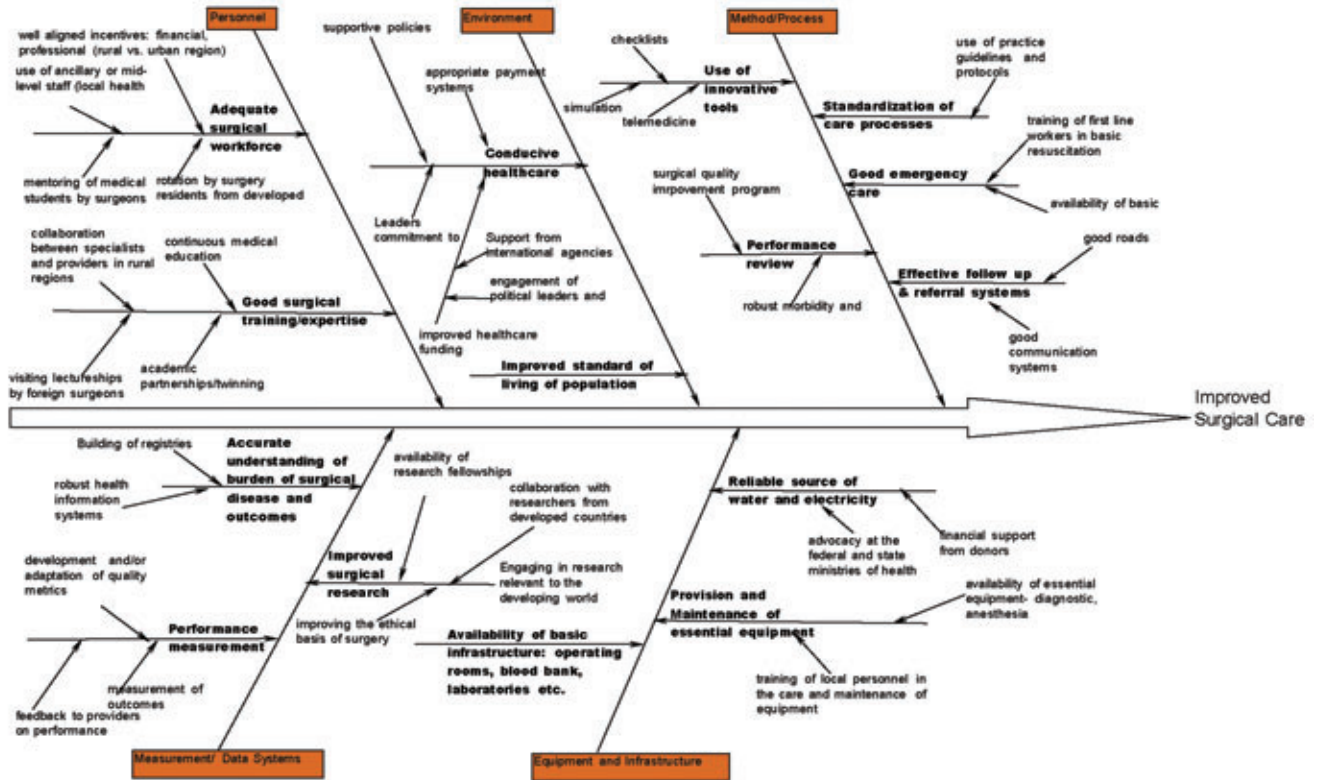


Figure 2. Factors identified as crucial to sustained and improved surgical care in developing countries.

Table 3. Relevant studies highlighting proposed solutions to the challenge of surgical care delivery in developing countries.

Domain	Solutions	References
Personnel	Training of workforce Incentives to prevent brain drain Diversification/retraining of health workers; task-shifting Volunteer surgical professionals Skill preservation through CMEs Intra- and international academic partnerships - twinning	Zafar <i>et al.</i> , ¹⁰ Leow <i>et al.</i> , ¹¹ Archampong, ¹⁸ Petroze <i>et al.</i> , ²³ Contini, ²⁷ No author listed, ²⁸ Spiegel <i>et al.</i> ⁴⁴ Zafar <i>et al.</i> , ¹⁰ Natuzzi <i>et al.</i> , ¹³ No author listed, ²⁸ Kushner <i>et al.</i> ³⁰ Zafar <i>et al.</i> , ¹⁰ Leow <i>et al.</i> , ¹¹ Meo, ¹⁷ Luboga <i>et al.</i> , ²⁶ Gosselin <i>et al.</i> , ³² Bickler <i>et al.</i> , ¹⁹ Quansah <i>et al.</i> , ³⁴ Linden <i>et al.</i> ³⁵ Farmer <i>et al.</i> , ² Tollefson <i>et al.</i> , ³⁸ Leow <i>et al.</i> , ¹¹ Dunne <i>et al.</i> , ³⁹ Figus <i>et al.</i> ⁴⁰ Leow <i>et al.</i> , ⁴² Udwardia <i>et al.</i> , ¹⁶ Duda, ³¹ Quansah <i>et al.</i> ³⁴ Farmer <i>et al.</i> , ² Chirdan <i>et al.</i> , ⁸ Tollefson <i>et al.</i> , ³⁸ Zafar <i>et al.</i> , ¹⁰ Shilpakar, ¹² Natuzzi <i>et al.</i> , ¹³ Calisti <i>et al.</i> , ¹⁴ Cameron <i>et al.</i> , ¹⁵ Udwardia <i>et al.</i> , ¹⁶ Petroze <i>et al.</i> , ²³ Luboga <i>et al.</i> , ²⁶ Contini, ²⁷ No author listed, ²⁸ Kingham <i>et al.</i> , ²⁹ Gosselin <i>et al.</i> , ³² Quansah <i>et al.</i> , ³⁴ Perkins <i>et al.</i> , ⁴¹ Leow <i>et al.</i> , ¹¹ Haglund <i>et al.</i> , ⁴³ Spiegel <i>et al.</i> ⁴⁴
Equipment and infrastructure	Provision of basic supplies and equipment Infrastructure building, including electricity Training staff on care and maintenance of the equipment	Farmer <i>et al.</i> , ² Natuzzi <i>et al.</i> , ¹³ Meo, ¹⁷ Kwon <i>et al.</i> , ²² Duda, ³¹ Spiegel <i>et al.</i> ⁴⁴ Farmer <i>et al.</i> , ² Natuzzi <i>et al.</i> , ¹³ Petroze <i>et al.</i> , ²³ Spiegel <i>et al.</i> ⁴⁴ Farmer <i>et al.</i> , ² Luboga <i>et al.</i> ³⁷
Methods and processes	Good referrals systems and emergency services Innovative practice: Use of care protocols, checklists, telemedicine Appraisal reviews at hospitals	Tollefson <i>et al.</i> ³⁸ Mock <i>et al.</i> , ⁴⁶ Haynes <i>et al.</i> , ⁴⁷ Syed-Abdul <i>et al.</i> ²¹ Linden <i>et al.</i> , ³⁵ Higginson <i>et al.</i> ⁴⁹
Data systems and performance measurement	Robust health data systems Targets and benchmarks for identifying best practices Research fellowships, academic collaborations Develop health information systems Clinical research modules	Ozgediz <i>et al.</i> , ⁵¹ Contini, ²⁷ No authors listed, ²⁸ Duda, ³¹ Vos ⁵⁰ Ozgediz <i>et al.</i> , ⁵¹ Bickler <i>et al.</i> , ³³ Duda, ³¹ Rogers ⁵² Perkins <i>et al.</i> , ⁴¹ Riviello <i>et al.</i> ⁴⁵ Daar <i>et al.</i> , ⁴ Weiser <i>et al.</i> , ⁵ Vos ⁵⁰ , Ozgediz <i>et al.</i> ¹ Nadler <i>et al.</i> ⁵⁴
Environment	Well aligned government policies Support of, and engagement for political and local leaders	Zafar <i>et al.</i> , ¹⁰ Linden <i>et al.</i> ³⁵ Aswani <i>et al.</i> , ²⁰ Kushner <i>et al.</i> , ³⁰ Gosselin <i>et al.</i> , ³² Jacobs ⁵⁵

these countries.³⁸

Use of guidelines or care protocols would also offer a way of standardizing processes across settings and comparing outcomes.⁴⁶ Other tools such as checklists,⁴⁷ simulation and telemedicine^{21,48} have also been successfully used to improve surgical care. Morbidity and mortality meetings also offer a means of appraisal of care delivered and outcomes and can help improve surgical care across different settings.^{35,49}

Just like the National Surgical Quality Improvement Program (NSQIP) established by the American College of Surgeons, regulatory bodies in the medical field of these countries have to play a more prominent role in quality improvement (QI). The basic methods of QI should be taught to providers and even medical students.³⁸

Data systems and performance measurement

Factors critical to quality are: development and/or adaptation of performance metrics for surgical care; building of data registries and feedback on performance.

The lack of data on performance and patient safety monitoring contributes to the poor qual-

ity of surgical services.^{10,50} The knowledge of the burden of disease in these countries is crucial to proper planning and advocacy, efficient resource allocation and intervention strategies.^{3,51} But this knowledge will not be obtained without the establishment of robust data systems that can adequately assess the burden of disease, and the outcomes of care provided.^{1,27,28,31,50} Also, continual monitoring of impact and cost-effectiveness of programs implemented is needed.⁴⁴

Feedback to surgical care providers on their performance will be essential for the involvement and active participation of providers in these countries in the quest for better surgical care. Targets should be set, and practices should be compared with both internal and external benchmarks, with the aim of identifying and emulating best practices.⁵² The awareness of performance evaluation may also, through a Hawthorne effect, further motivate providers to seek for strategies to improve the quality of care provided.³

Research in these countries also has to be improved.^{2,10,16,20,53} A previous survey among surgeons in sub-Saharan Africa had shown that many surgeons in these areas desire a better understanding of clinical research.⁵⁴

This knowledge is critical to improving interest and quality of surgical research. Research fellowships and academic collaborations with teaching hospitals in developed countries could help improve this knowledge.⁴¹ The medical school curricula in these countries should also include modules in clinical research whereby students can learn and be mentored into taking up research roles in addition to their clinical responsibilities upon graduation. Financial as well as academic support should also be given to researchers to encourage research on surgical conditions. Improved data through health information systems and networks should ultimately improve the quality of care.^{39,50,51}

Environment

A stable socio-political environment is critical to health care quality.^{12,24} There should be appropriate health policies, government funding and a general upgrade in the standard of living for citizens.⁸ Mismanagement and corruption at hospital and government levels must also be curtailed for surgical care to be optimal.^{12,24}

To begin new efforts or sustain existing ones to improve surgical care in these countries, the healthcare environment must be conducive. Government policies should be well aligned with the goals of the WHO, donors, providers or volunteers seeking to improve surgical care.^{10,35} This therefore makes the support and engagement of political and local leaders indispensable.^{20,30,32,55} Leaders must be committed to improving the health and livelihood of citizens-especially the poor.² Good transport and communication are also key to an effective referral system.^{24,31}

Poverty may deter citizens from seeking appropriate surgical care.^{20,24} A fee-for-service payment system could further prevent citizens from seeking the much needed care in a timely fashion. Medical insurance should therefore be provided for the poor. This improvement could in itself improve the health of citizens. Due to the resource limitations in these settings,³⁴ funding and support from international organizations to help fund projects for surgical care improvement will be important.^{10,11,15,34,35} To strengthen these healthcare systems, continual sufficient government funding of the health sector and on-going support from government bodies is also important²⁸ as well as Public-Private partnerships.¹⁶

Discussion

The burden of surgical diseases in developing countries is increasing. Various strategies to improve surgical care in these countries

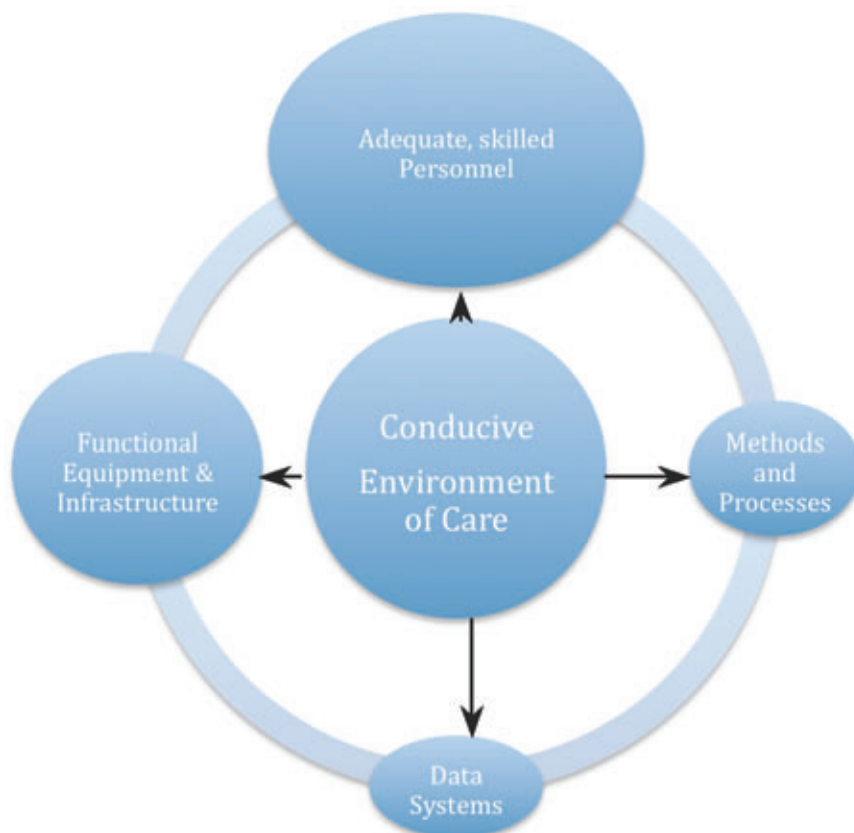


Figure 3. Framework showing relative contribution of major intervention domains to quality of surgical care in developing countries.

have been geared towards improving access and/or improving the quality of care when care is received. Unfortunately, the identified strategies, either at the micro level or macro level, are not individually capable of creating a permanent and sustainable improvement in surgical care in developing countries. The potential impact of, and inter-relationship between these factors makes it essential that these different factors are addressed simultaneously.

The shortage of well-qualified surgical personnel remains one of the major challenges of surgical care in the developing world. This is further worsened by the regionalization of services with many of the available workers congregating in urban regions of these countries.² The problem posed by brain drain which has been estimated to cost some developing countries as much as \$2.78 billion in loss of returns from investment also needs to be addressed.⁵⁶ Developing countries must devise a means of reducing brain drain along financial gradients, while maximizing the amount of care that can be obtained from available health care workers within the countries. Local providers must be afforded opportunities to grow professionally and compete with peers from within and outside the countries and also be able to earn a decent pay such that leaving the country in search of greener pastures will look less enticing. In the interim, surgical mission trips can help fill the gap. These stopgap measures must be well aligned with local needs and with collaboration with local providers. Reducing this shortage in the short-term, or improving the skills of providers in these countries will however not produce lasting effects without the support of the governments in these countries.

To ensure equipment that are well maintained, local staff should be trained in the care and maintenance of these equipment. Given resource limitations, equipment purchased by and donated to these health facilities should also be well adapted to the local environment, *i.e.* cost-effective.

As improvements are made, performance and outcome measurement will be key to identifying areas for improvement. These data should be used for policy development and planning effective strategies. Over the years, the WHO Reports for many healthcare indicators in these developing countries have shown abysmal numbers. Local governments and healthcare agencies should find ways to personalize these data and give feedback to the smallest unit of the healthcare system. This will make these data actionable, allowing for the development of targeted local improvement strategies. The awareness of their performance being measured might in itself through a Hawthorne effect improve care in areas where providers are already empowered to effect

change. Just like the NSQIP established by the American College of Surgeons, regulatory bodies in the medical field of developing countries have to play a more prominent role in QI. The basic methods of QI should be taught to providers and even medical students.³⁸

Research must also be encouraged and sustained. This is particularly essential, as the presentation and burden of diseases often differs between regions. To address the common conditions plaguing the citizens of developing countries, the onus rests on researchers in these countries to contribute to the body of knowledge through research.

The *environment* of care, including government policies and funding, general standard of living of citizens and socio-political climate will play a pivotal role in improving surgical care in these countries. A strong political will is vital for improving surgical care. A government committed to improving the health of its citizens is more likely to embrace the various interventions geared towards surgical care improvement. With this commitment, local and international efforts are more likely to produce lasting and far-reaching effects. Even when services are available, poverty and ignorance may deter citizens from presenting on time when they have a surgically amenable condition. This is further compounded by the out-of-pocket fee payment structure for care that exists in many of these countries, making it difficult for poor citizens- who usually needs surgical care the most- to look for and afford surgery. For sustainability of surgical care improvement in these countries, it is vital that the general socioeconomic status of citizens of these countries improves and appropriate payment structures put in place.⁸ The plague of infectious diseases, civil wars etc. also impoverish citizens and have to be simultaneously addressed for any efforts implemented to have a lasting impact. The different strategies to improve care in these countries will come at different costs, different magnitude of impact and different durations of effect. Unfortunately, no silver bullet exists to improve healthcare in these countries. Only when each of these factors is addressed will the improvement of surgical care in these countries be permanent and sustainable. Each factor should therefore be considered against the background of its effectiveness, financial commitment and most importantly, its potential to impact the quality of care. Ultimately, improving surgical care in the developing world will require a multi-dimensional approach, and integration with local efforts along with a proven commitment by the entire health system is crucial to attaining the desired gains, and for the sustainability of any improvements made.^{2,57}

This study is not without limitations; in conducting this review, the effect of the character-

istics of the regional setting on the effectiveness of the various proposed interventions was not investigated. In particular, the emphasis laid on each of these identified factors by countries seeking to improve surgical outcomes may vary with differing combinations of the challenges to surgical care and this may limit the extent to which the findings in this paper can be generalized. However, the framework for the improvement of surgical care put forth in this paper can serve as a guide to policy makers in developing countries seeking to improve the quality of care that is provided within them. In particular, the framework provides a holistic view of how various interventions along the outcome improvement pathway fit together to yield improved surgical care. Future research will be helpful in identifying the factors that may accelerate the rate of improvement of surgical care in different settings.

Conclusions

Many solutions exist to improve the quality of surgical care in developing countries. However a multidimensional approach with the use of the cost-effective strategies could help achieve the lasting effect desired.

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