PROGRAMME DESCRIPTION

COVID-19 resilient pharmacy education: A grassroots work-integrated programme to strengthen the pharmaceutical workforce in Namibia

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Abstract

Background: The COVID-19 pandemic has led to suspension of pharmacy education in resource-limited settings, negatively impacting pharmaceutical workforce outputs. **Aims:** To identify the elements of a COVID-19 resilient pharmacy education programme in Namibia and its grassroots impact on the pharmaceutical workforce and systems strengthening. **Methods:** An evaluation of COVID-19 resilience of the Diploma in Pharmacy programme in Namibia. Data on elements for resilience and outcomes were collected; qualitative and quantitative data were analysed descriptively. **Results:** The evaluation identified ten key elements for successful implementation of a COVID-19 resilient pharmacy education programme. The integration of quality improvement projects in the workplace strengthened pharmaceutical systems and workforce capacity in areas of rational medicine use and supply management of medicines. **Conclusions:** Whilst the COVID-19 pandemic has disrupted pharmacy education, this paper presents ten elements that, when implemented, may improve the resilience and minimise unforeseen academic interruptions during pandemics.

Context and Description of Programme

The global shortage of skilled pharmaceutical workforce remains a major barrier to healthcare delivery, particularly in resource-limited countries in sub-Saharan Africa. The global healthcare workforce is estimated to be in need of an extra 12.9 million skilled professionals by 2035; with countries in sub-Saharan Africa having significantly fewer pharmacists per capita than the global average (Global Health Workforce Alliance, 2013; Bates *et al.*, 2016). This is a concern during the current era of epidemics such as COVID-19, that requires efficient pharmaceutical supply chains and increased access to quality medicine for the public (Koehler & Brown 2017; Amimo, Lambert, & Magit 2020). Moreover, the burden of COVID-19 estimated at 1,727,837 cases in Africa and 12,675 in Namibia (as at midnight 26th August, 2020), has exposed the weak pharmaceutical systems in sub-Saharan Africa (Jernigan, 2020; Kagoya *et al.*, 2020). Most African countries are unable to locally manufacture essential medicines, particularly those critical in the fight against COVID-19 (Amimo *et al.*, 2020; Iwuoha, Ezeibe, & Ezeibe, 2020; Ogunleye *et al.*, 2020; Schneider & Ho Tu Nam, 2020). This

is partly due to a shortage of skilled pharmaceutical workforce in these settings, as well as the high disease burden and patient overload in the public sector which limits pharmacists to dispensing roles (Bates *et al.*, 2016; Joshi *et al.*, 2018). Similarly, the COVID-19 pandemic has caused a paradigm shift in pharmacy education in developed countries particularly in experiential learning. Its impact in reshaping pharmacy education, however, is less in developed countries, when compared to resource limited countries in Africa (Draugalis, Johnson, & Urice, 2020; Fuller *et al.*, 2020). Before 2015, the University of Namibia (UNAM), School of Pharmacy implemented a programme to upgrade pharmacist's assistants certificate holders, to pharmaceutical technologists in order to strengthen the pharmaceutical workforce and systems (Rennie *et al.*, 2019). The aim of the Diploma in Pharmacy programme was to strengthen pharmaceutical technical skills in Namibia that are not adequately catered for by the pharmacist and pharmacist's assistant (UNAM, 2019). The programme was particularly designed to address the development of technical skills in the pharmaceutical manufacturing industry and the provision of pharmaceutical care services in both primary and secondary healthcare settings to meet Namibia's healthcare needs (Mazibuko *et al.*, 2014; Rennie *et al.*, 2019). The Diploma in Pharmacy programme provides a bridging platform under which pharmacist's assistant certificate holders can reach their full potential in their pharmacy careers, through continuous education, so they can continue to work and earn a salary to support their families, while upgrading their knowledge and skills. The pharmaceutical technologist is recognised under the Pharmacy Act of Namibia (Act 9 of 2004) as a mid-level cadre that serves alongside pharmacist and pharmacist's assistant cadres (Government, Republic of Namibia, 2004). The continued, chronic need for pharmaceutical personnel in Namibia negatively impacts service delivery (Rennie & Hunter, 2020). During the needs-analysis for the diploma programme, various stakeholders, including Health Professions Council of Namibia, Ministry of Health and Social Services (MoHSS), Pharmaceutical Society of Namibia and pharmacy practice sector expressed the need for a mid-level pharmacy cadre to bridge current gaps (Kibuule *et al.*, 2017; Koehler & Brown, 2017; Joshi *et al.*, 2018; Rennie *et al.*, 2019).

The programme was implemented using a blended teaching and learning approach, as opposed to the traditional class-based programmes. This work-based programme has experienced minimal disruptions due to the COVID-19 state of emergency, compared to the full-time Bachelor of Pharmacy programme. The curriculum for the work-based programme is supported by pharmacists in the MoHSS, UNAM lecturers,

Pharmaceutical Society of Namibia, the Health Professional Council and industry. Currently, the programme has been restricted to articulate pharmacist's assistants to pharmaceutical technologists and consists of two-years of training, mainly to strengthen pharmaceutical systems. The programme has achieved several academic outcomes including annual admission of 28 students, with four cohorts graduated to date. The pass rates of this work-based programme remain high and there is a low attrition rate of less than 10%. Several graduates from the programme have articulated into the Bachelor of Pharmacy degree, financed by the Ministry of Health. This is a step forward for further strengthening pharmaceutical services in hard to reach and remote areas in Namibia (Table I).

Table I: Outcomes of the Diploma in Pharmacy Programme

	2015	2016	2017	2018	2019	2020
Enrollment number	30	30	30	30	28	25
Completion/pass rates (%)	96.7	93.3	90.0	92.8	88.0	
Dropout rates (%)	3.3	6.6	10.0	7.1	12.0	
Articulation into the B.Pharm.	2	2	2	3		

Consequently, the aim of the study was to audit the implementation of the UNAM work-integrated Diploma in Pharmacy programme and identify its successes and challenges, to provide guidance and a framework for uninterrupted pharmaceutical training programmes in the sub-region.

Evaluation

Design, procedure and outcomes

A cross-sectional descriptive evaluation of the Diploma in Pharmacy programme at the School of Pharmacy, UNAM. The programme has had minimal disruption during the COVID-19 pandemic. The programme was first implemented in 2015 to up-skill mid-level pharmaceutical cadres (pharmacist's assistants), working in both the public and private health sectors in Namibia. The primary outcome measure was to identify the key elements for implementing COVID-19 resilient pharmacy education in a resource-limited setting. The secondary outcome measures were the grassroots impact of the programme on pharmaceutical systems and workforces. Data were collected using key informant feedback and review of annual reports on outputs of the programme.

Table II: Elements of a resilient pharmacy education: lessons from Diploma in Pharmacy

Elements	Implementation of the element in the Diploma in Pharmacy programme
1. Competence based curriculum (Pearson and Hubball 2012)	The work-based programme is based on principles of Competence Based Education and Training with the learning, teaching and assessments aligned to clear outcomes or competences. This ensures that students develop specific skills and competencies as an outcome of each unit learnt, as well as maintenance of a student-centered teaching-learning process.
2. Blended learning approach	This entailed the integration of face-to-face contact sessions and eLearning since the inception of the Diploma in Pharmacy in 2015 • *Online learning:* Through a work-integrated approach, the programme is delivered using a blended block release mode. In this blended approach, over 83% (25 out of 30 weeks) of teaching and learning is conducted through student self-directed learning by means of Moodle, a virtual learning management system and work integrate learning activities included in the module workbooks. • *Contact sessions:* In addition, students complete up to 5 weeks (17%) of contact-classes for practical face-to-face training and practical apprentice, as well as an additional week of examinations. During contact weeks, progress of learning is also assessed by portfolio assessment and an end of contact week, combined test is always given. During the third contact session week, major tests are administered for all modules. • *Laboratory contact sessions:* The programme utilises laboratories accredited for training students on the Bachelor of Pharmacy programme, this creates completion for laboratory space and timetabling. As a result, contact sessions have to be appropriately scheduled with prior arrangements to avoid crashes of use of limited space.
3. Work-integrated	The work-integrated programme provides several advantages, including high motivation to learn, experiential-learning and employability and sustainability, due to the salaried students being able afford costs for learning. Apprentice: the work-integrated learning is supported by on-site pharmacists and healthcare professionals at the private or public facility under a Memorandum of Understanding with the MoHSS or by request to private establishments. In addition, there is a course coordinator for the DipPharm programme and the individual module lecturers engage students through the Moodle platform to interact with students during working hours.
4. Student-centred learning	• The learning, teaching and assessment activities have been structured to encourage student-centered learning. • *Learning and teaching resources:* The programme has intentionally developed module workbooks and study guides. The module workbooks outline the learning outcomes, the theoretical and practical content and formative assessment activities that students complete within a designated time frame. The workbooks also include three logs which include, daily activity log, reflection log and a feedback log. The completion of the activities and logs should be approved by the site supervisor. All module workbooks and guides have been developed and are updated yearly to meet the needs of the community. The workbooks, which are accessible on the Moodle platform are the main reference material for learning, teaching and assessments for all modules. • *Reference materials:* The module workbooks are supplemented by power point lecture materials with/without audio recordings. The recording of the voice overs is supported through the Panopto® software. The main reference text is "The Southern African Manual for Pharmaceutical technicians" that was collaboratively developed between the University of Namibia, Nelson Mandela Metropolitan University in South Africa and St. Louis College in the United States, to adapt the training to local needs in Southern Africa. In addition, several reference texts are uploaded on the Moodle platform and are also accessible through a remote library service of the University of Namibia. A number of recommended text books and laboratory guides also form part armamentarium of study materials of the programme, including the BP, BPC, USP, pharmacist initiated therapy, among others.
5. Learning Management systems	A learning management system is key in implementation of resilient work-integrated programmes. • *Activities and resources:* The Diploma in Pharmacy programme is mainly administered through the Moodle platform, to deliver online, live classes using the Big Blue Button® application, manage assessment and feedback and manage grades of the students. In addition the platform provides integrative learning through forums, chats and communication among students and the lecturers. The platform promotes transparency and accountability of the students towards their learning. Furthermore, the anti-plagiarism software URKUND® check helps to validate that the assignments and reports submitted by students are their own work.
6. Collaborative training	The programme has harnessed industry collaborative partnerships in the training of pharmaceutical cadre. The industry partners are from the public and private sectors. • *Work-based learning:* MoHSS and private community pharmacists approve of the applicants undertaking the work-based programme. In addition, the site pharmacists in both sectors participate in the teaching, mentorship and assessment of the students. Site supervisors are responsible for mentoring students during their day-to-day training at work by providing systematic guidance and support using structured tools such as workbooks and portfolio reviews. • *Experiential learning:* The programme has a strong experiential focus supported by industry partners who inject unique pharmaceutical technical skills. The strength of the programme lies in active engagement of various industry players. Moreover, students are exposed to two placements in their training with guidance from preceptors. During placement I, students develop skills in rational use of medicines, pharmaceutical inventory management and good pharmacy practice either in a hospital pharmacy setting or community pharmacy. In this placement, students conduct audits to identify pharmaceutical problems, then develop and implement interventions to resolve these problems. The findings are shared with stakeholders to improve pharmaceutical service delivery both in private and public sector. Placement II exposes students to practical learning experience in pharmaceutical manufacturing industry, Namibia Medicine Regulatory Council, Quality Surveillance Laboratory, and Pharmaceutical Distributing companies to enhance their skills in GMP, medicine registration and inspections, medicine information & Pharmacovigilance; quality control and pharmaceutical marketing.
7. Learning support & supervision system	The School has developed a student mentorship programme where students are assigned to a lecturer to support their learning as well as guide the completion of their projects. A resilient programme requires a support system for slow learners, given that lack of real time support to students in remote settings. The course coordinator monitors the progress of each student and evaluation of the progress is performed through workbook based discussions and portfolio assessments during the contact sessions. During these student-lecturer interactions, progress with each module is evaluated and success and challenges regarding the learning experiences and completion of activities are identified. Consequently, each students sets up goals for improvement which are assessed and graded in the subsequent portfolio or workbook based discussion.
8. Assessment and feedback system	*Formative assessments:* The formative and continuous assessment (CA) contribute 50 % of the final mark, except for the placements as well as the research and audit modules that is assessed by 100% CA. The specific types of assessments include written assignments and online quizzes on Moodle which are supplemented by various assessments that are conducted during contact sessions – portfolio based assessments, end of contact sessions assessments, laboratory reports. The summative assessments include written examinations, OSCEs and viva voce assessments.
9. Quality Assurance and Improvement system	There are multiple strategies in place to assure quality of teaching and learning. All formative assessments are internally moderated while pre and post examination moderation is done both internally and externally. In order to assure quality of online submissions, the programme applies the UNAM plagiarism policy through implementing an URKUND soft-ware plagiarism check system on all assignment and submissions and attracts penalties for >20%. This has enhanced the quality of independent work and critical thinking among the students. In addition the use of individual practical assessments such as OSCEs and viva voce during the contact session help to gauge the individual student progress with learning on each module. An online student-lecturer evaluation system has been embedded on the Moodle platform to assess the quality of teaching and learning and administration per lecturer per module. This gives Lecturers opportunity to improve their performance continuously. Furthermore, at the end of each contact session week, students are availed another opportunity to give feed-back for the purposes of quality improvement.
10. Integration of Technology infrastructure	The future of pharmacy integrates technology. The implementation of the Diploma in Pharmacy required a reliable ICT infrastructure supported by the Center of Open, Distance and e-Learning (CODeL) which coordinates and updates the infrastructure. In addition the University provides devices to facilitate online learning for all students, namely an internet device (dongle) and a monthly data bundles or access to free Wi-Fi at the respective campuses. There are also specific policies to promote the use of ICT across modules. This has supported the integration of pharmacy specific online teaching materials onto a common platform.

The target population were the key informants (KIs) involved in the implementation of the programme, who were mainly the heads of departments in UNAM School of Pharmacy, Namibia and selected stakeholders in the MoHSS. In addition, records of the quality improvement projects at workplaces were evaluated. The programme was implemented using a work-integrated, blended approach, i.e., online learning via the learning management system, Moodle, in-service experiential training and contact sessions over a period of two to three years. Consent was obtained from the key informants for provision of information on the implementation of the programme. Data were collected in July and August, 2020 and entered in Epidata v3.1 for management and analysis. Qualitative data were analysed thematically to identify key elements of implementing a COVID-19 resilient programme. The key informants (Head of Departments and stakeholders involved in the administration of the programme) were requested to independently identify and rank elements that contributed to the resilience of the Diploma in Pharmacy programme. The KIs ranked the elements in order of impact from 1 (least impactful) to 10 (most impactful). Consequently, the second phase of ranking of the elements was performed by a team consisting of four of the authors (DM, MM, DK and JL) based on the initial ranking and themes by the KIs. Lastly, the ten key elements were validated by all the KIs through a consensus meeting regarding the themes and ranking. Quantitative data on academic and work-based outcomes were analysed using descriptive statistical analysis.

Findings

Elements for resilient pharmacy education: lessons from UNAM Diploma in Pharmacy programme

Table II highlights the ten key elements for implementing a COVID-19 resilient pharmacy education programme. These could be adopted by pharmacy education programmes particularly in low- and middle-income countries, with limited resources and a negative balance of pharmaceutical workforce.

Grassroots impact of quality improvement project on pharmaceutical services

One module of the Diploma programme requires students to conduct an audit in their own workplace, followed by the student identifying an aspect of medicine use that is sub-optimal and designing an intervention to try and improve this aspect. All students are allocated a supervisor (lecturer) to support and guide them in this work; one supervisor supports two to three students.

The topics that students have addressed include improving patient satisfaction with pharmacy services, improving stock record keeping (at public hospitals, community pharmacies and central medical stores), improving storage conditions of medicines, reducing inappropriate prescribing of antibiotics (in public hospitals, community pharmacy and private hospital), minimising waste due to expiry, improving management of cold chain items in hospital theatre, improving labelling of dispensed medicines and improving patient adherence to antiretroviral therapy. Table III shows the impact of some of the students' projects.

Table III: Impact made by students' interventions

Indicator description	Intervention Site	Pre	Post	Year reported
% of stock records balanced	Gobabis District Hospital	47%	87%	2017
	Central Medical Store	20%	95%	2018
	Windhoek Central Hospital	63%	96%	2019
	Community Pharmacy, Keetmanshoop	33%	83%	2019
% of expired stock on shelves	Okahao District Hospital	13%	3%	2018
	Intermediate Hospital Katutura	17%	7%	2019
% of prescriptions including an antibiotic	Swakopmund District Hospital	50%	30%	2018
	Community Pharmacy, Windhoek	43%	23%	2019
	Military Hospital, Grootfontein	77%	30%	2019
	Intermediate Hospital Onandjokwe	60%	40%	2019
% of correctly labelled dispensed medicines	Engela District Hospital	43%	87%	2018
	Opuwo District Hospital	77%	100%	2019
% of patients that know how to take their medicine correctly	Namdeb Hospital, Orangemund	73%	96%	2017
% of patients satisfied with pharmacy service	Intermediate Hospital Onandjokwe	80%	90%	2019
Patients with 95% or higher adherence to ART	Okuryangava Clinic, Windhoek	37%	80%	2019

The module has been very successful and pushes the students to put the theory they are learning into practice, showing them how to go about improving medicine use in their workplace, in the hope that they will continue to identify and address medicine use issues as they arise. It also enables the students' supervisors and colleagues to

see concrete evidence of the students' development, which is important as some members of the Pharmacy sector in Namibia have questioned the need for the Diploma in Pharmacy programme. Students present their findings in a poster session that external stakeholders are invited to attend, and the posters and the student's presentations of the posters are assessed. This poster session also permits the School of Pharmacy to showcase the work that the Diploma students are doing, thereby raising awareness and support for the programme.

Table IV illustrates challenges to the implementation of the programme, which were mainly pertaining to development of policies and scope of practice for integration of this cadre in the Namibian public and private health sectors. A lot of progress has been made by the MoHSS to redesign the scope of practice of pharmacists and pharmacist's assistants so that pharmaceutical technicians can play an important role in the management and supply chain of medicines as well as promotion of rational use of medicines at primary health care level.

Future Implementation

Whilst several studies highlight the challenges regarding the impact of the COVID-19 pandemic on tertiary education, few provide a framework for implementation of resilient programmes in pharmaceutical sciences and pharmacy with a strict scope of competences (Badreldin *et al*., 2020; Stone & Pate, 2020). The findings of this evaluation provide a framework for the implementation of pandemic-resilient pharmacy education, particularly suited for resource-limited settings. The study reports ten key elements for implementation of a COVID-19 resilient pharmacy education programme and further demonstrates its impact on strengthening grassroots pharmaceutical systems and workforce.

With reference to the Diploma in Pharmacy programme, which has had minimum disruptions due to COVID-19, the study identifies ten elements for implementation of a pandemic resilient pharmacy education (Table II). The elements pertain to a competency-based curriculum, student-centred, integration of technology, work integration, collaborative training, support-supervisory system, blended learning approach and use of quality change projects to demonstrate learning. Studies recommend that the future of pharmacy education should be student-centred and implement a blended approach through integrated programmes, as a means to the attainment of competences required by the industry, and increased chances of employability of graduates (Lyons, Christopoulos, & Brock 2020; Persky *et al*., 2020). However, transition to the future mode of pharmacy

Table IV: Academic outcomes, challenges and strengths of the programme

	Academic outcomes of the programme
Research capacity	Increased capacity for clinical and pharmacy audits at primary health care, medicine use surveys, audit of stock supplied
Community service	The students participate medicine use audits and report finding to the respective therapeutic committees to implement recommendations. Free pharmacist to provide tier 2 and 3 hospital pharmacy services. The pharmaceutical technologist currently are essential in providing pharmaceutical services related to HIV/AIDS medication and care , several are employed at the national Central Medical Store to manage medicines, and others at hospitals to assist pharmacist in promoting the rational use of medicines.
Employment and Pharmaceutical workforce	All graduates are employed in the public and private sectors. Currently, the scope of practice of pharmaceutical technicians has been expanded by the council and is under consideration by the ministry of health. Scope of practice for pharmaceutical technicians and registration by the Health Professions Council of Namibia and registration on the government PAM system
Challenges	Policies to integrate cadre in the public sector are outdated and the cadre faces employment competition with the pharmacist, and Nurses who, until now provided the services of the pharmaceutical technicians through task shifting. Whilst most students are satisfied with the programme, a limited number have completed their registration with the Health Professions Council of Namibia, mainly due to lack of procedures and policies to integrate them in the public administration management structure. However this process is almost complete and more graduates are completing the registration processes with the pharmacy council. Delayed feedback on continuous assessments, particularly assignments is a concern. The School recommends an improved mechanism that will accelerate feedback on certain assessment activities, assignments in particular. Conducting of Tracer Studies is another area that needs improvement. Introduction of a Finance & Entrepreneurship module as part of the curriculum is another important area that will prepare students for start-ups and/or self-employment. Given the volatile economic situation inside and outside the country, it is important to equip graduates to become "job creators" instead of job seekers.
Strengths of the programme	Strong partnership with key stakeholders is a major cornerstone of this programme. Qualified academic staff with vast experience adds value and quality to the programme. The strength of the programme is demonstrated by the 100 % employment of all graduates. The programme has capacitated graduates to take on new roles of managing pharmaceutical services in primary health care. The programme has also created new career pathways for the graduates with some joining the Bachelor programmes within/outside Namibia.

education in Africa has been hampered by limited resources and limited capacity to integrate technology in the education system (World Economic Forum, 2017; Martin, Bohuslava, & Igor, 2018).

The work-based, integrated Diploma in Pharmacy programme using a blended approach has a high completion rate, >95%, compared to the full time Bachelor of Pharmacy programme (~75%). It appears that students studying in the real work environment are more motivated than students on the conventional programmes, where they are often isolated from the industry. The authors also report that the implementation of work-based quality improvement projects improved the medicine use indicators and the management of medicines at health facilities (Table II). In addition, the students obtained learning support from supervisors and other healthcare professionals. The learning activities were deliberately designed to solve problems at the workplace; this contributes to contextualisation of learning. Several studies have advocated for work-based pharmacy education to improve learning and develop professional skills (Ley *et al*., 2008; Pearson & Hubball, 2012; Jackson, 2015).

The findings of this evaluation should be interpreted with the following limitations, that was a single- programme evaluation implemented only in the last five years, and the evaluation findings were based on expert opinions in one country, Namibia. Nevertheless, the study provides a preliminary framework for strengthening pharmacy education programmes in resource-limited countries to better prepare and minimise disruption during emergencies.

The UNAM School of Pharmacy plans to review the curricula of all its programmes, to ensure assimilation of these ten key elements for resilient pharmacy education. This will involve wide stakeholder engagement, to facilitate quality assured, work-integrated, blended learning, that can meet Namibia's current and future pharmaceutical workforce needs.

The authors conclude that the ten elements detailed in this paper provide an essential framework for implementation of a pandemic-resilient pharmacy education programme, particularly in resource-limited settings. Student-centred, work-integrated, pharmacy education programmes offered through a blended approach, using information and communication technologies and block release format, have the potential to strengthen pharmaceutical systems and workforces in resource-limited settings, particularly during emergencies such as the COVID-19 pandemic.

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