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Post-Graduate Urology Training in LMIC

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Abstract: Introduction: Urological conditions significantly impact global health, with increasing demand for urologists in both developed and developing countries. Disparities in access to surgical care between high-income countries (HICs) and low- and middle-income countries (LMICs) are evident. Despite advancements in urology, LMIC training programs often follow outdated curricula and traditional methods. Methodology: A comprehensive search strategy identified urology training programs in LMICs using the EduRank website, Google searches, and PubMed. Data were collected from literature, official documents, and online resources, focusing on variables such as program duration, research requirements, and resident salaries. **Results**: The analysis revealed significant variability in program structures and requirements across LMICs. Residency training durations ranged from 4 to 6 years, with inconsistent research obligations and resident salaries averaging $12,857 annually, with a range from 5,412 to 18,174$. Fellowship opportunities were limited, with only a small number of programs achieving international accreditation. **Conclusion**: The study highlights substantial disparities in urology training between HICs and LMICs. There is an urgent need for standardized and locally tailored training frameworks to enhance the quality of urology education in LMICs. Future research should focus on developing strategies to improve training opportunities, ensuring equitable access to advanced urological care and education globally.

Keywords: Education; Post graduate training; LMIC; Residency

1. Introduction:

Urological conditions constitute a significant burden of disease worldwide [1], and the need for urologists in developing and developed countries is increasing [2]. Evident disparities in access to adequate surgical care between high-income countries (HICs) and low- and middle-income countries (LMICs) are widely recognized [3]. Despite notable advancements in the field of urology [4], training programs in LMICs often lag behind, adhering to traditional teaching methods and outdated curricula [5].

The training programs in different countries vary. For instance, the number of years of training in the United States (US) and Canada is five compared to seven in New Zealand and Australia, and nine in the UK [6]. In addition, the training requirements and pathway structures differ. Training methods vary depending on the experience of the institutions, individuals, and structure. Urology training is shifting from classical surgeries and has begun to incorporate minimally invasive as well as robotic surgeries, as well as simulation-based training. Minimally invasive surgeries (MIS) are becoming more favored, resulting in challenges and high learning curves [7].

Urologists traditionally train through observation, hands-on practice, and teaching, and gain extensive experience over time. However, owing to the European Working Time

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Directive, operative exposure time has become limited. Simulation has been a tempting tool for training, allowing the repetitive practice of a procedure to minimize errors and increase learning [8]. Compared with the developed world, urology training in the developing world does not have a clear structure, and there is a wide variety in the level of competence of graduates from different programs [5]. In contrast to Western practices, where MIS and laparoscopy training are conducted using models, simulators, and under the guidance of expert mentors, training in developing nations predominantly involves hands-on experiences with real patients in the operating room (OR). This disparity arises primarily because of financial constraints [5]. Coupled with an unstable curriculum, infrastructural deficiencies, and limited operative resources, urologists in LMICs face significant challenges in accessing adequate training opportunities [1,5,9]. We aimed to explore the training opportunities in low-middle income countries, inform potential trainees, and influence future adjustments to training structures.

2. Methodology

A comprehensive search strategy was used to identify urology training programs across various countries, focusing on those classified as low-middle-income countries (LMICs). The EduRank website (https://edurank.org/medicine/urology) was used to obtain an initial list of the top 100+ urology training programs. This website provides rankings for medical schools and urology programs worldwide. From the list obtained via EduRank, the official websites of the respective universities and hospitals were visited to gather detailed information on their urology residency and fellowship programs. However, the EduRank list did not encompass a sufficient number of programs, so the search was extended by performing Google searches using terms such as "urology training programs followed by the name of specific LMICs. This allowed for the identification of additional training programs that may not have been listed on EduRank. PubMed database was used searching keywords such as: "Urology training" ,"Low-middle-income countries", "developing countries", "LMICs", "and "Surgical training". We excluded any papers from HICs.

Data were collected from literature, publicly available documents from official governing bodies, collected forms sent to current residents, and online resources. Variables of interest included the name of the university/hospital, country, the program's number of years, research requirements, number of available seats, and type of program. Countries belonging to the class were determined based on the World Bank annual report (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups).

The World Bank employs a classification system based on Gross National Income per capita [10], aiding in defining the relationship between economic status and national health, thus identifying areas requiring support. It identifies countries with a limited financial capacity to provide healthcare for their citizens and individuals who may encounter significant barriers in accessing medical interventions.

3. Results

3.1 Residency

In our analysis of urology residency programs across various institutions, we observed a significant diversity in program structures and requirements. Ten institutions from eight different countries: Lebanon, Pakistan, India, the Philippines, Egypt, Iran, Bangladesh, and Jordan. All are classified as low-middle income countries according to the World Bank [10].

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The duration of the training programs ranged from 4 to 6 years, with a median of 5 years. Surgical (core) training durations ranged from no years (Mansoura University, Egypt) to 3 years (All India Institute of Medical Sciences and Christian Medical College, Vellore, India), with a median of 2. The number of years dedicated to urology-specific training varied from three to four years. The number of seats ranged from one (Aga Khan University, Pakistan) to 11 (All India Institute of Medical Sciences, India), with some entities opting not to disclose specific seat quotas. The average annual salary for residents was $12,857 with a range from 5,412 to 18,174$ [Table 2]. However, when compared to the general population, urology residents in Egypt and India earn significantly higher incomes. For instance, in Egypt, the average annual salary for the general population is $2,345, while urology residents at Mansoura University earn $18,174.

The American University of Beirut and the Philippine General Hospital mandated one clinical research project and assigned research projects, respectively, during their 6-year residency programs. Aga Khan University in Pakistan required the completion of two research projects during its 4-year residency program. Programs in Egypt and Pakistan had the shortest duration, each lasting four years. The Iranian Urology and Transplantation Center has a 5-year program, with 6 months of core surgical training and 4 years and 6 months of urology-specific training. The India Institute of Medical Sciences has the greatest number of seats available, which is 11. While selected institutions provided direct access to their program websites for prospective applicants to obtain further information, others lacked readily accessible online resources, necessitating alternative ways for program exploration. Exploring the curricula of residency programs proved challenging because many institutions do not have these data readily available online. While many programs mention that their curriculum includes the acquisition of detailed factual knowledge of the entire field of urology [11,12], they often do not specify which subspecialties are covered, such as female urology, transplants, oncology, and pediatric urology. Bangabandhu Sheikh Mujib Medical University stands out by providing detailed information on its website about the minimum number of cases required for graduation, including a logbook for tracking this data [13]. In contrast, other programs lack such transparency, failing to mention case requirements, or offer comprehensive details about their training curricula online.

Table 2. A comparison of key features in each institution.

University/Hospital	Years	Country	Program	Research Required	Years of other surgery training (e.g. core surgical training)	Years of urology specific	No. of Seats	Average annual salary of urology residents in USD ($)	Average annual salary in USD ($) [36]
American University of Beirut	6	Lebanon	Residency	1 Clinical Research	2	4	2	Not Available	305

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Aga Khan University	4	Pakistan	Residency	2 Research Projects	2	4	1	5,412	3,529
All India Institute of Medical sciences	3	India	M.Ch	Not Available	3	3	11	15,000	4,605
Christian Medical College Vellore	3	India	M.Ch	Not Available	3	3	5	13,000	4,605
Philippine General Hospital	6	Philippines	Residency	Assigned Research Project	2	4	Not Available	Not Available	9,116
Mansoura University	4	Egypt	Residency	Not Available	0	4	4	18,174	2,345
Iranian Urology and Transplantation Center	5	Iran	Residency	At least 1 research Paper	6 months	4 years & 6 months	3 to 4	Not Available	12,773
Bangabandhu Sheikh Mujib Medical University	5	Bangladesh	Residency	Assigned Research Project	2	3	Not Available	Not Available	2,652
Lebanese American University	5	Lebanon	Residency	Not Available	Not Available	Not Available	1 to 2	Not Available	305
Jordan University Hospital	5	Jordan	Residency	At least 1 research Paper	1	4	8 to 9	12,700	26,838

3.2 Fellowship

We conducted a search of various fellowship-accredited societies [Table 3]; however, only a limited number of programs were offered in LMICs. The Endourology Society Accredited Fellowship programs (https://www.endourology.org/fellowships/clinical) only included three out of 84 (3.57%) programs from LMICs. Two of them were from India (Muljibhai Patel Urological Hospital Safdarjang Hospital and Vardhman Mahaveer Medical College) and one was from Egypt (University Mansoura). All three programs offered a combined fellowship (Endourology, Laparoscopic, and Robotics). Notably, the fellowship program at the University of Mansoura in Egypt required a minimum of three publications. Both programs in India mandated publications and presentations at the National and World Congress of Epidemiology (WCE). The Muljibhai Patel Urological Hospital has listed a minimum case load of 250 per year.

The Society of Reconstructive Urology had one accredited fellowship program out of 30 (3.33%) in an LMIC located at the Kulkarni Reconstructive Urology Center in India. The program duration was one year, focusing on reconstructive urology, with a minimum requirement of 145 procedures annually. However, past fellows averaged 379 cases annually. [https://societygurs.org/gurs-fellowships-match/].

Société Internationale D'Urologie (SIU) accredited 44% of its training programs in LMICs. Specialties include endourology, prostate cancer, urogenital tumors, pediatrics, and others, which can be found on their website. LMICs listed in the SIU are summarized in [Supplementary Material 1].

We also explored exchange programs listed in the European Association of Urology, and many collaborations have been made between the American, Canadian, Taiwanese, Korean, and Japanese associations. However, no developing countries have taken part in these partnerships. [Table 3]

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Table 3. LMIC Representation in Urological Societies, Exchange Programs, and Boards.

Fellowship Societies	Number of LMICs included
Société Internationale D'Urologie	11 out of 25 (44%)
Endourology society	3 out of 82 (3.65%)
Society of reconstructive urology	1 out of 30 (3.33%)
Society of pediatric urology	0
Society of sexual medicine	0
Society of female urology	0
Society of uro-oncology	0
Kidney transplantation program	0
Society of the study of male reproduction	0
European Society for Paediatric Urology	0
Society of urodynamics, female pelvic medicine & urogenital reconstruction	0
European association of Urology	0
Exchange programs	**Number of LMICs included**
EAU-AUA (American urological association)	0
EAU-CUA (Canadian urological association)	0
EAU-TUA (Taiwan urological association)	0
EAU-KAU (Korean urological association)	0
EAU-JAU (Japanese urological association)	0
Boards	**Number of LMICs included**
The Arab Council for Health Specializations	8 out of 16 (50%)
European Board of Urology	0

3.3 Examinations and Certification

Examinations and certification procedures for urology in LMICs may not consistently adhere to international standards, and international medical graduates seeking certification in the U.S. must often undergo additional training and assessment to meet these standards, stressing the disparities in certification processes globally [14,15]. Challenges such as language barriers, differing educational norms, and access to examination centers can complicate the certification process. While some LMICs have established their own certification boards, others rely on international bodies for accreditation [16]. This variability in examination and certification standards can result in disparities in the quality of the trained urologists. [17]

4. Discussion

4.1 Training

The length of training varied considerably between the regions. In contrast to structured urological training found in developed countries, training in the developing world is largely unstructured. This resulted in significant variations in the quality of graduates from the different programs. Urology training in the US is a 5-year program with one year of general surgery and four years of dedicated urology training. In comparison, training in India is six years in total, three of which are in general surgery, while the other three are dedicated to urological training. Although the overall training is longer, dedicated urology training is

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less leading to some trainees not gaining sufficient operating experience in all urology subspecialties within the three-year timeframe. [18] Differences in training are also apparent in the number of hours residents work. Programs in the US mandate a maximum average of 80 hours per week, compared to 48 hours for the UK. While Institutions in developing countries have been designing their programs to match their Western counterparts, some surgical trainees still work up to 90 hours per week in places such as Iran, which is close to double the number of trainees in the UK. [19] Other aspects that negatively affect training include inadequate surgical caseloads, a shortage of trained faculty, and limited access to modern technology [20].

In most structured urology training programs worldwide, including those in Low- and Middle-Income Countries (LMICs), residents are expected to rotate through various subspecialties within urology. These rotations typically include fields such as oncology, endourology, reconstructive urology, and female urology, ensuring comprehensive exposure to the breadth of urological practice [21]. Furthermore, a minimum case-load requirement for graduation is often mandated to ensure that residents acquire sufficient hands-on experience. However, detailed documentation of these requirements is frequently inadequately articulated on official websites or entirely absent.

4.2 Curricula

Urology curricula in LMICs are frequently designed after Western programs but should be developed considering local requirements [9]. Foreign experts frequently use training guidelines from developed countries [22,23], which may not be practical in resource-limited settings. Typically, these programs include a mix of didactic lectures, journal clubs, practical skill training for simulations or robotics, and clinical rotations.

Research experience is an obligatory prerequisite for training in almost all countries [6]. Residency programs are highly variable in terms of dedicated research time. However, only a few offer protected research time during urological training.

4.3 Hospitals and Training Environment

The inclusion of institutions from LMICs in accredited fellowship programs plays a significant role in strengthening institutions and enhancing individual abilities. Ultimately, they return to their community. However, Baqain et. Al [24] showed that only 3.57% of institutions in the endourology society belong to developing countries.

The quality of urology training in LMICs is profoundly influenced by challenging environments characterized by overcrowded hospitals, inadequate facilities, and a shortage of essential medical supplies. Allocating these already limited resources amid the COVID-19 pandemic poses persistent ethical dilemmas. Recent experiences have highlighted the need for innovative solutions, including reallocating staff to address urgent needs, utilizing telemedicine for consultations [25], and optimizing personal protective equipment to ensure both safe patient care and effective education. These conditions hold back to the learning experience, as trainees may not be exposed to a wide range of urological conditions or have limited access to operating rooms and surgical equipment. Nonetheless, some centers of excellence exist in LMICs that provide high-quality training environments and serve as models for other institutions.

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4.4 Financial Constraints

The World Bank employs a classification system based on Gross National Income per capita [10], aiding in defining the relationship between economic status and national health, accordingly identifying areas requiring support. This stratification revealed that more than one-third of the global population earns less than US$ 4,456 annually, putting them at risk of falling into a cycle of health-related poverty [Table 1]. It identifies countries with a limited financial capacity to provide healthcare to citizens. Considering the major differences in economic issues across countries, a comparison may not be feasible. However, it seems that medical residency courses are associated with serious restrictions in most countries where the issue has been studied. Notably, our findings revealed that the average resident salary was $12,857, significantly less than average salary of a trainee in the US, $64,000, in 2022 [26].

Table 1. Classification of Countries by Annual Per Capita Income According to the World Bank.

World bank grouping	Annual per capita income (USD)	% World population	Acronym
Low-income countries	≤$1,135	12.0	LICs
Low-middle-income countries	$1,136 TO $4,465	24.9	LMICs
Upper-middle-income countries	$4,466 TO $13,845	24.9	UMICs
High-income countries	>$13,846	38.2	HICs

The average annual salary in each country was determined according to (https://worldsalaries.com). Discrepancies in salaries exist among different institutions in the same country. Additionally, higher positions typically command higher salaries. However, there is a lack of information that necessitates the use of outdated or less reliable sources. Some notable findings in [Table 3] that urology residents in Egypt and India earn significantly higher incomes than the general population do. For instance, in Egypt, the average annual salary for the general population is $2,345, while urology residents at Mansoura University earn $18,174. Similarly, in India, the average salary is $4,605, whereas urology residents earn $15,000 in the AIIMS and $13,000 in CMC Vellore. In Jordan, the general average annual salary is $26,838, which is more than double the average annual salary of urology residents at Jordan University Hospital, which is $12,700. While the general salaries are high, resident salaries are relatively low. For several countries, such as Lebanon, Philippines, Iran, and Bangladesh, the average annual salary of urology residents is not available on official websites, making it difficult to draw comparisons for these countries. Similarly, obtaining information about case volumes has also proven challenging, complicating the process for new postgraduates to identify suitable programs.

4.5 Obstacles to Growth

In LMICs, a lack of qualified faculty to provide educational opportunities, combined with difficult working conditions and lower salaries, often compels professionals to emigrate to HICs in search of better pay, training, and working conditions [27,28].

Economic constraints are a primary barrier limiting investment in medical education and healthcare infrastructure. Neglecting research priorities and political instability can lead

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to violence, damage research infrastructure, and jeopardize the safety of investigators at work [29,30].

LMICs encounter not only training issues, but also infrastructural issues in surgical care, especially urology. For instance, in the United States, there are five pediatric urologists for a population of less than 10 million, in contrast to Sub-Saharan Africa, which has around 1 billion people, yet no fellowship-trained pediatric urologists outside South Africa [31].

Data from the World Bank show considerable incongruence in healthcare funds between the LMIC and the HIC. The lack of essential basic services, such as water and electricity, impedes the delivery of urological services [32].

4.6 Strategies for Improvement

Simulation-based education (SME) has proven crucial for improving trainees' ability to perform tasks. Efforts to reduce operative time have progressed in LMICs, particularly under the supervision of COSECSA. Additionally, international collaboration and remote training programs are crucial for enhancing urological and surgical training in these regions. [32]

Telemedicine is an effective strategy to improve urological training in LMICs. This video communication method between doctors and patients has gained prominence owing to recent technological advancements, cost-effectiveness, and increased adoption in the post-COVID era. [25,33]. Facilitating remote consultations and follow-ups and enabling real-time collaboration between local healthcare providers and international experts. This approach not only enhances the quality of training and patient care but also provides access to a broader range of educational resources and specialized knowledge that may not be locally available. Google class livestream was one way in which tele proctoring between a surgeon in Mozambique and a reconstructive surgeon in the US took place over several months, which resulted in several surgical procedures being proctored with no complications. [34].

Exchange programs with reputable institutions offer a promising strategy to enhance surgical training in LMICs. A study on a Canadian-Kenyan pediatric surgery exchange program showed significant educational benefits for participants [35]. Such initiatives across medical specialties promote cross-cultural learning, best practice sharing, and global professional networking, enriching educational experiences and enhancing healthcare delivery worldwide.

Initiatives that provide free access to articles from top-tier urology journals provide a learning platform for growth and insight into knowledge. Similarly, Project Muse in collaboration with Google Scholar offers free access to journals and books for all people who intend to use them in low-income countries [36]. This idea can be extended to include urology journals on LMIC medical personnel knowledge.

Providing access to grand rounds is an invaluable educational resource. The University of California hosts a weekly grand round global online conference accessible to anyone (https://www.urology.uci.edu/grandest_rounds.shtml). This UCI experience can be implemented worldwide, offering health professionals in LMICs the opportunity to learn from lectures by world-renowned urologists and gain exposure to innovative knowledge and practices in the field.

Research represents a minor aspect of urological training, although it is widely regarded as an integral component of residency training [5]. Promoting local research initiatives and providing funding and mentorship can improve the research output and academic development in these regions. Yang et. Al [37] observed that increased dedicated

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research time correlated with higher publication output, and was linked to pursuing fellowship training and academic careers.

5. Limitations

This study had notable limitations, one of which was the lack of readily available website information. Whether this is due to a lack of updating websites, writing in a different language, or not opting to disclose sensitive information such as the number of available seats or salaries. Salaries are a rough estimate; however, one can obtain an exact number by contacting the institution's human resources department. The scarcity of prior studies on urology in LMICs limits access to crucial information, as most existing research predominantly focuses on high-income countries such as the United States and the United Kingdom. Discrepancies among different institutions within the same country were noticed, calling for a generalized body to unify the curricula in the region.

6. Conclusion

Disparities in urology training between HICs and LMICs underscore the significant challenges. Despite global advancements in urology, LMICs often contend with outdated curricula, limited faculty, and inadequate resources, hindering a comprehensive educational experience. Our study revealed substantial variability in training programs across LMICs, highlighting the urgent need for standardized and tailored educational frameworks. We encourage future research to build on these findings to refine and enhance urological training in LMICs.

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