REVIEW ARTICLE

Improving Surgical Capacity and Infection Prevention in Resource-Limited Settings: A Case Study of Kyrgyzstan

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Abstract

Post-graduate surgical training programs in low- and middle-income countries (LMICs) face challenges such as limited resources, high infectious disease rates, and poor infection prevention and control (IPC) measures. A review of surgical education in 34 LMICs, particularly Kyrgyzstan, identified these obstacles, assessed IPC practices, and suggested improvements. Despite local adaptations, LMICs struggle with trainer shortages, balancing clinical and educational demands, and inadequate healthcare funding. The link between surgical education and infection management is critical in LMICs because of the higher communicable disease rates and increased surgical risks. Recommended strategies include integrating IPC education into surgical curricula, upgrading sterilization and personal protective equipment, and developing IPC policies, community involvement, and research to guide interventions. The Kyrgyz State Medical Institute and National Surgical Center case study highlighted the importance of collaboration, organizational structures, and regulatory frameworks in enhancing surgical training and healthcare outcomes. Addressing these issues requires infrastructure improvements, policy implementation, community engagement, and international collaboration, with progress monitored using metrics such as surgical workforce density, surgical volume, and perioperative mortality rates.

Key words: Infection prevention and control, low- and middle-income countries, medical education, personal protective equipment, post-graduate surgical training

INTRODUCTION

Context of surgical care in low- and middle-income countries (LMICs)

Nearly two billion people globally lack access to essential surgical care, with the greatest disparities found in LMICs. Despite significant financial and resource constraints, surgery has been shown to be cost-effective.[1-3] The limited availability of surgical treatments in these areas stems from the shortage of qualified surgeons. Some countries address this shortage by employing non-physician clinicians and creating advanced surgical training programs,[4-6] aiming to produce surgeons suited to local needs. While the goals of post-graduate surgical training programs are similar worldwide, their methods and durations vary and lack standardization.[7] This study investigated post-graduate surgical training in 34 LMICs, particularly Kyrgyzstan, to evaluate present programs, pinpoint major obstacles, examine the incorporation of infection prevention and control (IPC) practices, propose strategies for enhancing collaboration, and create a comprehensive framework that addresses challenges and aligns training with local healthcare requirements.

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SITUATION IN LMICS

Regional surgical training programs

Sub-Saharan Africa offers surgical training through local institutions and regional programs, such as the West African College of Surgeons and the College of Surgeons of East, Central and Southern Africa,[8,9] with the Pan-African Academy of Christian Surgeons providing advanced training.[10] After 2 years of post-graduate training and a membership exam, the students underwent 3 years of specialty training and a fellowship exam. University-trained post-graduates can take these exams for regional college accreditation and recognition of surgical qualifications, similar to the Association of Southeast Asian Nations regional recognition in Southeast Asia.[11,12] Our evaluation of the general surgery programs in 34 LMICs revealed diverse income levels and locations.

Historical development of surgical training

LMICs gradually introduced post-graduate surgical programs between 1944 and 2008, with sub-Saharan African countries such as Malawi and Rwanda starting programs in 2005 and 2008, while South Africa and Nigeria have had programs for decades.[13-15]

Structure of training programs

Despite the variability, most programs consist of 6 years of undergraduate study, a 1-year internship, and 4–5 years of post-graduate training, with preliminary, intermediate, and final assessments. Programs tailored to national needs include general surgery, orthopedics, urology, neurology, and burns, with the aim of placing graduates in rural or district hospitals. Aligning training levels with future work settings is essential for improving patient care and physician satisfaction. Challenges include trainer shortages, conflicting demands between clinical practice and education, limited supervision, arranging visiting surgeons, and maintaining the local curricula.

Challenges in surgical education

Assessment methods include written, oral, and practical examinations, with question bank repositories benefiting from educational programs. External examiners ensure quality and national board exams and accreditation procedures are common.[16-18] Medical education costs over $100 billion annually and is primarily funded by private or government sources.[19] Some sub-Saharan African programs require mandatory government services as repayments for sponsorship.[9] Limited healthcare funding has challenged the expansion of surgical training in these regions.

INFECTION MANAGEMENT IN SURGICAL EDUCATION

High burden of infectious diseases

In LMICs, the intersection of surgical education and infection management is crucial because of the high rates of infectious diseases such as human immunodeficiency virus/acquired immunodeficiency syndrome, tuberculosis, and hepatitis, which affect surgical safety and efficacy. Addressing these issues requires targeted strategies for enhancing surgical training and infection control. Challenges increased rates of communicable diseases, high rates of infectious diseases in LMICs increase transmission risks during surgery, jeopardizing patients and medical staff. Studies have shown that these diseases exacerbate surgical site infections (SSIs), resulting in greater patient morbidity and financial burden on healthcare systems.[20-22]

Limited infection control resources

Many healthcare facilities in LMICs lack sufficient resources for effective IPC, including personal protective equipment (PPE) and sterilization technologies, which are crucial for managing the spread of infection during procedures involving communicable diseases.[22,23]

Inadequacies in surgical and IPC education

Training programs in LMICs often do not sufficiently emphasize IPC practices tailored to communicable disease challenges. This leads to poor adherence to IPC protocols and higher risks of hospital-acquired infections.[23,24]

IMPROVEMENT STRATEGIES

Holistic and integrated education

Surgical training must include comprehensive IPC education, covering surgical protocols for infectious patients, safe handling of sharp objects, proper PPE use, and effective sterilization and disinfection methods. Artificial intelligence (AI)-powered platforms can provide feedback and simulate surgical scenarios, even in resource-limited settings.[25,26]

Enhanced infection prevention infrastructure

Investing in advanced sterilization equipment and reliable PPE supply chains is essential for strengthening IPC infrastructure. Innovations, such as solar-powered autoclaves offer cost-effective solutions in resource-poor regions, reducing infection risks and promoting safe practices.[22,23]

Policy development and implementation

Governments and healthcare institutions should devise and implement IPC policies tailored to infectious diseases, aligned with global standards and local epidemiological data. Emphasis should be on proven interventions, such as chlorhexidine gluconate and alcohol-based skin preparations, which significantly reduce SSIs.[24,27]

Public engagement and education

Raising awareness of infection control and early detection of infectious diseases within communities can lower transmission rates. Engaging local leaders and organizations in educational initiatives enhances community support for IPC measures.[22]

Research and monitoring

Studies on the prevalence and transmission of infectious diseases in surgical settings can inform targeted interventions. Improved data collection on infection rates and outcomes is crucial for refining surgical and IPC practices.[20,22]

Addressing the challenges of surgical training and infection control in LMICs with respect to infectious diseases requires a multifaceted approach. Enhancing training, upgrading infrastructure, enforcing policies, and engaging communities will help LMICs to navigate the complexities of surgical procedures. Adopting innovative solutions and fostering international collaboration can create safer surgical environments and improve health outcomes.

THE DEPARTMENT OF SURGERY AND NATIONAL SURGICAL CENTER IN KYRGYZSTAN: A CASE STUDY

Present collaborative challenges

The Department of Surgery at the Kyrgyz State Medical Institute of Post-graduate Training and Continuous Education and the National Surgical Center in Kyrgyzstan face collaborative challenges due to the absence of regulatory mechanisms for managing microeconomic aspects. Accurately assessing labor costs and medical activity intensity is problematic, with present metrics inadequately capturing doctors' contributions. Institutional policies neglect shared responsibilities and compensation for additional work under mandatory medical insurance, whereas sociological factors and traditional educational approaches further complicate collaboration, posing challenges for surgeons' training and professional development.

Development of a collaborative framework

Before 2007, a comprehensive evaluation of collaborative efforts and an analysis of perceptions from clinical department heads and hospital administrators highlighted the need for specific cooperation regulations, leading to a structured framework that addresses key challenges. The healthcare sector must prioritize the organizational, legal, and economic elements that support clinical departments. An organizational model depicting collaboration between the Department of Surgery at the Kyrgyz State Medical Institute and the National Surgical Center was developed, initially focusing on medical and organizational strategies. Cooperative agreements have provided essential assistance, guidance, and support, contributing to professional development, and serving as crucial sources of information, expertise, and coordination.

Impact of collaboration on education and healthcare

Collaboration between the Kyrgyz State Medical Institute's Department of Surgery and the National Surgical Center has enhanced research, forecasting, competency-based program design, innovative approaches in education and healthcare, and improved patient care quality and outcomes. Since 2000, substantial organizational, legal, financial, and economic changes have been implemented, and enhanced organizational and methodological approaches have improved the collaboration efficiency. Medical and economic assessments revealed that the National Surgical Center exceeded the standard treatment workload by 1.4 times, with financial expenses surpassing the department's revenue. Despite the increased workload, employees are ineligible for additional compensation due to the lack of regulatory support under mandatory medical insurance. An organizational model was developed to address this issue and improve the quality and efficiency of medical care. Effective communication among ministries is crucial for designing efficient post-graduate programs and optimally distributing the surgical workforce.[19] However, regular reporting on surgical workforce density is insufficient, despite the World Health Organization providing data on physician density.[20]

KYRGYZSTAN'S UNIQUE CHALLENGES AND IMPROVEMENT APPROACHES

Kyrgyzstan, an LMIC, faces unique challenges in terms of surgical education and infection prevention, particularly regarding communicable diseases. Limited resources hinder the healthcare system and affect surgical training and infection-control measures. The high prevalence of infectious diseases, such as tuberculosis and hepatitis, and zoonotic conditions, such as brucellosis and alveolar echinococcosis, complicate surgical procedures and increases the risk of

SSIs,[28-30] which imposes a significant economic burden on LMICs.[20,21]

Limited resources and training inadequacies

Surgical centers often use outdated equipment and lack proper sterilization, increasing the risk of SSI. A shortage of PPE and vital supplies hampers effective infection control.[22,23] Surgical education programs frequently omit comprehensive IPC components, especially for handling operations involving infectious patients. The lack of standardized curricula and skilled instructors diminishes the training efficacy.[22] The prevalence of infectious diseases in Kyrgyzstan heightens the risk of cross-infection during surgeries, endangering both patients and medical staff.[29,30]

Strategies for IPC enhancement

It is crucial to integrate IPC practices into surgical training programs, including modules for handling infectious diseases and adhering to IPC protocols. Technologies, such as AI and virtual reality can enhance training outcomes in resource-limited settings.[25,26] Funding is required to upgrade surgical facilities with modern equipment and reliable sterilization technologies. Portable autoclaves and other cost-effective solutions can improve infection control and reduce SSIs.[24,27] Formulating national guidelines for surgical and IPC practices tailored to infectious disease challenges can standardize care. These should align with global standards and incorporate evidence-based strategies, such as chlorhexidine gluconate and alcohol-based skin preparation.[24,27] Educating local communities and stakeholders on IPC can reduce the prevalence of infectious diseases. Collaboration with international organizations can provide additional resources and expertise.[31] Studies assessing SSIs incidence and IPC intervention effectiveness in the context of infectious diseases are crucial. Enhanced surveillance systems are needed to track infection trends and outcomes and to inform future policies and practices.[22]

Kyrgyzstan's efforts to improve surgical training and infection control, particularly for infectious diseases, require a comprehensive strategy that involves education, infrastructure, policy, and community engagement. Addressing these issues can enhance surgical capacity and reduce infection burden, leading to better health outcomes. International cooperation and innovative solutions are essential for sustainable healthcare improvement.

CONCLUSION

Standardized post-graduate surgical training in LMICs is crucial for improving healthcare outcomes and reducing the incidence of communicable diseases. Incorporating IPC measures into the surgical curricula can enhance procedural safety and efficacy. The case of Kyrgyzstan demonstrates that interdepartmental and interhospital collaboration can foster professional growth, patient care, and innovative educational and healthcare management practices. Comprehensive strategies involving policy development, infrastructure improvement, and community engagement are necessary for achieving safer surgical environments and better health outcomes. Evaluating these strategies using indicators such as surgical workforce density, surgical volume, and perioperative mortality rates is essential for the sustained progress in surgical education and healthcare delivery in LMICs.

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