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Transforming pharmaceutical education: A needs-based global analysis for policy development

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ABSTRACT

Background: A needs-based approach is desirable for the transformation of pharmaceutical education, and to link pharmaceutical education with the health needs of populations and national priorities. There are varying levels of data in the literature on the status of pharmaceutical education in all six World Health Organization (WHO) regions, especially in the context of needs identification and evidence-based policy interventions. The framework for this study was the FIP Development Goals.

Objectives: The aim of the study was to develop evidence-based policies through a needs-based approach for pharmaceutical education transformation nationally, regionally and globally by addressing the following objectives: 1. Identify global and regional needs in pharmaceutical education, through a regional SWOT analysis and prioritization of FIP development goals; 2. Develop valid and credible regional roadmaps for pharmaceutical education advancement according to the identified prioritized goals and 3. Develop a global call to action as a policy intervention for advancing pharmaceutical education.

Methods: This study was conducted between 2020 and 2021 using a mixed methods approach. Surveys of higher education institutions and a series of qualitative interviews were conducted with national professional leadership organizations, with further regional workshops having 284 participants recruited from the International Pharmaceutical Federation (FIP) membership base, spanning all six WHO regions.

Results: Eleven out of 21 FIP DGs were identified as priorities for regional roadmaps and FIP DG 1 (Academic capacity) was identified as a priority in four regions. All regions had distinctive results with an area of commonality between them. There were common weaknesses in the adoption of competency-based education and inter-professional education.

Conclusions: It is critical for every country and region to develop needs- and evidence-based policies for the transformation of pharmaceutical education, for which FIP DGs provide a systematic framework.

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1. Introduction

According to the World Health Organization's (WHO) Global Strategy on Human Resources for Health Workforce 2030, ensuring equitable access to health workers within strengthened health systems can accelerate progress towards universal health coverage (UHC) and achievement of the United Nations Sustainable Development Goals (UN SDGs).[1] The WHO states that there is no healthcare without a workforce, and there is no workforce without education.[2] The role of education is at the centre of advancing health services, including sustainable pharmaceutical services to meet the health needs of populations.[3]

Despite the rapid changes and transformation in healthcare settings, there are still areas of improvement, for which health professions educators must keep pace[4,5]; these include improvements from fragmented, outdated, and static curricula that increase risk for skill gaps in graduates. Areas of concern include a mismatch between technical and managerial competencies, poor teamwork and persistent gender inequality in the profession.[4] Prior to development of any educational intervention, it is necessary to work around needs and gaps identification to build a foundation for evaluation, intervention and transformation.

The International Pharmaceutical Federation (FIP) advocates for a needs-based approach to the advancement of pharmaceutical education, linking pharmaceutical education with the health needs of populations and national priorities. This approach requires that pharmaceutical education to be locally or regionally determined, socially accountable, globally connected and quality assured to meet the health needs of communities.[6] This needs-based approach requires an assessment of the needs of the community, nation, or region and then development, or adaptation, of supporting educational systems and/or interventions accordingly.[7]

Through a consensus-based approach in 2016, FIP developed three milestones that aim to advance pharmaceutical science, education and practice by transforming pharmacy education to provide an improved healthcare service.[8] In 2020, building on the FIP Pharmaceutical Workforce Development Goals published in 2016, the 21 FIP Development Goals (DGs) were launched, as a key resource for transforming the pharmacy profession regionally and nationally.[9] Aligned with FIP's mission to support global health by enabling the advancement of pharmaceutical practice, sciences and education, these goals are set to support pharmacy transformation in alignment with wider global imperatives such as UN SDGs,[10] WHO Triple Billions Goals,[11] and the Declaration of Astana on Primary Health Care.[12]

Every goal in the UN SDGs and FIP DGs requires education and workforce development to empower people with knowledge, skills, and values. While working towards achieving health-related UN SDGs through FIP DGs by putting education at the centre, FIP is progressing towards the SDG 4 (Quality education) to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.[10]

One of the essential factors favouring development of professional competence is the exchange of experience and knowledge between universities and other learning institutions, together with collaborative practice between stakeholders such as university teachers, researchers, and administrators from different regions. FIP has steadfastly and purposefully developed frameworks, resources, and programs to address such gaps in pharmaceutical education and training. The FIP-UNESCO UNITWIN program (hereafter called the UNITWIN program) integrates twinning (practice, knowledge and resources sharing) across academic institutions to bridge educational needs and translates this to pharmaceutical workforce robustness and delivery of quality pharmaceutical interventions.[13] Through the pioneer FIP UNITWIN Centre for Excellence in Africa, FIP has performed an expertise and network mapping activity, matched the needs and priorities of pharmaceutical education in sub-Saharan Africa with the existing experience within its network, leading to improvement in academic capacity, needs-based education and policy strategies.[14]

Regarding transformation of the pharmaceutical workforce through education, varying levels of data across the six WHO regions exist, requiring a robust analysis across all six regions (The Americas, the European, Eastern Mediterranean, South-East Asian, Western Pacific, and African regions). For instance, previous studies have used the FIP Pharmaceutical Workforce Development Goals (PWDGs) as a systematic framework for understanding and identifying priorities as well as needs for pharmacy workforce development with a view to education transformation.[15] Furthermore, a study from the Eastern Mediterranean region used the FIP PWDGs as a framework for assessment of the pharmaceutical workforce and education.[16] In addition to these approaches, identification of the gaps in education through a SWOT analysis approach has been adopted by other healthcare professions for the situational assessment of educational needs.[17,18] A global survey of 48 countries and territories has described the range of specialization and professional recognition systems for advanced pharmacy practice worldwide. This is due to the increasingly complex nature of pharmaceutical care delivery and a consequent need to be able to endorse professional capabilities of the pharmaceutical workforce.[19]

Prioritization of goals to focus on implementation is always critical to the achievement of a transformation agenda. Based on these previous studies, there was a need for a comprehensive global study showing the status of pharmaceutical education across all regions to provide an action plan for transformation using the concepts of needs identification through FIP development goals as a framework. FIP operates within the six WHO regions with a mission to support global health by enabling the advancement of pharmaceutical practice, sciences, and education. The aim of the study was to develop evidence-based policies through a needs-based approach for pharmaceutical education transformation nationally, regionally and globally by addressing the following objectives: 1. Identify global and regional needs in pharmaceutical education, through a regional SWOT analysis and prioritization of FIP development goals; 2. Develop valid and credible regional roadmaps for pharmaceutical education advancement according to the identified prioritized goals and 3. Develop a global call to action as a policy intervention for advancing pharmaceutical education.

2. Methods

The study methodology was designed to accomplish three principal outputs aligned with the study objectives. This study was conducted between 2020 and 2021 using a triangulation design: convergence model mixed method approach (Fig. 1).[20] The method chosen was determined by the aim of the study which was to develop policy through a needs-based evaluation; to enable a triangulation of the collated data. The sample comprised of national professional leadership bodies (NPLBs) and higher education institutions (HEIs) recruited from the FIP membership base spanning all six WHO regional locations. A non-probability sampling technique was used with the respondent organizations being coded based on their WHO regional location.

The methodology included surveys of FIP HEIs, and a series of qualitative interviews conducted with FIP NPLBs having a database of $N = 174$ and $N = 151$ respectively. A subsequent series of international global meetings was conducted to validate the outputs of these methods. The survey was developed in English by the project team and piloted within the extended project team who are all representatives of the target audience of the survey. The survey tool was designed to obtain insight on the use and prioritization by HEIs of the FIP DGs that are oriented to elements of education and training. The survey was distributed through an online platform and targeted to senior academics in the sampled HEIs.

The qualitative interviews with senior representatives of NPLBs were conducted online and recorded with their permission. For the interview, a total of 26 professional organizations and agencies from 21 countries across five World Health Organization (WHO) regions were invited to ensure regional representation and ease of data collection. These interviews were based on a topic guide to maintain a standard interview structure and investigated current policy directions of the leadership bodies with respect to the FIP DGs. Senior representatives included personnel such as chief executives, elected presidents and senior policy directors. The interviews were conducted by FIP dedicated research team members who have extensive

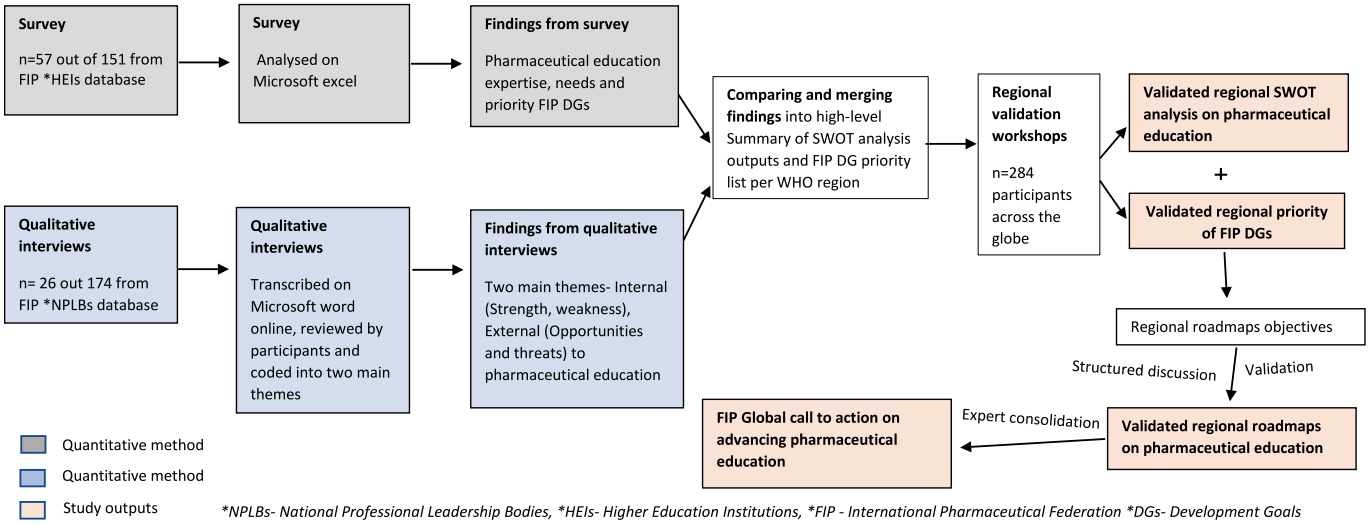


Fig. 1. Methodology for developing a global policy on pharmaceutical education using the FIP development goals and SWOT analysis on pharmaceutical education.

experience conducting interviews, and a training session was carried out based on the topic guide to support the interviewer. The structured interviews were carried out in English and transcribed using Microsoft word online and shared with the participants for review and feedback. This was then coded by two researchers independently in Microsoft Excel. After conducting the initial coding, codes were categorised into internal (strengths and weakness) and external (opportunities and threats) themes which were reviewed for credibility.

Coded extracts of the NPLB interviews were then combined with the HEI survey data to enable a full SWOT (strengths, weaknesses, opportunities, and threats) analysis with a focus on education and training across all regions. Both the quantitative and qualitative combined data were collated into country-level summaries describing policy priorities, use and priorities of the FIP DGs as well as perceived policy strengths and weaknesses. Expert panel review, using an iterative nominal group technique, provided validation and credibility input into these country-level summaries.

The country-level summaries were grouped by WHO region and used as a basis for a series of regional validation workshops. Participants including educators, practitioners, scientists, and pharmacy leaders were recruited through an FIP membership database, on a regional basis. An FIP research team conducted each regional validation workshop using a standardized engagement process with participant guidelines and structured documentation (the data from evidence collection). Participants were guided to engage with outputs of the SWOT analysis outputs to provide written and oral feedback on each regional summary. Regarding the SWOT analysis, the regional workshop participants were asked if the listed strengths, weaknesses, opportunities, and threats align with their region, and to identify if there are any relevant gaps, missed points, duplication, or redundancy. Regarding the FIP DGs priorities, the participants were asked the extent to which they agreed to the selected priority FIP development goals in relation to their region.

The structured discussion iterated proposed solutions and potential actions for developing regionally valid action plans and developmental roadmap objectives for pharmaceutical education transformation engagement in the region. These proposed solutions for each roadmap objectives were then consolidated through extensive region-wide consultation exercise which led to regional roadmaps on pharmaceutical education. These were then consolidated by an expert panel into the FIP Global call to action for advancing pharmaceutical education.

All regions had the same format for the structured discussion except for the African region. The discussion in this region had a different structure and context from the others because the UNITWIN Centre for Excellence emerged from this region, and a similar exercise was done and reported for the region in 2020.[14] The focus of the workshop was to establish an Africa-wide association of pharmacy schools, to progress the implementation of identified gaps in the SWOT analysis and prioritize FIP DGs through consolidation of existing evidence. Formal ethical approval was not required for this study; data were not classified as confidential, patient health related, personal or commercially sensitive. However, ethical oversight and committee review was obtained from FIP governing bodies and board structures and is on record.

3. Results

Sample demographics:

Table 1 shows the number of responses (%) of the three study steps- The interviews of National Professional Leadership Bodies (NPLBs), survey of Higher Education Institutions (HEIs) and regional workshops across all six WHO regions.

3.1. Findings from regional needs assessment in pharmaceutical education

3.1.1. The Americas region

The regional workshop for the Americas region was carried out for North America separately from the Central and South American subregions due to language differences. The workshop had 55 participants from the United States of America (from North America) and Argentina, Brazil, Chile, Colombia, Costa Rica, Puerto Rico, and Uruguay (from Central and South America). Table 2 shows the SWOT analysis and FIP DGs prioritizations for the WHO Americas region.

3.1.2. European region

The workshop for the European region involved 38 participants from Albania, Denmark, France, Malta, Montenegro, Netherlands, Norway, Portugal, Romania, Slovakia, Slovenia, Switzerland, Turkey, Ukraine, and United Kingdom. Table 3 shows findings from the SWOT analysis and FIP DGs prioritization for the European region.

3.1.3. Eastern Mediterranean region

The workshop for the Eastern Mediterranean region had 44 participants from Bahrain, Egypt, Iraq, Jordan, Kuwait, and Lebanon. Table 4 shows the SWOT analysis and FIP DGs prioritization for the Eastern Mediterranean region.

3.1.4. South-East Asian region

The workshop had 35 participants from India, Indonesia, Nepal, Sri Lanka, and South Korea. (South Korea is in the WHO Western Pacific region. The workshop for the South-East Asian region was co-chaired by a

Table 1
Summary of regional responses (%) for each study step.

Study step	Total responses	Responses from regions (%)					
		Africa	Americas	Eastern Mediterranean	Europe	Southeast Asia	Western Pacific
Interviews of NPLBs	25	14	24	28	–	10	24
Survey of HEIs	57	10	14	17	31	11	17
Regional workshops for validation	284	21	19	13	15	12	20

Table 2
SWOT analysis and FIP DGs prioritization for the Americas region.

FIP development goals (DG) prioritization results	1st priority FIP DG DG 13 (policy development) (agreement rate = 74%)	2nd priority FIP DG DG 1 (academic capacity) (agreement rate = 67%)	3rd priority FIP DG DG 9 (continuing professional development strategies) (agreement rate = 70%)
SWOT analysis on pharmaceutical education for North America			
Strengths	Weaknesses	Opportunities	Threats
The region does well in:	There are room for improvements in:	There are opportunities for:	There are possible challenges due to:
Offering innovative, needs-based pharmacy education curricula in patient-centred care, experiential, interprofessional education, and evidence-based practice	Natural products research	Global collaboration in innovative research activities, curriculum development for PharmD and clinical pharmacy	Inadequate policies enabling providers status for pharmacists
A diverse science and practice research portfolio, including health outcomes research, nanotechnology research and pharmacology	Cultural awareness, e.g., diversity & inclusion in curriculum discourse	Training and capacity building in population health	Uneven distribution of pharmaceutical workforce
Developing academic capacity of the faculty	Experiential learning in pharmaceutical sciences	Standardization of digital health education, including telehealth practices	Decrease in students' admissions and universities funds
Having consistent education curriculum due to having one accreditation agency — Accreditation Council for Pharmacy Education	Advocacy for pharmacists' involvement in public health	Teaching genomics in pharmaceutical education	Decline in domestic student admission, especially for pharmaceutical sciences
Having good quality and quantity of faculties across education, practice, and research	Entrepreneurship as part of pharmacy curriculum	Greater coordination in emergency response of the entire workforce	
Robust residency training that complements initial education and leads to advanced specialist practices and clinical capabilities	Developing new models of care, and relevant competencies, to improve public health	Advocacy for providers status as well as public health roles of pharmacists to sustain services beyond COVID-19 pandemic	
SWOT analysis on pharmaceutical education for South and Central America			
Strengths	Weaknesses	Opportunities	Threats
The region does well in:	There are room for improvements in:	There are opportunities for:	There are possible challenges due to:
Partnerships for quality assurance in pharmacy education and training	Research in pharmaceutical care, clinical pharmacy practice and their relevant components in curricula for undergraduate and postgraduate programs	Global north-south collaboration in academic capacity development, research project and cooperation agreements between university research groups	Inadequate accreditation of pharmacy programs
Having a high number of pharmacy schools	Continuous professional development delivery systems	Collaboration to develop competency frameworks for advancement and early career	Inadequate policies on workforce development
Having increase in the number of pharmacy graduates, hence boosting the pharmaceutical workforce capacity	Faculty and infrastructural capacity of pharmacy schools	Institutions to deliver continuing professional development components	Lack of systems and policies enabling continuing professional development
Herbal medicines and their pharmaceutical formulation research	Interprofessional education	Blended education, including newer hybrid learning methodologies in pre- and post-graduate education	Inadequate financing of pharmacy schools
	Active learning methodologies	Collaboration between academia and professional organizations for stronger advocacy for the profession	Poor recognition, value and renumeration of pharmaceutical workforce
	Leadership, policy, administrative and management skills to be included in curriculum	Strengthen cooperation between the universities from Spanish-speaking countries in the field of pharmaceutical services education, research, and provision	Inadequate accreditation of pharmacy programs
	Graduate certifications for specific fields, e.g., pharmaceutical engineering and pharmacogenomics	Blended education including newer hybrid learning methodologies in pre- and post-graduate education	Pressures to regulate the use of e-learning as the major learning method in pharmacy pre-graduation education

South Korean participant since the validation on the roadmaps was done with the wider Asian regional perspective, not solely South Korea). Table 5 shows the SWOT analysis and FIP DGs prioritization for the South-East Asian region.

3.1.5. Western Pacific region

The workshop for the Western pacific region had 53 participants from Australia, China, Japan, Malaysia, New Zealand, and The Philippines. Table 6 shows the SWOT analysis and FIP DGs prioritization for the Western Pacific region.

3.1.6. African region

The workshop for the African region had 59 participants from Burundi, Cameroon, Kenya, Nigeria, Senegal, South Africa, and Zambia. The African region workshop had a different structure and context from the others and no validation exercise was done during the workshop because the

Table 3
SWOT analysis and FIP DGs prioritization for European region.

FIP development goals (DG) prioritization results	1st priority FIP DG DG 13 (policy development) (agreement rate = 75%)	2nd priority FIP DG DG 5 (competency development) (agreement rate = 58%)	3rd priority FIP DG DG 20 (digital health) (agreement rate = 54%)
SWOT analysis on pharmaceutical education for European region			
Strengths	Weaknesses	Opportunities	Threats
The region does well in:	There are room for improvements in:	There are opportunities for:	There are possible challenges due to:
Having a Europe-wide recognized pharmacy program that enhances educational and professional mobility	Competencies for the expanding scope of practice, e.g., geriatric pharmacy, precision medicine, patient-centered care	Global collaboration for innovative research activities and curriculum development, including conducting research on the clinical reasoning of pharmacists	Potential shortages of pharmacists due to challenge of attracting students into the profession
Clinical pharmacy competencies for developing innovative pharmaceutical services	Academic expertise, e.g., pharmaceutical regulatory science, entrepreneurship in pharmaceutical services	Resources and best practice sharing for building academic capacity globally	Non-clinical areas attracting graduates resulting in shortages of community and hospital pharmacists where demand is increasing due to ageing population and complex therapies
Pharmaceutical technology competencies for developing advanced drug delivery systems	Expanding education across other skills that graduates need to have, e.g., economics, social skills, digital skills, collaboration skills, and policy development and implementation skills	Technological innovation to advance teaching and learning	Unallocated funding and grants for research and capacity building
Partnership with both public and private sectors for research and innovation	Continuing education and post-graduate education for the existing workforce as well as training of the future workforce in competency-based education	Creating a regionally recognized competency framework since there is a recognized European-wide pharmacy program	Variability in the region as to expectations and acceptance of pharmacists' extended scope of practice by other healthcare professionals
Facilitation of mobility of students, faculty, and professionals across the region	Interprofessional education and collaboration	Making education relevant to innovation, e.g., improving education and competencies in artificial intelligence, machine learning, coding, and 3D production	Variation in the extent of implementation of pharmaceutical care services across countries
		Diversification of the program to include specific programs in the sciences due to MPharm becoming more clinically oriented	Skills and practice gap between incoming and existing pharmaceutical workforce
		Developing advanced education and specializations for the expanding roles of pharmacists (e.g., community pharmacy, regulatory pharmacy, medicine production and compounding) in alignment with undergraduate education	Threat on the scope of pharmaceutical practice due to the increased demand from other healthcare professionals on providing pharmaceutical services
			Inadequate professional response to the expanding scope of practice, e.g., regulatory and policy areas

Table 4
SWOT analysis and FIP DGs prioritization for Eastern Mediterranean region.

FIP development goals (DG) prioritization results	1st priority FIP DG DG 5 (competency development) (agreement rate = 93%)	2nd priority FIP DG DG 9 (continuing professional development strategies) (agreement rate = 86%)	3rd priority FIP DG DG 6 (leadership development) (agreement rate = 73%)
SWOT analysis on pharmaceutical education for Eastern Mediterranean region			
Strengths	Weaknesses	Opportunities	Threats
The region does well in:	There are room for improvements in:	There are opportunities for:	There are possible challenges due to:
Knowledge-based education in industrial pharmacy, pharmaceutical science, and clinical pharmacy	Academic capacity and leadership development of faculty members as well as the entire workforce	Creation of early career pharmacists' competency framework and advanced competency framework	Political instabilities
Evolving simulation-based teaching and experiential education	Development of competency-based education	Better alignment for research and capacity building	Inadequate allocation of funds
Research on novel drug delivery systems, drug utilization studies, onco-pharmacology, and quality assurance of pharmaceutical education	Delivery of interprofessional education and continuing professional development	Quality assurance in pharmacy education due to variation in the quality levels of education	Healthcare and pharmaceutical legislation and/or regulations not meeting expanding scope of practice
	Academic capacity and leadership development of faculty members as well as the entire workforce	Greater emphasis and efforts on global outreach	Inadequate recognition of the pharmacy profession due to ethics and professionalism challenges in community practice setting
	Curriculum update to meet expanding scope of practice	Active learning modalities to advance teaching and learning	Limited national and regional strategies for pharmacy profession and workforce development
	Pharmacy practice research that links to health priorities in the region	Establishing institutional centres for supporting mental health, wellness, and career planning of academic staff and students	Brain drain with the risk of migration of faculty members to overseas countries
			Lack of infrastructure to provide practical teaching on emerging pharmaceutical technologies

Table 5
SWOT analysis and FIP DGs prioritization for South-East Asian region.

FIP development goals (DG) prioritization results	1st priority FIP DG DG 5 competency development (agreement rate = 90%)	2nd priority FIP DG DG 1 (academic capacity) (agreement rate = 75%)	3rd priority FIP DG DG 9 (continuing professional development strategies) (agreement rate = 88%)
SWOT analysis on pharmaceutical education for South-East Asian region			
Strengths	Weaknesses	Opportunities	Threats
The region does well in:	There are room for improvements in:	There are opportunities for:	There are possible challenges due to:
Having abundant pharmacy student resources for education	Pharmacy practice education, including patient-centered care, clinical pharmacy, and inter-professional education	FIP to build UNITWIN Center of Excellence for South-East Asia	Variation across countries in capacity and policies for quality and harmonization of education and workforce development
Research and curriculum delivery for pharmaceutical science focused areas, including drug delivery systems, pharmaceutical biotechnology, pharmacogenomics research, precision medicine and herbal medicine	Lack of alignment and harmonization of pharmacy curricula due to regional diversity	Global research collaboration in drug discovery and development with advanced university or institution	Convergence and integration of pharmacy profession into healthcare team, which affects interprofessional collaboration
	Career, leadership, and academic capacity development, especially for preceptors and younger faculty members	Global research collaboration in natural products with sophisticated equipment	Inadequate funding and unstable finances for infrastructures and research
		Specialist and region-matched program development Continuing professional development strategies implementation Establish collaboration with other universities and R&D institutions to close the infrastructure and advanced equipment gap to perform drug discovery Generalized advanced clinical training and internship	

Table 6
SWOT analysis and FIP DGs prioritization for the Western Pacific region.

FIP development goals (DG) prioritization results	1st priority FIP DG DG 19 (patient safety) (agreement rate = 76%)	2nd priority FIP DG DG 1 (academic capacity) (agreement rate = 67%)	3rd priority FIP DG DG 4 (advanced and specialist development) (agreement rate = 89%)
SWOT analysis on pharmaceutical education for Western Pacific region			
Strengths	Weaknesses	Opportunities	Threats
The region does well in:	There are room for improvements in:	There are opportunities for:	There are possible challenges due to:
Having heterogenous pharmacy schools or institutions with differing education and research foci	Student and academic staff exchange for capacity building	Intra-regional collaboration for best practice and resource sharing to strengthen countries and institutions in their unique area of weakness	Alternative teaching platforms during COVID-19 pandemic may influence quality of pharmaceutical workforce
Most institutions offer pharmaceutical science foci in education and research	Greater emphasis on education in indigenous health, mental health, and interprofessional and experiential education	Validate and adapt global competency framework that will enhance pharmacy practice and pharmaceutical care regionally	Potential workforce shortage due to decrease in student admissions and university funds
A few institutions lead in pharmacy practice foci in education and research	Training students to develop competence for pharmaceutical public health	Train students in computational thinking and data literacy as there is an expanding scope of practice in health informatics and digital health	Variation in economic development of the countries
	Building professional competencies (e.g., resilience, communication, reflection, self-regulation)	Collaborative research projects as an enabler to facilitate inter-institutional collaboration and faculty exchanges	Variation in the number and quality of pharmacy schools across the region
	Building health equity and social accountability competencies	Academic curriculum to become more patient-focused rather than medicine-focused	Inadequate workforce strategies to inform education processes

UNITWIN Centre for Excellence emerged from this region, and a similar exercise was done and reported for the region in 2020, available data based on this may be found in the FIP report titled “FIP pharmacy education in sub-Saharan Africa”.[14] The focus of the workshop was to establish an Africa-wide association of pharmacy schools, to progress the implementation of identified gaps in the SWOT analysis and prioritize FIP DGs through consolidation of existing evidence and data. The Africa-wide association will be tasked with the validation and development of a regional roadmap using the priority FIP DGs and the SWOT analysis. The SWOT analysis for the African region is shown in Table 7.

3.1.7. Global overview of FIP DGs prioritization

Summarizing the FIP DGs prioritization exercise across the six WHO regions, Table 8 shows the number of regions that chose a particular FIP DG and the level of priority for that region.

3.2. Findings from regional roadmaps on pharmaceutical education development

During the workshops, regional roadmaps were created based on significant SWOT analysis findings and linked with prioritized FIP DGs to create three roadmap objectives per FIP DG. Participants partaking in a structured

Table 7
SWOT analysis for the African region.

FIP development goals (DG) prioritization results	1st priority FIP DG DG 3 (quality assurance) 2nd priority FIP DG DG 1 (academic capacity)	3rd priority FIP DG DG 18 (access to medicines, devices, and services) 4th priority FIP DG DG 4 (advanced and specialist development)	5th priority FIP DG DG 8 (working with others)
SWOT analysis on pharmaceutical education for African region			
Strengths	Weaknesses	Opportunities	Threats
The region does well in:	There are room for improvements in:	There are opportunities for:	There are possible challenges due to:
Offering didactic curricula in pharmaceutical education	Advanced practice and specialization education, e.g., regulatory, and industrial pharmacy	Updating curricula and programs in the light of global best practices	Lack of institutional and political willingness to support education transformation
Public health competencies, including infectious and tropical diseases competencies	Student and faculty exchanges for leadership development and capacity building	Innovative means of teaching and learning	Inadequate funding
Science-driven research for antimicrobials, herbal products, and novel drug delivery systems	Interprofessional education	Improving competencies in pharmacists, such as vaccination roles	Need for technological innovations to adapt teaching post-COVID-19 pandemic
		Institutions to identify gaps in education and work together to close those gaps	

Table 8
Summary of FIP development goals priorities by WHO region.

Region	Americas	Europe	Africa	Eastern Mediterranean	South-East Asia	Western Pacific
DG 1 (Academic capacity)	2		2		2	2
DG 3 (Quality assurance			1			
DG 4 (Advanced and specialist development)			4			3
DG 5 (Competency development)		2		1	1	
DG 6 (Leadership development)				3		
DG 8 (Working with others)			5			
DG 9 (Continuing professional development strategies)	3			2	3	
DG 13 (Policy development)	1	1				
DG 18 (Access to medicines, devices, and services)			3			
DG 19 (Patient safety)						1
DG 20 (Digital health)		3				

discussion proposed solutions and actions to achieve these objectives. The results below show the roadmap objectives for each region aligned with their priority FIP DGs as well as the roadmap actions for meeting these objectives.

3.2.1. The Americas region

For the North Americas sub-region, the first objective linked with policy development (FIP DG 13) is to develop a policy that enhances the scope of practice through, for example, resolving the medical insurance providers' status issues.[21] The action to address this objective is to provide a platform (through the UNITWIN program) to bring authorities, associations, accreditation bodies and academia together to develop policies for emerging practice, science and education/workforce issues (e.g., needs of the "underserved populations").

The second objective linked with academic capacity (FIP DG 1) is to develop a regional initiative that attracts young pharmacists from all areas of pharmaceutical practice and science into academia. The action to address this objective is to create awareness and broaden information on the job opportunities and expertise and competency needs that exist for young pharmacists and pharmaceutical scientists in academia (e.g., through promoting academia roles through media resources).

The third objective linked with continuing professional development strategies (FIP DG 9) is to develop programs to support return to practice after career breaks or sector changes. The action to address this objective is to develop and implement self-assessment tools to help professionals understand where to focus for subsequent learning.

For the South and Central Americas sub-region, the first objective linked with policy development (FIP DG 13) is to amend existing pharmaceutical policies in favour of professional recognition of pharmacists (e.g., to expand scope of practice, allocate funds for academic capacity). The action to address this objective is to host a regional roundtable discussion with key stakeholders, including academia and students, to advocate professional recognition.

The second objective linked with academic capacity (FIP DG 1) is to develop intra-regional academic capacity building initiatives for faculty staff in areas of clinical pharmacy, pharmaceutical care, and public health. The action to address this objective is to collaborate in the establishment of quality standards for interprofessional and multidisciplinary education, experiential learning and cognition/metacognition strategies and hybrid teaching methods by publishing a guidance toolkit showing best practices across other regions.

The third objective linked with continuing professional development strategies (FIP DG 9) is to promote continuing professional development strategies and self-directed learning at undergraduate level. The action to address this objective is to host a series of webinars in collaboration with other universities to promote continuing professional development strategies and self-directed learning. This series should cover (but not be limited to) transformational leadership, minimal skills and competencies for practice in Latin America, specialty courses including pharmacovigilance, and interprofessional collaboration. An additional action will be to establish alliances between universities, health authorities and professional organizations to develop policies and complement the initiatives (between the UNITWIN Centre for Excellence program and FIP's Pharmaceutical Forum of the Americas.

3.2.2. European region

The first objective linked with policy development (FIP DG 13) is to develop policies that provide a response to the expanding and emerging scope of pharmacy for pharmaceutical education. The action to address this is for FIP to provide a regional platform in collaboration with existing regional

stakeholders (e.g., a roundtable through the UNITWIN program) bringing together national bodies, educators, researchers, practitioners, students, policy makers and other key stakeholders (e.g., government officials, other healthcare professionals). This will support the co-creation of national and/or regional policy interventions through periodic horizon scanning on pharmacy and pharmaceutical sciences, supported through clinical-translational and pharmaceutical outcomes research demonstrating the impact of pharmacy services on health outcomes. An additional action to address this will be for FIP to work in collaboration with existing regional stakeholders to provide tools and highlight opportunities on how institutions can support the empowerment of academic staff to provide advocacy and policy development at national and regional levels.

The second objective linked with competency development (FIP DG 5) is to develop competency frameworks responding to the expanding scope of pharmacy (e.g., geriatric pharmacy, precision medicine, patient-centred care competencies, entrepreneurship and business skills). The action to address this objective is to host "expanding the scope of pharmacy and pharmaceutical sciences in the European region" workshops led by academic institutions to identify emerging competencies and learning outcomes and describe entrust able professional activities.

The third objective linked with digital health (FIP DG 20) is to integrate digital skills and competencies into initial and continuous pharmacy education including artificial intelligence, machine learning and 3D production of medicines. The action to address this objective is to establish a working group in collaboration with the FIP Technology Forum, including IT, industry, digital health service providers and experts outside of pharmacy to identify basic (for all graduates) and advanced (specialty) skills for pharmacists and pharmaceutical scientists, based on the current and emerging needs in digital health practice.

3.2.3. Eastern Mediterranean region

The first objective linked with competency development (FIP DG 5) is to develop a competency framework for expanding scope of practice and adopt this framework through implementation of policies. The action to address this is for the UNITWIN Centre for Excellence for the Eastern Mediterranean region to form a working group which will host workshops to spread awareness on competency frameworks, including mapping with the curriculum. These workshops will invite key regional stakeholders (e.g., academic and research institutions, government officials, other healthcare professionals, national bodies) to address needs-based competency frameworks and competency-based education, perform competency assessment, implement competency frameworks in practice and develop a regional competency framework accordingly.

The second objective linked with continuing professional development strategies (FIP DG 9), is to promote continuing professional development strategies and self-directed learning at undergraduate level. The action to address this objective is for FIP to support the region in building on its existing FIP resources for FIP DG 9 and develop a continuing professional development toolkit. This toolkit will be for raising awareness among faculty leadership and members, including continuing professional development as a part of undergraduate curricula. It will also be supported with country case studies across all regions (e.g., active learning methodologies, involving students in continuing professional development, specialty certification programs for expanding scope of pharmacy and pharmaceutical sciences). It will build lifelong learning culture from undergraduate to all career levels of practitioners, encouraging practice sector leaders to develop career ladders and pathways. Finally, it will support establishing and implementing regional and national policies to support recertification of pharmacists through continuing professional development.

The third objective linked with leadership development (FIP DG 6) is to support regional development of leadership skills for academics, students, pharmacists and pharmaceutical scientists. The action to address this objective is to build on existing FIP resources on FIP DG 6, work in collaboration with regional stakeholders and student associations, host virtual leadership programs for students and early career professionals, where practitioners can provide real-life leadership cases, with an outcome of building regional pharmacy leaders of the future, equipped with professionalism.

3.2.4. South-East Asian region

The first objective linked with competency development (FIP DG 5) is to develop a regional advanced competency framework. The action to address this objective is for the UNITWIN Centre for Excellence for the South-East Asian region to form a working group to adopt and adapt FIP's global competency framework into the regional context.

The second objective is to provide young faculty members with opportunities to build academic capacity (FIP DG 1). The action to address this is to develop an "academic capacity" trainer series for all levels of academics, building on the FIP competency framework for educators.

The third objective is to build a continuing professional development culture from the undergraduate level (FIP DG 9). FIP will support the region in building on its existing FIP DG 9 resources to develop a continuing professional development toolkit for building a life-long learning culture and infrastructure from undergraduate to all career levels of practitioners. FIP will also support raising awareness of students, faculty members and leadership of the benefits of including continuing professional development as a part of undergraduate curricula, supported with country case studies across all other regions.

3.2.5. Western Pacific region

The first objective linked with patient safety (FIP DG 19) is to incorporate patient safety competencies into initial and continuous education curricula as well as develop an advanced and specialist patient safety program. This action will be addressed through the UNITWIN Centre for Excellence for the Western Pacific region issuing a "Call to action on patient safety in pharmacy and pharmaceutical sciences education" for policy makers. In addition, existing tools in the region (e.g., as in Australia) will be adopted and adapted to ensure patient safety becomes an outcome of pharmaceutical education and training programs.

The second objective is to establish an intra-regional faculty exchange program for capacity building and knowledge sharing (FIP DG 1). This will be achieved by creating a regional working group consisting of leading institutions, through the UNITWIN Centre for Excellence for the Western Pacific region, to spearhead intra-regional faculty and student exchanges, to collate case studies of successful exchanges from initiation to outcomes, and to support development of institutional strategies and actions to secure seed funding to support these research initiatives.

The third objective is to adopt and adapt existing global or national frameworks (from other countries) for early career and/or advanced and specialist development (FIP DG 4). This objective will be addressed through creating a repository of existing early career/foundational, advanced and specialist development frameworks in the region and organizing a regional needs-assessment workshop to build capacity for regional adoption and adaptation of existing regional and FIP frameworks.

3.2.6. African region

The roadmap for the African region focused on the process required for setting up the Africa-wide association of pharmacy school for the engagement and advancement of pharmaceutical education.[22] The action plan of establishing the association acts as a preliminary roadmap to deliver prioritized FIP DGs The association, once established, will be tasked to develop a detailed roadmap for each of the FIP DGs. Building on the pioneer UNITWIN Centre for Excellence, the activities of this association will advance pharmacy profession in the region, especially in the context of DG 3 (Quality assurance), DG 1 (Academic capacity), DG 8 (Working with others), DG 18 (Access to medicines, devices, and services) and DG 4 (Advanced and specialist development).

3.3. Findings from a global stakeholders' engagement on the regional roadmaps and a global call to action on pharmaceutical education

After completion of the six regional workshops, a compilation and triangulation of all of them was performed, aligned with the FIP DGs, to build a global policy call to action for pharmaceutical education. A global summit was held for the purpose of consolidating the regional roadmaps and launching the policy call to action on pharmaceutical education. At this summit, a stakeholder engagement activity was carried out regarding all roadmaps, except that of the African region, in the context of willingness to reflect on the roadmaps and implement the roadmaps in their institutions/countries. Africa was purposely excluded from this global stakeholders' engagement on the regional roadmaps because the region had the pioneer UNITWIN Centre for Excellence. See Section 3.2.6 for more details.

Fig. 2 shows participants' willingness to reflect on their region's roadmaps in their future plans. The results from stakeholders' engagements show that the roadmaps developed were widely accepted by most regional stakeholders (>50%) for the purpose of revisiting their academic institutions' plans, except in the Americas region.

Fig. 3 shows participants' perceptions about the relationship between implementing the roadmaps and a positive impact of advancing pharmaceutical education in their region. Overall, >70% of participants from all regions agreed that implementation of these roadmaps will have a positive impact on the region's pharmaceutical education advancement.

4. Discussion

The regional needs identification process yielded distinctive findings across the six WHO regions. For instance, the South-East Asian and Western Pacific regions have a strong research focus in the pharmaceutical sciences, including herbal medicines. The North America and Eastern Mediterranean regions do well in needs-based education and experiential learning as part of their pharmacy programs.

Studies have shown the value of needs-based education,[23] however despite globalization and futuristic advancements, needs-based education requirements of each country should always be kept in context with a focus on what would be best for patients.[24] Experiential learning is a fundamental element in pharmacy education which uses practice-based experiences to provide direct contact with patients and training opportunities in real conditions.[25,26]

Weaknesses identified from the SWOT analyses showed that building and enabling interprofessional education to facilitate development of collaboration and working with other members of the healthcare team is an area for improvement across Africa, Eastern Mediterranean, Europe, and Central and South America. Collaborative practice is critically important for the delivery of quality healthcare services, including pharmaceutical services.[27] It requires local as well as high-level policy interventions to incorporate interprofessional education and training into education systems. Building competencies of the workforce through adoption of competency-based education, competency frameworks and mapping are also areas for improvement for the regions especially the Eastern Mediterranean and South and Central Americas. Inadequate recognition of pharmacists is one factor that threatens pharmaceutical education. Many health systems in developing countries do not recognize pharmacists as part of the integrated healthcare team. Inadequate policies to enable pharmacists to deliver these services as well as uneven distribution of workforce also hinders delivery and implementation of services.

An intra-regional collaboration between the North American and South and Central American sub-regions is an opportunity to advance development of pharmaceutical education in the whole Americas region. In this region, there can be short-term exchange programs between universities for collaboration on increasing academic capacity. Also, continuing professional development components, including activities such as conducting research and consulting with colleagues, would be beneficial.

For the Eastern Mediterranean region, incorporating international or intercultural aspects into the teaching, research and service functions of the pharmacy institutions would be helpful. For the region's early career and

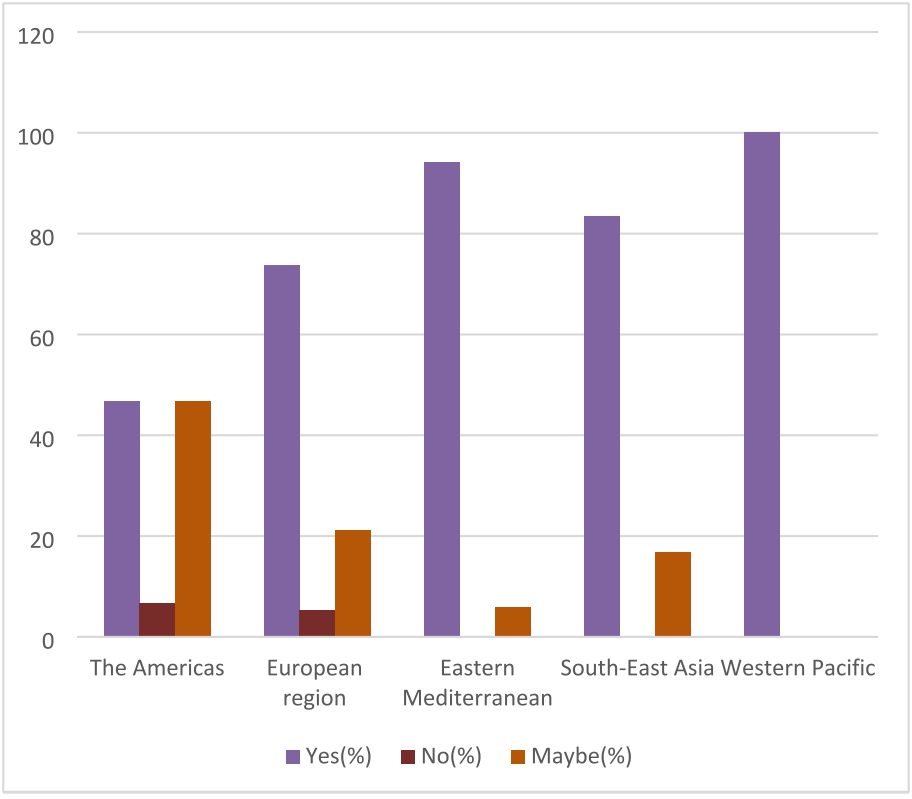


Fig. 2. Willingness of stakeholders to reflect their region's roadmaps in their institutions or country's future plans.

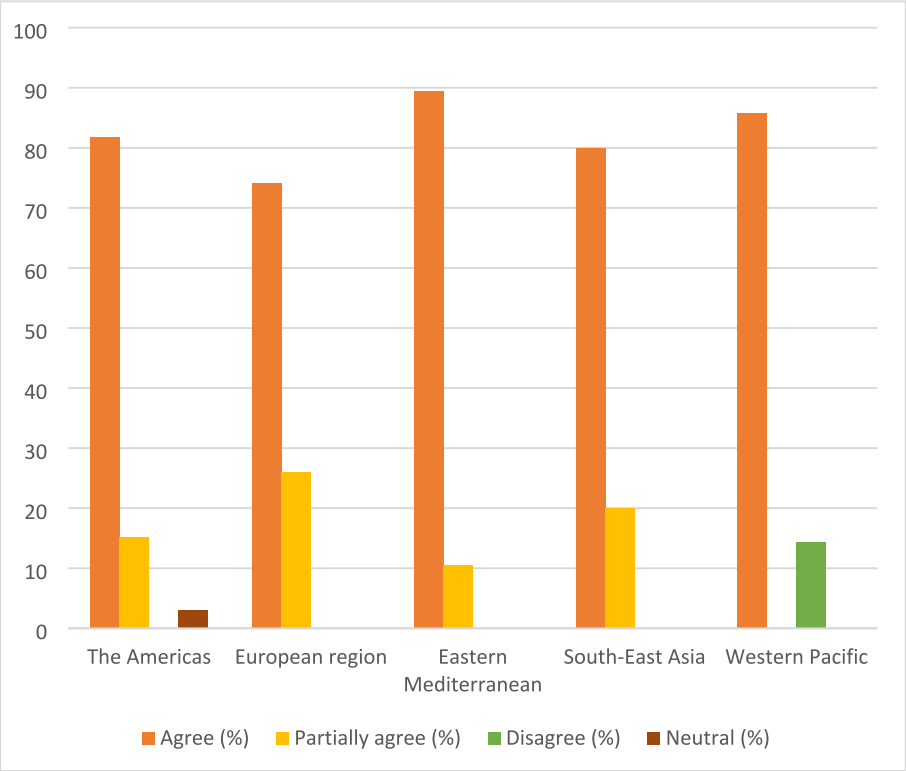


Fig. 3. Anticipated implementation of regional roadmaps and its positive impact on pharmaceutical education.

advanced specialist development, different services such as extracurricular programs to include an international and intercultural dimension can be considered. Based on the European region's SWOT analysis, support for global collaboration and technological innovations, and innovative virtual exchange programs to connect students and faculties with international counterparts are suggested.

Increasing intra-regional collaboration, promoting interprofessional education and integrating activities with students from universities in different countries can support the South-East Asian region's priorities for pharmacy practice education as well as the Western Pacific priorities on patient safety education. For the African region, student and faculty exchanges at national and international levels would support leadership development and capacity building. A Collaborative Online International Learning (COIL) based methodology[28] is advised across all regions.

Focusing on FIP DGs prioritization for action, among the 21 FIP DGs, 11 were identified as priorities for action to improve education in different regions (Table 8). Among those, academic capacity (DG 1) was identified as a priority in four regions of which having a competent and capable pharmacy workforce depends on the capacity of the academic workforce to teach and train.[29] Academic capacity (DG 1) is crucial to prepare a competent pharmaceutical workforce and capacity building of faculty members is requisite for a solution to the current yearning to meet the demand for change in practice and align with the global shift in professional practice from product-based to patient-centred.

The issue of academic capacity needs to be addressed nationally, regionally, and globally through collaboration, policy interventions, equitable resource allocation and quality standards.[30] Improving academic capacity is a priority across four WHO regions and academic exchanges are an essential strategy to build such capacity. Findings from Japan showed that, through collaboration, academic capacity was increased while Algeria showed that advocacy initiatives for the establishment of a stand-alone faculty of pharmacy can improve academic capacity.[30]

Promoting competency development (FIP DG 5) through regional and advanced competency frameworks will help pharmacists to develop their professional practice and careers in line with national and international requirements. For example, from Malta's perspective, this goal is a foundation for enabling practitioners to perform specialized professional services within their area of competence.[30] Development and implementation of a competency framework and mapping of pharmacy curriculum with delineated learning outcomes are essential to prepare future pharmacists to deal with complex and emerging health conditions, such as the COVID-19 pandemic.

Developing a competency framework for expanding the scope of practice across all regions, as necessitated by a region's priority, is essential to train competent pharmacists who are prepared for the future. The FIP Global Advanced Development Framework identifies three broad-based advanced practice stages across developmental competencies. It includes managing health and professional delivery services and people, training, and mentoring, and developing evaluation skills and innovation in health service provision. Adopting this framework through implementation of appropriate policies would further enhance the potential of pharmacists in all regions.[31]

Promoting continuing professional development (FIP DG 9) will also facilitate competency-based systems of education. This will promote a culture of life-long learning at the undergraduate level and throughout the career pathway which would result in self-learners and a qualified pharmacy workforce that will take its natural position within the healthcare team. Leadership development is a necessity as it is a crucial factor in improving management and performance of institutions. View leadership development as a lifelong learning process,[32] incorporating it into every individual's or institution's continuing professional development plans will facilitate a continuous supply of skilled leaders in the academic community, now and in the future.

The UNITWIN regional roadmaps for the six WHO regions have provided action plans for taking intentional steps to transform the pharmaceutical education practices and processes for all regions in the context of the FIP DGs. The results from stakeholders' engagements show that the roadmaps developed were widely accepted by most regional stakeholders (>50%) for the purpose of revisiting their academic institutions' plans, except in the Americas region. Likewise, most region's stakeholders (>70%)

perceived that implementing the actions in the roadmap will have a positive impact on advancing pharmaceutical education in their region. This is valuable for transformation of pharmaceutical education in each region of the world.

The regional roadmaps developed through this study showed that the measures identified urgently need to be actioned to advance pharmaceutical science and practice through transforming pharmaceutical education at all levels. By bringing academic institutions, professional organizations, policy makers and key pharmaceutical stakeholders around the world within each of the regional UNITWIN centres for excellence, FIP will facilitate the implementation of these regional roadmaps, address identified needs and work towards identified priorities through collaborations within and between all regions. The evidence from this study showed that there is no "one size fits all" approach, while recognizing the fact that it is essential to form alliances because learnings can be adapted and adopted among regions and countries.

FIP can capitalize on its unique global network of academic institutions, professional organizations, policy makers and key pharmaceutical stakeholders through the global call to action for advancing pharmaceutical education.[33] Alliances formed through the UNITWIN centres for excellence will ensure regional and country level ownership and dissemination of the roadmaps, with impact and progress towards the achievement of UN SDGs through the FIP DGs by 2030.

Some limitations to this study could be potential bias from researchers (especially during the triangulation of SWOT analysis insights and FIP DGs priorities to create regional roadmap objectives) and cultural barriers (especially potential errors during the translation exercise). There are also limitations due to self-selection and issues with generalizability. Another limitation could be the purposeful exclusion of the African region from some outcomes of this study due to the region being the pioneer centre for excellence.

Further studies need to investigate the progress of the implementation of the roadmaps and the FIP call to action for advancing pharmaceutical education towards 2030 and ensure the validity of each roadmap based on emerging needs and priorities in the regions. Additional research may be required after reaching out to countries that are not represented within FIP's network.

5. Conclusions

Transforming pharmaceutical education is essential for the provision of a quality, flexible and adaptable pharmaceutical workforce that can deliver sustainable pharmaceutical services that will facilitate the achievement of UHC. Evidence-based policies developed through a needs-based approach facilitates understanding of every region's context and progresses a transformation through partnerships and collaboration. FIP's regional roadmaps and global call to action on advancing pharmaceutical education are key resources for countries across all regions to realize their pharmaceutical workforce development aspirations. It is critical for each country and region to adopt and adapt these evidence- and needs-based roadmaps into their own contexts and to prioritize progressing towards them in the mission to support global health and provide essential healthcare services to patients and communities. FIP's mission is to support global health by enabling the advancement of pharmaceutical education, alongside practice and sciences. To deliver its mission, through the UNITWIN program, FIP is fully committed to address diverse needs and priorities, leaving no country or region behind.

CRediT authorship contribution statement

Alison Etukakpan: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Visualization. **Nilhan Uzman:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Project administration. **Ozge Ozer:** Conceptualization, Writing – original draft. **Toyin Tofade:** Investigation, Writing – review & editing. **Silvana Nair Leite:** Investigation, Writing – review & editing. **Arinola Joda:** Investigation, Writing – review & editing. **Yahya Choonara:** Investigation, Writing – review & editing. **Chiluba Mwila:** Investigation, Writing – review & editing. **Lilian M. Azzopardi:** Investigation, Writing – review & editing. **Aukje K. Mantel-Teeuwisse:** Investigation, Writing – review & editing. **Mohammad Rahal:** Investigation, Writing – review & editing. **Rula Darwish:** Investigation, Writing – review & editing. **Beom-Jin Lee:** Investigation, Writing – review & editing. **Rajani Shakya:** Investigation, Writing – review & editing. **Paul J. Gallagher:** Investigation, Writing – review & editing. **Pierre Moreau:** Writing – review & editing. **Luis Lourenço:** Writing – review & editing. **Ross A. McKinnon:** Writing – review & editing. **Ralph J. Altiere:** Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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