

Enhancing Pathology and Medical Technology Education and Capacity in Africa: Insights from Mozambique.

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Museum Pathology Department Damasio Prates- Maputo Hospital founded 1944

Introduction

In modern healthcare, the pivotal role of pathology and laboratory medicine (PALM) cannot be overstated. Accurate and timely diagnosis, along with effective treatment planning and communication with patients, are crucial aspects of patient-centred care ⁽¹⁾. The provision of cross-cutting, intersectoral PALM services is indispensable for ensuring safe and equitable healthcare delivery and global health security. However, access to PALM services in low-income and middle-income countries (LMIC) remains severely inadequate and inequitable. Achieving the Sustainable Development Goals (SDG) and Universal Health Coverage is contingent on addressing these disparities in PALM services.

The Maputo Declaration 2008 and Lab Systems Strengthening

The Maputo Declaration on Strengthening Laboratory Systems, issued on January 22nd-24th, 2008, aimed at harmonizing and standardizing clinical laboratory testing. This consensus meeting primarily focused on scaling up services for tuberculosis, malaria, and HIV

diagnosis and care ⁽²⁾. According to a 2022 WHO report, the prevalence of bacteriologically confirmed pulmonary TB in many Sub-Saharan African countries remained high during 2007-2018. The need for strengthened laboratory systems is evident in the face of significant health challenges, with countries such as the Republic of South Africa reporting 850 cases per 100,000 population ⁽³⁾.

Pathology lab infrastructure and facilities in Africa

In LMIC, including Africa, a mere 2% of health centres possessed the resources to conduct all eight basic laboratory tests at the time of the survey. These essential tests include haemoglobin, blood glucose, malaria diagnostics, urine dipstick glucose, HIV diagnostics, syphilis rapid diagnostic tests, and urine pregnancy tests. Addressing this gap in resources could potentially prevent one million premature deaths attributed to conditions like diabetes, hypertension, HIV, tuberculosis, hepatitis B, and complications during pregnancy ⁽⁴⁾. Shockingly, less than two-thirds of LMIC, particularly in Sub-Saharan Africa, lack a continuous electricity source or a generator, contributing to the limited access to diagnostics. The significance of diagnostics in healthcare was underscored by the COVID-19 pandemic, emphasizing the need for resource reallocation in health systems.

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Barriers to expand access to PALM in Africa

Four persistent barriers hinder the expansion of PALM access in Africa: insufficient human resources, limited work capacity, inadequate infrastructure, and subpar quality and standards. Improving pathology and medical technology education and capacity in Africa is crucial to reducing mortality, particularly concerning clinical and surgical interventions, with a notable impact on maternal and child mortality. Post-COVID, the top pathology shifts in 2023 were observed in mental health, substance abuse, infectious diseases, malnutrition, food insecurity, sexual and reproductive health, environmental pollution, the climate crisis, cancer, and diabetes ⁽⁵⁾.

Clinical and Anatomic Pathology Laboratory Infrastructure in Mozambique

A survey conducted from October to December 2018 across the four central hospitals of Mozambique highlighted critical issues. The lack of essential infrastructure outside urban centres and a shortage of adequately trained laboratory staff and pathologists impede the expansion of pathology services in Mozambique ⁽⁶⁾.

Hospital and Population-Based Cancer Registry in Mozambique

The first hospital and population-based cancer registry in Lourenço Marques (now Maputo) was initiated during the Portuguese colonial era (1956-1959). After Mozambique gained independence in 1975, two more cancer registries were established in Beira (2005) and Maputo (2012) ⁽⁷⁾. These registries have been instrumental in determining the frequency of malignant neoplasms, particularly in males (Kaposi sarcoma, prostate, and liver cancer) and females (cervical, breast carcinoma, and Kaposi sarcoma) ⁽⁸⁾.

Innovative Approaches in Africa Anatomical Pathology in Mozambique

Between 1995-2000, the Central Hospital of Maputo trained the first three surgical pathologists in Mozambique through a four-year post-degree program, supported by institutions in Portugal, Spain, Brazil, and the USA. This initiative has resulted in 15 surgical pathologists being fully trained in Mozambique, with additional overseas training ⁽⁹⁾. Since 2003, a new category of Bachelor Lab Technician Health Professionals has been supporting surgical pathologists in Mozambique. Although they cannot perform diagnostic microscopy, they are well-trained in gross macroscopy description and cytopathology.

Digital Pathology and Telepathology Distance Education

In 2013, the Pathology curricular unity on the MOODLE platform was shared between the Faculty of Medicine at the University of Porto and Eduardo Mondlane University. Since 2018, this learning system has been managed by the University Eduardo Mondlane. Digital histopathology slides with telemedicine real-time and asynchronous sessions have facilitated continuous training for students, residents, and pathologists. The Mozambique Institute for Health Education and Research (MIHER) has embraced Distance Education as a blended tool, creating new postgraduate courses for health professionals at various universities.

Fine Needle Aspiration Cytology (FNAC)

Since 1996, Fine Needle Aspiration Cytology (FNAC) has been performed at the Pathology Department of the Central Hospital of Maputo. This diagnostic tool, handled by experienced pathologists and residents, offers a fast, efficient, and highly accurate method for diagnosing

lymph node, breast, and superficial nodules. Guided with ultrasound, FNAC is utilized for thyroid, liver, and other tumours, as well as for inflammatory, reactive, and neoplastic diseases⁽¹⁰⁾.

Validation of Minimal Invasive Autopsy (MIA)

Given the limitations of verbal autopsy, clinical records, and complete autopsies, Minimal Invasive Autopsy (MIA) procedures were validated in 2016 to identify the cause of death in many adult deaths in Mozambique. This tool has played a significant role in improving the understanding and surveillance of causes of death, particularly in areas where infectious diseases are prevalent⁽¹¹⁾. MIA has been utilized to support the Child Health and Mortality Prevention Surveillance program (CHAMPS).

Radiotherapy

Inaugurated on March 28th, 2019, radiotherapy facilities at the Central Hospital of Maputo bring together interdisciplinary tumour specialists for comprehensive diagnosis and treatment discussions. While magnetic resonance imaging (RMI), tomography (TM), and other services are concentrated in the main public hospital, private hospitals remain less accessible and more expensive.

MIHER and Fostering Sustainable Biomedical Research

From 2015-2021, MIHER, under the Medical Education Partnership Initiative (MEPI-NEPI-AFREhealth), has been instrumental in building research capacity at Eduardo Mondlane University (UEM) and allied institutions. This initiative included the design and implementation of postgraduate training programs and the enhancement of physical and human research infrastructure. Bioscience master's and Ph.D. programs, biotechnology, and a Field Epidemiology and Laboratory Master (FELTP) are actively running at the Faculty of Medicine, focusing on diagnostic competence through laboratory diagnostic training and research⁽¹²⁾. During the 6th Annual AFREhealth Symposium in Maputo in August 2023, co-organized by UEM, MIHER, and AFREhealth, the fourth subtheme highlighted the importance of strengthening Africa's service capacity, including diagnostic services.

Path forward

Urgent action is needed to improve pathology and medical technology education and capacity in Africa. A comprehensive approach should be developed, focusing on the organization and equipment of laboratories, training and retention plans for lab technicians at all levels, strengthening lab management information, and embracing telemedicine and digital imaging tools, including simple devices like smartphones. Additionally, services should be evaluated, and funding should be ensured for public health laboratory services. Collaboration with international initiatives for grants and public funding, along with initiatives focused on digital literacy, artificial intelligence, e-learning, and community-based services, can foster health professional

education.

Conclusion

The transition in epidemiology and the growing burden of non-communicable diseases pose significant challenges to weak African health systems and PALM. National policies and programs, such as those for malaria, tuberculosis, and AIDS, must be prepared for the emergence of new pandemics like COVID, Ebola, Dengue, and other infectious diseases. A "One Health" approach, encompassing climate changes and waterborne diseases, necessitates robust laboratory systems. Public-Private Partnerships could be instrumental in complementing national budgets for reactive measures, equipment, and consumables, preparing for future challenges to strengthen pathology, medical technology education, and capacity in Africa.

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