

Training of pharmacists in Zambia: Developments, curriculum structure and future perspectives

AUBREY CHICHONYI KALUNGIA^{1*}, LUNGWANI TYSON MUUNGO¹, SARAH MARSHALL², BUGEWA APAMPA³, CLAIRE MAY⁴, DERICK MUNKOMBWE¹

¹Department of Pharmacy, University of Zambia, Lusaka, Zambia

²Brighton & Sussex Medical Schools, University of Sussex, Falmer, Brighton, United Kingdom

³School of Pharmacy, University of Sussex, Falmer, Brighton, United Kingdom

⁴School of Pharmacy and Biomolecular Sciences, University of Brighton, Brighton, United Kingdom

Abstract

In Zambia, local training of pharmacists commenced in 2001. Development of pharmaceutical education in Zambia has been largely influenced by the national need for pharmacists in the healthcare sector. Training institutions offer the Bachelor of Pharmacy (B.Pharm.) degree programme which follows a four-year curriculum structure. The B.Pharm. programme aims to produce pharmacists with requisite competences to practise pharmaceutical care and sustain the development of pharmacy in Zambia. Seventeen years down the line, Zambia continues to advance local pharmaceutical education programmes. Over 700 pharmacists have graduated from the national training programmes in Zambia which continue to address the pharmaceutical workforce needs. Pharmaceutical education in Zambia offers a number of career prospects in hospital, community, pharmaceutical manufacturing, medicine regulation, public health administration, and progression to academia. Positive transitions made to advance pharmacists' training in Zambia give a positive outlook for the future.

Keywords: *Pharmaceutical Education, Pharmacist Training, Curriculum, Zambia*

Introduction

Globally, there has been an underscored need to assure the development of an adequate and appropriately trained pharmaceutical workforce, along with the academic and institutional infrastructure to deliver the required competency-based education and training (Toklu & Hussain, 2013). Academic capacity and foundation training infrastructure feature prominently among the 13 pharmaceutical Workforce Development Goals introduced by the International Pharmaceutical Federation (FIP) in 2016 (FIP, 2017). These are aligned to advancing the pharmaceutical workforce towards achieving universal health coverage and global Sustainable Development Goals (SDGs). As a consequence of this and the extended roles of pharmacists, many countries have embarked on introducing, expanding, or undertaking major transformations to pharmaceutical education and training processes (FIP, 2014). Undoubtedly pharmaceutical education, like most other health professions' education programmes, is witnessing momentous paradigm shifts from focus on educational processes to educational

outcomes (Norcini *et al.*, 2013). World-over, pharmaceutical education systems and curricula have since transitioned from 'product-centred' pharmaceutical sciences to 'patient-centred' clinical sciences in response to the national and international need for pharmaceutical care services.

Zambia, a low-middle income country (LMIC) in sub-Saharan Africa with a population of about 17 million people (World Bank, 2018), is serviced by just over 1,800 public healthcare facilities (Institute for Health Metrics and Evaluation [IHME], 2018) and only 214 registered private community pharmacies (Zambia Medicines Regulatory Authority, 2018). These facilities are largely distributed in the urban towns of Zambia. A 15 percent drop in the number of registered community pharmacies recorded between 2016 to 2018 may be a reflection of the pharmaceutical workforce gaps affecting investment in the sector. Under current Zambian law, a pharmacy must be under the management and control of a registered pharmacist (Medicines and Allied Substances Act, 2013). The need to promote community

*Correspondence: Aubrey Chichonyi Kalungia, University of Zambia, Department of Pharmacy, P.O Box 50110, Lusaka, Zambia. Tel: +26 0977800311. Email: chichokalungia@gmail.com.

pharmacy as an avenue towards attaining universal access to essential medicines in Zambia is evident.

Treatment, prevention, and elimination of infectious diseases such as HIV/AIDS, tuberculosis, malaria, respiratory tract infections, and diarrheal diseases which feature high among the top ten causes of morbidity and mortality in Zambia are the principal health needs of the population (IHME, 2018). Consequently, national health strategies have focused on, among other priority areas, primary healthcare and human resource development for health (Ministry of Health, 2016). Pharmaceutical human resource developmental strategies started as early as mid-1980s but actualised in the early 2000s (University of Zambia, 2002).

Prior to 2005, pharmacists practising in Zambia were all trained from different countries abroad that may have employed pharmacy curricula that did not necessarily address the local competence requirements (UNZA B.Pharm. Curriculum, 2002; Whitmarsh, 2008). The need to develop and grow local training programmes to produce pharmacists who meet the contemporary competences for pharmaceutical care provision was an eminent national priority in Zambia. Currently, there are two universities training pharmacists in Zambia, namely: University of Zambia (public) and Lusaka Apex Medical University (private). A number of other local public and private universities are currently developing and accrediting pharmaceutical education programmes. As of 2016, well over 700 pharmacists have been produced by the local pharmacy training programmes (Health Professions Council of Zambia [HPCZ], 2016) which continue to address the pharmaceutical workforce needs in Zambia.

In this paper, the authors describe developments, state and structural aspects of current pharmacists' training in Zambia; particularly focusing on the developmental contribution it has made in healthcare provision in the country, lessons learnt and prospects for the future. The authors conducted a desk review of published and unpublished literature on pharmaceutical education and training of pharmacists in Zambia, including other archived national and international publications related to the subject from the period 1964 to 2018. Both printed and online articles were consulted. For online publications, we employed PubMed and Google Scholar search engines using the following key search words: 'pharmaceutical education and Zambia' or 'training of pharmacists and Zambia' or 'pharmacy in Zambia'. Relevant institutional and expert publications, manuscripts and documents pertaining to pharmaceutical education and training in Zambia were consulted. National policy documents, institutional websites, statutes, and reports published were also searched for content pertaining to localised pharmaceutical education and training. Descriptive content analysis was used to describe the development, process and structure of pharmacist training in Zambia.

Description of the Zambian undergraduate pharmacy degree programme, curriculum structure and model

Local training of pharmacists at degree level was first introduced in 2001 at the University of Zambia (UNZA) – the oldest and largest public university in the country (UNZA, 2002). The University in collaboration with stakeholders such as the Ministry of Health and the Pharmaceutical Society of Zambia (PSZ) - the professional association, developed and implemented a four-year undergraduate Bachelor of Pharmacy (B.Pharm.) curriculum tailored to meeting local needs in the pharmaceutical sector. Despite global trends and shifts in models of pharmaceutical education at the time tilting towards the Master of Pharmacy (M.Pharm.) degree offered at universities in United Kingdom (UK) and Europe on the one hand (Sosabowski & Gard, 2008), and the Doctor of Pharmacy (Pharm.D.) degree offered in United States of America (USA), parts of Asia and a number of other LMIC (Anderson & Futter, 2009) on the other hand, Zambia's basis of adopting the B.Pharm. model was arguably based on two key fundamentals. Firstly, the in-country context of needs at the time and secondly the prevailing qualifications level descriptors of higher education in Zambia. The Zambian education system considers the bachelor degree model for undergraduate education programmes at level 7 in the National Qualification Framework (Zambia Qualifications Authority, 2016). Moreover, since all other health professions' education programmes at UNZA were classified as bachelor degrees at the time, it can be argued that the paradigm shift to award an undergraduate degree as 'masters' or 'doctor' (terminologies largely preserved to refer to postgraduate level qualifications in Zambia) was perhaps not an agreed approach in Zambia at the time. In keeping with global trends, is this the right time for Zambia to consider a re-modelled approach to training pharmacists? This is the discourse the profession and its stakeholders in Zambia should engage going forward.

As Anderson & Futter earlier argued, although there is an increasing trend in LMIC towards Pharm.D. level education, a number do not yet have a trained and available pharmaceutical workforce actively practising clinical pharmacy who are competent to mentor Pharm.D. students. They further argued that some countries have not paid particular attention to considerable pre-requisites of such a programme such as its skewed (clinical) approach which demands precepted clerkships with measurable outcomes (Anderson & Futter, 2009). These are difficulties even high income countries such as USA have faced with Pharm.D. training (American Society of Health-System Pharmacists, 2008). The authors contend that when considering a suitable model of pharmaceutical education, it is paramount that countries pay attention to their local pharmaceutical workforce requirements in the context of need, capacity to train students at the appropriate level and competence demands of the contemporary practice of pharmacists they wish to produce.

The B.Pharm. curriculum implemented in Zambia is structurally focused towards pharmaceutical care competencies developed from pharmaceutical science disciplines that address four key thematic areas (Figure 1). The B.Pharm. curriculum developed at UNZA was accredited by the HPCZ - the statutory regulator of health professionals as established by legislation. It is the same curriculum model that has been adapted by Lusaka Apex Medical University (LAMU) which commenced training pharmacists in 2010.

Figure 1: Thematic areas and structural framework of the B.Pharm. curriculum in Zambia

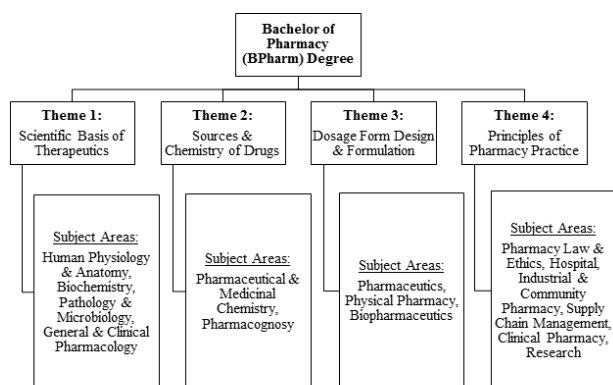


Table I: Educational objectives of the B.Pharm. curriculum in Zambia

Curriculum Objective:

To produce pharmacists who possess knowledge, attitudes, skills and professionalism to address the current and emerging pharmaceutical care needs of patients and the public.

Outcome Competences Expected of the Trained Pharmacist:

- Designs pharmaceutical products
- Manages the manufacturing of pharmaceutical products
- Manages the pharmaceutical supply chain
- Evaluates medicines prescribed to patients – this includes quality, safety, efficacy and cost-effectiveness
- Practices rational use of medicines
- Initiates pharmaceutical care for patients
- Provides information and education on medicines
- Promotes community health and responds to symptoms in the pharmacy
- Demonstrates good leadership, communication and management skills
- Conducts research
- Demonstrates life-long learning
- Exhibits professional and ethical conduct

Source: UNZA B.Pharm. Curriculum, 2013

The orientation of the B.Pharm. curriculum aims to develop requisite competences expected of pharmacists to provide pharmaceutical care (Table I) in the local setting. Core subject areas in the curriculum include: Pharmaceutics, Pharmacology, Clinical Pharmacy, Biopharmaceutics, Pharmaceutical Chemistry, Pharmacognosy, and Pharmacy Practice (UNZA B.Pharm. Curriculum, 2013). Arguably, the comparisons in subject focus areas between the current B.Pharm. curriculum offered in Zambia and other models such as the M.Pharm. offered in UK and Pharm.D. offered in USA are not too far apart. The pharmacist training pathway encompasses a delivery model that is 60 percent traditional (discipline-based) approach and 40 percent experiential and problem-based learning approach in clinical areas (UNZA, 2013). This delivery model was also adopted by LAMU.

Table II: Overview of the revised B.Pharm. curriculum map

Year of Study	Focus Areas	Subject Areas Covered at this stage
YEAR 1	Introductory basic science components of pharmaceutical education	Pharmaceutical Chemistry, Basic & Metabolic Biochemistry, Physical Pharmacy, Comparative Physiology & Anatomy, Molecular Cell Biology, Pharmaceutical Microbiology, Behavioural & Social Sciences, ICT & Information Management Systems
YEAR 2	Fundamental knowledge and application of pharmaceutical sciences	Pharmaceutics, Pharmacology, Pharmacognosy, Pharmaceutical Mathematics, Radiopharmacy, Pathology & Pathophysiology, Basics of Pharmacy Practice, Pharmaceutical Analysis & Quality Control of Medicines, Pharmacovigilance
YEAR 3	Students gradually transition to operational and procedural application of knowledge and skill relevant to the practice of pharmacy	Medicinal Chemistry, Biopharmacy, Pharmacology & Toxicology, Business Entrepreneurship, Pharmacoeconomics, Professional Pharmacy Practice, Clinical Pharmacognosy & Nutraceutics, Research Methodology, Epidemiology & Biostatistics
YEAR 4	Student-centred and experiential learning which includes: clinical rotations, industrial & community placements, seminars and research projects	Clinical Pharmacy, Leadership, Management & Governance, Pharmaceutical & Biotechnology, Pharmaceutical Engineering, Community Pharmacy, Hospital Pharmacy, Veterinary Pharmacy, Industrial Pharmacy, Pharmaceutical Supply Chain Management, Research Project

Source: UNZA B.Pharm. Curriculum version 2017

In Year 1 and 2 (pre-clinical stage), pharmacy students undertake both foundational pharmaceutical and basic health science subjects (Table II). Beyond course work in Year 3 and 4 (clinical stage), students are expected to complete at least 24 weeks of experiential learning in clinically oriented subject areas during the academic year. (UNZA, 2017). At UNZA, pharmacy students undertake their clinical pharmacy experiential learning precepted by the various specialised clinical departments at the University Teaching Hospitals – Zambia’s highest specialised tertiary hospitals situated in Lusaka. This initial arrangement was facilitated by a previously long standing relationship with the Ministry of Health to support practical and clinical learning of university students using preceptors who were practising pharmacists at the hospitals (UNZA, 2002). However, private universities such as LAMU have had to enter into separate memoranda of understanding with the Ministry of Health, including some private sector healthcare providers to enable their students to undertake clinical and experiential learning at the sites.

In terms of programme structure, there is variation in the local pharmacy programmes. Whereas LAMU follows a semester system and enrolls two intakes of pharmacy students per academic year, UNZA follows a term (quarter) system and enrolls one intake of students per academic year. Which system (semester versus terms) serves students best is still a constant debate in the local setting. In the absence of well-equipped simulated skills labs, high student to preceptor ratios, including dependence on limited hospital infrastructure to accommodate the growing numbers of pharmacy students from the training institutions, utilising the few clinical and experiential learning sites poses a challenge to the limited number of public and private healthcare facilities supporting pharmacist training in Zambia. The impact of this on the quality of skills training of pharmacy students is yet to be evaluated. Elsewhere, evidence has shown that increased student numbers increases fiscal, human and infrastructure resources required during clerkships and may adversely impact quality of education (Hemmer *et al.*, 2008; Gibbs & Jenkins, 2014).

Student recruitment and entry requirements

Similar to most countries in southern Africa, Zambia adapted its primary and secondary education system from the British system. The Zambian system awards the Ordinary (“O”) level school certificate upon successful completion of secondary school education. In Zambia, attainment of the O-level school certificate is a gateway to higher education and its academic worth is comparable to the UK’s General Certificate of Secondary Education (GCSE) and USA’s high school diploma.

Currently, to study pharmacy, admission to the B.Pharm. programme is *via* three selection criteria as follows (UNZA, 2013):

- (i) Candidates with O-level school certificate with minimum five passes (credit or better) in relevant science subjects, English Language and have successfully completed Advanced (A) level equivalent subjects (Biology, Chemistry, Physics and Mathematics) at pre-pharmacy foundation year in the University;
- (ii) Candidates with four A-level passes in requisite science subjects (Biology, Chemistry, Physics and Mathematics) or candidates with other relevant academic degree qualification in a health-related field in addition to possessing an O-level school certificate required for admission to the University;
- (iii) Candidates with a diploma in pharmacy technology (*i.e.*, Pharmacy Technologists) who also have the requisite O-level school certificate with passes in at least five subjects suitable for admission to the programme.

The latter two entry points to the pharmacist training programme recognise prior learning attainment by applicants.

From 2010 to date, total enrolment numbers on the B.Pharm. programme at UNZA have averaged well over 300 undergraduate pharmacy students per academic year across all the four levels of pharmacy training (UNZA, 2013). With the increasing demand for pharmaceutical education coupled by the current deficits of health workforce in Zambia (Ferrinho *et al.*, 2011), the student enrolment sizes are reported to be even higher at LAMU which enrolls two intakes of pharmacy students per academic year. At UNZA, enrolment is done once per academic year. The University Senate approved selection and quota allocation policy, which is based on capacity of learning facilities rather than financial ability to pay or stakeholder determined acceptable numbers, underpins pharmacy student enrolment numbers. A competitive points-based selection criteria based on academic performance (particularly in science subjects) is applied where 30 percent of the available places on the programme are reserved for female students, 70 percent of the places are competed for by both male and female students, five percent allocated to students from rural areas of Zambia and a further 5 percent allocated to international students accordingly. Arguably, this female affirmative selection policy has the potential to contribute to narrowing the gap in gender disparity in pharmaceutical education in Zambia. An average of 70 trained pharmacists graduate from the programme each year (UNZA, 2013), half of which are female pharmacists. Unlike in other countries such as Britain and Canada where women make up the majority of practising pharmacists (Janzen *et al.*, 2013), historically the pharmacy profession in Zambia has been dominated by males. It will be interesting to evaluate in the future Zambia’s contribution to attainment of around 72% average female proportion of the total global pharmacy workforce by 2030 as envisaged by FIP (FIP, 2018).

To maintain quality of students enrolled on health professions' training programmes in Zambia, HPCZ introduced the student indexing system that tracks all students undertaking training in health professions regulated by the Council. The indexing system ensures only students that meet the respective programme entry requirements specified by the approved curriculum are enrolled. The Council believes that this student indexing mechanism will foster an early sense of professional responsibility and accountability as well as provide a basis for monitoring compliance to the admission criteria for students pursuing health related training programmes (HPCZ, 2018a).

Furthermore, with plans underway to establish more public and private pharmacy schools in Zambia, a rise in the numbers of pharmacy students is projected despite limited availability of local experts suitably qualified to teach. For instance, at the two universities currently training pharmacists, fewer than one-third of the academic staff have obtained Ph.D. degrees with the majority holding Master's degrees in pharmacy-related fields. There are also concerns that this expansion of pharmacy schools and student enrolment numbers in Zambia may be occurring at a time when prior projections related to the pharmaceutical workforce requirements may not have been consistent with the sector-specific uptake capacity, distribution and retention of the graduates.

Evaluation, quality assurance and regulation of pharmacist training in Zambia

A two-tier system of regulation and accreditation of health professions' education programmes exists in Zambia. The HPCZ is responsible for the regulation of all health professions, including pharmacy, within the country (with the exception of the nursing profession which is regulated by other legislation). The roles of HPCZ as enshrined in a substantive piece of legislation

include: registration of healthcare practitioners and regulation of their professional conduct; licensing and regulation of all health facilities; accreditation of healthcare services provided by health facilities; and the recognition and approval of training programmes for health practitioners (HPCZ, 2016). Apart from HPCZ, all higher education institutions are registered and their curricula accredited by the Higher Education Authority (HEA) – a statutory body established by legislation that regulates higher education in Zambia (HEA, 2017). It is a legal requirement for all academic institutions training pharmacy professionals in Zambia to be approved by both HEA and HPCZ, respectively. Whereas HEA accredits curricula based on quality assurance benchmarks, content and credit specifications, HPCZ regulates and enforces standards of academic training of health professionals. HPCZ in collaboration with PSZ, monitors compliance to standards for training pharmacists by the responsible institutions.

As of 2017, there were three main higher education institutions offering pharmaceutical training programmes in Zambia (Table III).

This scenario is likely to change in the next few years as more local universities begin to offer pharmaceutical education and training. Although this may represent positive developments in terms of increasing opportunities for citizens to access pharmaceutical education and addressing, in the long term, the pharmaceutical workforce deficit both locally and in Africa (FIP, 2018), it may present the challenge of maintaining quality of pharmaceutical education outcomes to be provided if necessary quality assurance benchmarks are not set and met by all training providers.

Notwithstanding, the importance of increasing availability and access to pharmaceutical education in countries, extra attention to issues of quality of educational processes and outcomes is one aspect training institutions are currently having to deal with. Clearly, there is an increasing role for regulators of

Table III: Registered academic training institutions offering pharmaceutical education programmes in Zambia, 2017

Institution	Location	Programme(s) offered	Mode of Study	Programme Duration
University of Zambia	Lusaka	• Bachelor of Pharmacy (B.Pharm.)	Full-time	4 years
		• Master of Clinical Pharmacy (M.Clin.Pharm)	Full-time	3 years
		• Master of Science by Research (MSc.R in Pharmaceutics, Clinical Pharmacology & Nutrition, Pharmacognosy or Pharmacy Practice)	Full-time	2 years
		• Doctor of Philosophy (Ph.D.)	Full-time Part-time	3 years 4 years
Lusaka Apex Medical University	Lusaka	• Bachelor of Pharmacy (B.Pharm.)	Full-time	4 years
Evelyn Hone College	Lusaka	• Diploma in Pharmacy Technology (Dip.Pharm.)	Full-time	3 years

pharmaceutical education going forward. While prospects of over-supply of pharmacists on the market are still unlikely in Zambia, establishing quality pharmaceutical education systems and processes that will contribute to pharmacists' value addition to healthcare are essential. The local pharmaceutical job market in Zambia is still relatively unsaturated and has potential to accommodate all pharmacist graduates in the short and medium term.

Although each academic institution in Zambia has liberty to develop its own pharmacist training curriculum, educational philosophy, and programme delivery model, it remains paramount that outcome competences and credits are harmonised across the training programmes. According to Atkinson and colleagues (Atkinson *et al.*, 2014) the use of competences and credits leads to harmonisation of programmes eliminating ambiguity in syllabi and clearly establishes from the onset what the trainee is able to do upon completion of the training. Evidently, harmonisation of content and outcome competences for pharmacist training is important at both country and regional level (FIP, 2018). For instance, in response to changes in the roles of pharmacists, all European Union (EU) pharmacy degree programmes follow the European Directive 2005/36 for the recognition of qualifications and harmonisation of training content and competences for sectoral professions (Atkinson *et al.*, 2014). The EU initiative demonstrates that harmonisation of training content and outcome competences is possible and is consonant to realisation of the FIP global competence framework. Perhaps Zambia and other countries in Africa can actualise such an approach.

Currently, an undergraduate pharmacy degree (B.Pharm. or its equivalent) is considered the primary professional qualification required for entry-level professional registration to practise as a pharmacist in Zambia. Four modes of professional registration to practise exist for pharmacists as follows:

- (i) *Provisional registration*, valid for one year (for new graduates who have a pharmacy degree obtained within Zambia) for purposes of undertaking supervised pre-registration internship;
- (ii) *Temporary registration*, valid for two years (for new graduates who have a pharmacy degree obtained outside Zambia) for purposes of undertaking supervised pre-registration internship. To be placed on the provisional or temporary register, graduates have to pass the Licensure Examinations administered by HPCZ. This composite assessment confirms that graduates possess the minimum knowledge and skills necessary to perform their tasks safely and competently (HPCZ, 2018b);
- (iii) *Full registration* (for graduates who have a pharmacy degree and have successfully completed pre-registration professional internship accordingly);

- (iv) *Specialist registration* (for practising pharmacists who have attained advanced level postgraduate qualifications in pharmacy-related fields). These professional registers are maintained by HPCZ.

Generally, the academic training pathway for one to graduate as a pharmacist in Zambia takes about three to five years to attain an undergraduate pharmacy degree. A further one to two years is required to obtain professional licensure to practise as a pharmacist. Successful pharmacist graduates on provisional or temporary registration proceed to undertake supervised professional internship for one year at various designated public and private health facilities in the country. The internship programme is intended to orient and further develop skills in professional practice, apply and relate knowledge gained from academic studies on the job, and enable the graduate pharmacist to function as an independent professional practitioner (PSZ, 2008). In Zambia, internship for pharmacists is facilitated by PSZ and recognised by HPCZ as a requisite for full registration. Zambia's system of qualifying pharmacist-trainee graduates into professional practice is quite similar to that employed in the UK (Sosabowski & Gard, 2008), South Africa (Summers *et al.*, 2001) and Namibia (Rennie *et al.*, 2018).

In Zambia, the professional qualifying (pre-registration) examination is one of the requirements jointly agreed upon by HPCZ and PSZ in 2004 as a way of recognising completion of pharmacy training and subsequent full registration of anyone intending to practise as a pharmacist (PSZ, 2008). The professional qualifying examinations administered by PSZ are conducted twice yearly. The examination is a one-day assessment consisting of two parts:

- Part I: - Theory-based multiple-choice items assessing theoretical concepts of pharmacy practice, including clinical and therapeutic knowledge;
- Part II: - Open-book multiple-choice assessment of problem solving in practical or situational scenarios.

Being a high stakes professional qualifying examination, this assessment is intended to not only assess the pre-registration intern pharmacist's consolidated knowledge and professionalism acquired from both formal academic training and experiential learning during supervised internship, but to also assure competence to practise independently. Arguably, although the selected response (multiple choice items) method of assessment has been employed by PSZ for some time, it largely assesses cognitive knowledge rather than performance of skills. On that demerit, it may not be the best method to measure clinical and practical competence in modern practice. In keeping with assessment theory as postulated by Miller's principles of assessing clinical competence of health professionals (Miller, 1990), Miller would likely agree

that whereas lower order cognitive ability ('knows' level competence) is best measured using written objective tests such as selected response methods (multiple choice items), higher order cognitive ability ('knows how' level) including clinical competence and performance of skills ('shows how' and 'does' level competence) requires performance-type assessment methods such as Objective Structured Clinical Examinations (OSCE), Mini-Clinical Examinations (Mini-CEX) or 360-workplace evaluations (Downing & Yudkowsky, 2009). These methods of assessment objectively measure clinical competence of a pharmacist.

As guided by Downing & Yudkowsky (2009), the fidelity, reliability and defensibility of such high-stakes professional examinations in Zambia may need to be improved upon by considering assessment methods that bring together all the cognitive knowledge, skill abilities, and experience into performance in the real world, which is observed by expert and experienced clinical tutors and assessors. Current evidence suggests OSCE, supported by its reliability and validity to assess interpersonal and communication skills, professional judgment, skills of resolution and so on, in comparison to multiple-choice tests and other methods of assessment, as the 'gold standard' for the evaluation of clinical skills in pharmacy worldwide (Shirwaikar, 2015). Notwithstanding its merits, conducting OSCEs tend to be resource-intensive and more difficult to organise. This may perhaps explain their limited use in resource-limited settings.

A criterion-referenced pass/fail criteria is used to rate performance in the professional internship examination for entry-level pharmacists in Zambia. Criterion referenced assessment involves a process of evaluating and grading the achievement of learning outcomes by candidates independently against a pre-specified criteria for progression, without reference to the achievement of others (Hambleton & Li, 2014). The pre-specified criteria or level of achievement is what candidates have to attain in order to demonstrate achievement of the standard. To pass the professional internship examination, candidates are expected to attain at least 70 percent composite score. This is comparable to other countries. For example in Canada, the professional qualifying examination for Pharm.D. graduates consists of two parts: a two-day case-based multiple-choice examination of clinical and therapeutic knowledge (part 1) followed by a 16-station OSCE (part 2). Their qualifying examination is also administered twice annually (Austin & Ensom, 2008).

Challenges, opportunities, and future perspective of pharmaceutical education in Zambia

Like many other LMICs, Zambia continues to experience challenges to delivering quality pharmaceutical education such as limited infrastructure, limited access to teaching resources, inadequate academic staff development, and research capacity (FIP, 2013; Anderson *et al.*, 2014). These will need to be addressed for quality improvement in pharmaceutical education systems. Despite registering

a significant increase in the number of qualified pharmacists joining the profession in the last decade, quality of pharmaceutical care delivery still remains unattended to (Kalungia & Kamanga, 2016). This is largely because the initiation of national training of pharmacists in Zambia, as initially intended by the 1999 Zambia National Drug Policy, was based on the urgent need for pharmaceutical personnel to not only manage essential medicines and pharmaceutical supplies in the health sector, but also provide patient-focused pharmaceutical care services. However, there has been a lapse in the subsequent policy frameworks to fully utilise the extended roles and services of pharmacists in the provision of comprehensive patient care. Arguably, the wealth of pharmaceutical knowledge imparted in the pharmacy trainees is being under-utilised leading to the picture of inadequacy. This outlook can be reversed by developing national health policy that enhances and mainstreams the vital role pharmaceutical care plays in overall comprehensive patient care of patients.

To inform the future of pharmacy, the profession in Zambia can also do well to draw lessons from other countries that have undergone seismic transformations in the profession and, in particular, pharmacy education to remain current and relevant. For example, countries such as USA, Canada, Pakistan, India and South Africa have transitioned to a more clinical degree (Pharm.D.) training for pharmacists. This has partly been due to their rapid evolving disease burden and patient care needs, as more complex drugs become available that require additional clinical competence of pharmacists, and population dynamics that require complex therapies along with the growth in tertiary and hospital-based care (Anderson & Futter, 2009). India launched a Pharm.D. programme in 2008 amidst huge misconceptions and a lack of understanding of both the programme and role of clinical pharmacists in the nation (Deshpande *et al.*, 2015). Training institutions in India were still offering B.Pharm. and Master of Clinical Pharmacy degrees in parallel to the new Pharm.D. Through deliberate policy change, political and stakeholder will, raising awareness and capacity building, India has made remodelling pharmaceutical education a reality despite the challenges (Deshpande *et al.*, 2015). Similarly in Zambia, to prevent and eliminate HIV/AIDS, tuberculosis, malaria, and non-communicable diseases affecting the population, remodelling pharmaceutical education will be needed to enhance the competences and contributions of pharmacists to healthcare in the future. Zambia should make pharmaceutical education more relevant in the context of local needs and global trends.

In addition, Zambia will benefit from strengthening quality assurance in pharmaceutical education processes, development of effective frameworks and strategies aimed at strengthening competence-based programmes, including assessment methods that assure demonstrable knowledge, skills and professionalism expected of a pharmacist. This may require investment in purpose-built infrastructure for training, faculty

development, and monitoring and evaluation systems, including regulatory frameworks for strengthened quality assurance in pharmaceutical education.

Although the issue of employability of pharmacists may not be an immediate challenge in Zambia, with the B.Pharm. degree currently almost always assuring employment for the graduates, this may change shortly as outputs of locally trained pharmacists graduating from the various training institutions increase. This will also increase demand for professional internships. The Ministry of Health may not be able to afford to employ all pharmacist graduates to come for internships and thus, the private sector practice may be required to offer career pathways in future. Currently, there is no case of capping pharmacy student numbers in pharmacy schools in Zambia. However, as noted in other countries where employability of pharmacists is a challenge, this will lead to fewer students applying for pharmacy programmes as the guarantee of employment after graduation will not be assured (Sosabowski & Gard, 2008).

The absence of nationally agreed competency standards for graduate pharmacists in Zambia has been a cause of concern. With the recent introduction of licensure examinations by HPCZ as a quality assurance measure (HPCZ, 2018), competence requirements for entry-level pharmacists and pharmacy technologists are being developed in collaboration with PSZ. It is anticipated that downstream, competence standards that licensure examinations are intended to detect will influence improvements to education and training processes. In following this route, there are lessons Zambia can learn from experience in the UK where national registration examinations for pharmacists were based more on theory than practice and fixed criteria tended to be knowledge-based rather than competence-based assessment (Sosabowski & Gard, 2008). Therefore, employing competence-based assessment methods will drive student learning and programme delivery.

Opportunities exist for the profession of pharmacy in Zambia to suitably direct training to address contemporary pharmaceutical care needs. This can be done by ensuring training programmes offer a broad range of subjects and educational activities that utilise active learning approaches to promote and develop problem-solving, critical thinking, entrepreneurship and professionalism in the graduates. Scholars argue that while scientific foundations are important, pharmacy programmes may need to increase their focus on clinical and generic skills, including leadership, entrepreneurship and innovation (DiPiro, 2011; Keshishian & Brenton, 2011; Shaw *et al.*, 2015). In line with the global competency framework suggested by FIP (FIP, 2012), pharmaceutical education systems in Zambia must consider orienting competencies towards scientific knowledge domains relevant to develop population and patient-focused care, and management knowledge domains required for systems and personal development-focused pharmacy practice.

Going forward, the authors contend that the outlook for pharmaceutical education and training processes in Zambia is positive as evidenced by the transitions made over the years since inception. Although more traditional roles of pharmacists still exist in Zambia's pharmacy practice, the profession needs to re-invent itself by creating more opportunities for pharmacists to enhance their contribution to healthcare. For instance, one of the main changes that has positively enhanced pharmacy practice in the UK is the introduction of pharmacist-independent prescribing which involves an element of diagnosis and choice of medicines (Brack, 2017). Subsequently, undergraduate pharmacy programmes in the UK now include the additional training required for prescribing responsibilities (Sosabowski & Gard, 2008). Other countries such as Nigeria are also beginning to explore this trend (Auta *et al.*, 2015).

Community pharmacy sector practice remains one major niche area of pharmaceutical care where pharmacists have monopoly of practise with potential to add value to healthcare. As argued by Auta and colleagues in 2015, community pharmacists' accessibility, availability and patients' reliance on them for their minor ailments, medication counselling and health promotion could be facilitators of extended roles of pharmacists. Curricula will do well to strengthen competences in these areas of value addition. With the introduction of a national health insurance scheme in Zambia, there is a potential for community pharmacists to become fully integrated players in healthcare delivery through their application of dispensing knowledge, clinical pharmacy skills to care for patients with communicable and non-communicable diseases in the community, inter-professional collaboration with prescribers, and conducting medicine use reviews.

This review was limited to documented information (both published and grey literature) regarding training of pharmacists in Zambia hence methodological quality and rigour of systematic review may not have been met. Notwithstanding, the authors remain confident that information discussed in this paper reflects the current state, developments and prospects of pharmacists' training in Zambia.

Conclusion

Zambia's pharmaceutical education systems and curricula continue to make significant development and contributions to pharmacy workforce development and improving health. Quality improvement in pharmaceutical education systems locally remains a continuous process essential for educating and training pharmacy students to develop relevant competences required to provide quality pharmaceutical care. Being a LMIC, the authors feel greater emphasis should be paid not to weaknesses of the training model but instead to critical indicators such as professional value addition to healthcare, increased access to pharmaceutical care

services, availability of, and appropriate use of safe, cost-effective, efficacious, and quality medicine as valuable contributions pharmaceutical education continues to make in Zambia. As pharmacist training in Zambia evolves and develops further, the authors shall continue to monitor its developments in the future.

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