The FIP vaccination reference guide

Knowledge and skills to support professional development and inform pharmacy education in vaccination

2022

1 ACADEMIC CAPACITY

9 CONTINUING PROFESSIONAL DEVELOPMENT STRATEGIES

16 COMMUNICABLE DISEASES

fip International Pharmaceutical Federation

Colophon

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Contents

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Executive summary

Pharmacists in many parts of the world play key roles in public health, including vaccination-related services. As established advocates, educators and qualified providers of vaccines, pharmacists have a significant role in promoting and supporting the uptake and monitoring of vaccination. Their roles include raising awareness of the benefits of vaccination and improving immunisation coverage. To successfully deliver these important roles, pharmacists need to obtain the required knowledge and skills in the area of vaccination.

"FIP vaccination reference guide: Knowledge and skills in pharmacy education and professional development" is developed by FIP for educators and academic institutions, practitioners and professional organisations, and policymakers. The reference guide outlines the knowledge and skills that should be acquired by students during their undergraduate pharmacy education, and expands into the knowledge and skills that should be obtained by pharmacists through professional development and training.

The undergraduate pharmacy education chapter describes knowledge and skills requirements to equip undergraduate pharmacy students to become vaccine-ready pharmacists upon graduation or registration. We provide country examples to guide readers on existing programmes, and this chapter can be used by educators and academic institutions to develop undergraduate pharmacy curricula on vaccination or to improve their existing curricula.

- In order for pharmacists to be vaccine-ready upon graduation and registration, their undergraduate education and training should include basic and tailored content. This should be based on emerging needs of patients, practice and the profession within the country.
- In countries where vaccination by pharmacists is not supported, it is still important to prepare and future-proof pharmacists because vaccination and related services go beyond just vaccines administration as pharmacists have a mandatory public health role. This is regardless of the countries' regulations on allowing pharmacists to administer vaccines.
- Not all existing undergraduate pharmacy education programmes cover all the required knowledge and skills for pharmacists in vaccination. There is a room for development in existing undergraduate pharmacy education programmes on vaccination to provide the following knowledge and skills to pharmacy students: vaccine supply; policies; regulations; guidelines about vaccines; multidisciplinary patient-centred care; and ethical practice.
- The knowledge and skills required for a pharmacist at graduation or registration are described, as are existing undergraduate pharmacy education programmes on vaccination. These have varied educational methods, settings, timings and content to provide knowledge and skills.
- A programme-based approach or specialisation in undergraduate education about vaccination and immunisation, with experiential and hands-on approach, could increase the knowledge and skills of pharmacy graduates.

The continuing professional development (CPD) chapter is designed to provide a point of reference to the competencies in the FIP global competency framework related to pharmaceutical care and public health. These competencies are expected to be acquired and maintained by pharmacists so that they can effectively fulfil their vaccination-related roles.

The chapter covers the knowledge required by pharmacists in this area and the associated skills. We also suggest learning outcomes for CPD courses in vaccination for CPD providers and pharmacists.

Finally, CPD providers and pharmacists can use the tables on knowledge and skills as a guide for course development and self-learning.

- Across various areas of practice, pharmacists are well-positioned in communities and healthcare teams to provide vaccination-related services and interventions based on scopes of practice and regulatory permissions to support patients.

- Pharmacists are expected to acquire and maintain competencies by practising continuing professional development (CPD). Building on the need to maintain competence in areas relevant to a pharmacist's area of practice, their knowledge and skills must also be acquired and updated to advance competence.
- Knowledge and skills in the area of vaccination for pharmacists are described chapter 5. These have been based on existing FIP resources, international guidance and expert input. Knowledge and skills encompass pharmacist-led interventions and roles from advocacy, health promotion, vaccine administration and monitoring for adverse effects.
- This vaccination reference guide is intended to support practising pharmacists, CPD providers, educators, and trainers supporting CPD design and delivery. It outlines knowledge areas, common skills, techniques, and procedures in vaccination, and potential learning outcomes from programmes and courses on vaccination.
- Considerations are shared to support the development and implementation of training, guidelines and transformative CPD programmes that are focused on improving the competence and capacity of pharmacists in the area of vaccination.

1 Introduction

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Pharmacists in many countries have played a key role in administering vaccines for several years. In Argentina, vaccine administration has been part of pharmacists' scope of practice since 1983. Since then, this role has been introduced in at least 40 countries around the world, establishing a consolidated trend that has steadily accelerated in the past decade.[1] However, in addition to vaccine administration, pharmacists have played a variety of roles that have contributed to increasing awareness and understanding of the benefits of vaccination among the population, and particularly for at-risk population groups. They have ensured appropriate vaccine logistics and supply, and have, through relationships of trust, built confidence in vaccines by fighting misinformation and providing evidence-based advice.

Through these roles, pharmacists have contributed to achieving higher vaccination coverage rates across all ages and population groups, leading to healthier communities and more resilient health systems.

The workforce and education elements of FIP Development Goal (DG)16 (Communicable diseases) state that globally we must have education and training infrastructures in place to develop a workforce prepared to deliver quality services around communicable and vector-borne diseases.

The FIP Transforming Vaccination (TV) programmes in 2020 and 2021 identified workforce and education mechanisms to implement DG 16 in the context of vaccinations. The TV programme identified the following two key mechanisms to transform vaccination via DG 16:

1. Ensuring adequate education and training for the effective performance of vaccine delivery and related roles as part of foundation and early career training of the pharmaceutical workforce (FIP DG 2) as well as in postgraduate and CPD pathways (FIP DGs 4 and 9 workforce elements).
2. Identifying competencies for vaccination delivery and related roles as part of undergraduate education and/or CPD pathways whenever the regulatory frameworks for pharmacists' scope of practice support the delivery of these services (FIP DGs 5 and 7 workforce elements).

In summary these two priorities were identified:

1. A focus on initial and postgraduate education and training — preparing the future workforce for providing vaccination services upon registration; and
2. A focus on the current active workforce — comprehensive CPD and upgrade for preventive health care, particularly for life-course immunisation against vaccine-preventable diseases.

Currently, there is variation across vaccination training programmes in terms of content, length, scope and regulatory or mandatory aspects.

This reference guide will be available for all nations and FIP members, for pre- and post-registration education and training for vaccination delivery and related services. This will directly support FIP members, including, but not limited to, national pharmacy organisations and academic institutions, in developing and delivering education and training for routine vaccination service delivery.

The imminent launch of the World Health Organization's "Global competencies for universal health coverage" will provide guidance on immunisation and vaccination services. The key knowledge and skills will map directly to both FIP competency frameworks, including the FIP Global Competency Framework and the FIP Advanced Competency Framework, to directly support national training programmes.

The evidence generated at the TV 2020 & 2021 programmes, and existing FIP resources (e.g., webinars, toolkits) on immunisation and vaccination services is cross-referenced in this reference guide and has informed its development. This publication also builds on the recently published "FIP vaccination handbook for

pharmacists: Procedures, safety aspects, common risk points and frequent questions" and "Building vaccine confidence and communicating vaccine value — A toolkit for pharmacists", both from 2021, which outline the various roles pharmacists play that contribute towards improving vaccination coverage rates and access to vaccination services across all ages and population groups.

The aim of this publication is this to provide a reference guide that outlines the elements of education and training, at all levels, for pharmaceutical workforce development to provide vaccination-related services, and to share examples of useful and relevant resources in the context of education, training and workforce development.

Specific objectives of this resource include:

1. To describe knowledge and skills requirements to equip pharmacy students in undergraduate and post-graduate education for providing vaccination-related services; and
2. To identify criteria for vaccination training providers, ensuring quality immunisation and vaccination training programmes.

2 Pharmacists' vaccination-related roles

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Pharmacy is an evolving profession, changing to meet the needs of patients, communities and health care systems. In particular, pharmacists are playing an increasingly bigger role in primary healthcare and public health, through disease prevention, screening and referral, and treatment optimisation. In recent decades, pharmacists' roles related to vaccination have also expanded around the world, with at least 36 countries having regulated pharmacy-based vaccination by 2020, in a consolidated trend at global level.[1] Since then some other countries have introduced pharmacy-based vaccination, which makes it at least 40 countries available for pharmacy vaccination.[1]

With adequate training, pharmacists are competent to perform a series of roles that contribute to improving vaccination coverage rates, from providing evidence-based advice on vaccines, to ensuring the supply and proper storage of vaccines, and from administering vaccines to managing vaccination records, as described in FIP's 2021 publication "FIP Vaccination handbook for pharmacists".[2] Beyond contributing to accessibility, pharmacists also facilitate the reduction of inequity in immunisation by reaching out to isolated individuals and populations and promoting vaccination across all ages and population groups.[3]

Chapter 2 describes the key roles that pharmacists play in relation to vaccination. For further details, see the above-mentioned handbook.

2.1 Advocating vaccination

As advocates of vaccination, pharmacists actively raise awareness about vaccines in the communities they serve and emphasise the benefits of vaccination for specific population groups.

According to a 2020 FIP survey, 70% of respondents confirmed that pharmacists in their country or territory play an active role in educating the population on diseases that are preventable through vaccines as well as advocating vaccination.[4] Pharmacists have the knowledge and expertise to recognise when a person belongs to a specific at-risk population group, such as older adults, people living with non-communicable diseases, patients on immunosuppression or pregnant persons. In these cases, pharmacists can be vigilant about suggesting vaccines to these individuals to make sure that they receive the vaccines that they need.

According to the same survey, 92.5% of pharmacists who responded claimed that they are involved in at least one type of awareness-raising or advocacy activity in relation to vaccination.[4] This is a common role by pharmacists even in countries where they are not yet legally authorised to administer vaccines.

Pharmacists can also advocate to legislators to allow them to become authorised to administer vaccines or to ensure adequate reimbursement for vaccine services. Pharmacists must work collaboratively to recommend responsibilities that benefit patients, expanding the profession's scope of practice and impact on the community.

Another area of advocacy is through mass vaccine events, such as participating in vaccination clinics organised by local health departments, collaborating on vaccine promotional campaigns, and speaking at public events to highlight and emphasise the importance of getting vaccinated. All these activities lead to an increase in public awareness of vaccine benefits as well as expand the pharmacist's impact beyond the walls of the pharmacy.

2.2 Building vaccine confidence

Vaccine hesitancy, i.e., the concerns related to vaccination or outright refusal to receive vaccines despite their availability, is a major threat to global health and an important barrier to the success of vaccination strategies

worldwide. Vaccine hesitancy results from misinformation and distrust in vaccines and it can compromise not only the health of individuals but also public health as a whole.

Pharmacists' accessibility and frequent contacts with patients provide precious opportunities to engage in meaningful conversations and tackle vaccines hesitancy, to unlock possible fears of vaccines and provide clear and evidence-based messages to support vaccine uptake. They can correct misconceptions people may have about vaccines, offer alternative vaccine types or manufacturers where necessary, address concerns from specific faith groups, and explain the risks of not getting vaccinated.[5] It is vital to leverage this unique position of pharmacists, and the trust bestowed upon them by communities, to play an active role in building vaccine confidence.

2.3 Managing the vaccine supply chain

Pharmacists play a significant role in providing access to vaccines, managing stock, and assuring vaccine efficacy and safety through appropriate cold chain management — and they can have an impact in this space. Establishing and complying with technical conditions related to conservation and preservation of vaccines is a major facet of a pharmacist's role in the management of vaccines. Pharmacists are knowledgeable about the vaccine supply chain and storage requirements. This allows for vaccines to be safely stored and their quality maintained. Pharmacists can monitor the movement of vaccines from the manufacturing site to the end user. Pharmacies also have the necessary equipment to allow for the proper storage and monitoring of vaccines to ensure vaccine stability and efficacy.

Pharmacists can participate in a needs analysis regarding provision and assignment of financial resources based on vaccination objectives and priorities.[3] Participating in the acquisition of vaccines allows pharmacists to make sure that they come from reliable and recognised quality sources.

Pharmacists must also understand the consequences of mishandling vaccines and know what routes to take if any mismanagement occurs in any step of the supply chain process.[6] With the ability to comprehend scientific literature, pharmacists can obtain the information they need to understand the nuances of vaccine viability, stability and expiration.

In a 2020 FIP survey, 91% of respondents reported that the most common requirement for vaccine administration is the proper storage and conservation of vaccines in the pharmacy.[4]

2.4 Keeping vaccination records and counselling on vaccination status

Allowing pharmacist access to vaccine records enables them to advise patients about the vaccines they could benefit from according to their age or clinical situation. It also allows pharmacists to register the vaccines they administer when supported by appropriate regulatory frameworks. It is important for any healthcare provider to have proper access to vaccine records so that patients can be advised appropriately, take measures to provide the patient with a vaccine, or refer the patient to another provider.

Alternatively, pharmacists can identify potential gaps in vaccination based on the medicines a patient is taking, especially for chronic conditions, or on the information they gather from the patient. Recommending vaccines is not the only part of the process of counselling patients. Pharmacists have the knowledge to recommend against certain vaccines based on patient-specific contraindications. Ultimately, the pharmacist can refer these patients to a physician for evaluation.

By making use of appropriate technologies, pharmacists are now able to counsel patients through phone calls, video conferences, email, or other means.[5] The increased accessibility to a pharmacist's expertise is important for patients who have mobility restrictions. Pharmacists also have the ability to develop systems to remind patients to get vaccines when these become overdue.

In FIP's 2020 survey cited above, 67% of respondents reported that pharmacists do not have access to vaccine records.[4] Advocacy to grant the authority to use these vaccine records by pharmacists should be a top concern.

The same survey concluded that 7% of respondents reported that they participate in assessing patients' vaccination status and sending reminders as well as identifying high-risk patient groups.[4]

2.5 Performing vaccine safety surveillance

Pharmacovigilance is a key role for pharmacists. Likewise, reporting on events that may have occurred as a result of vaccinations to the national or regional authorities, and following up on these, is an important task for pharmacists to ensure proper monitoring of vaccine safety.[2]

Medication errors should be properly reported and analysed. These errors could be any mistake in the prescription, indication, dispensing or administration of vaccines. It is the responsibility of the pharmacist to report, monitor and follow up on vaccination-related errors, whether or not the error was caused by them.

2.6 Dispensing vaccines

Pharmacists can be involved indirectly in the vaccination process by dispensing a vaccine to a patient for it to be administered by a nurse or physician. Pharmacies have the necessary equipment to store vaccines safely whereas, in some settings, physicians' or nurses' offices might not. Providing this service may ensure vaccine availability, quality and safety. A pharmacy can keep a stock of vaccines available for the community based on epidemiological needs.[5]

2.7 Prescribing vaccines

When clear eligibility criteria and protocols are available in each jurisdiction for each vaccine, pharmacists should be able to assess and identify eligible individuals and prescribe the appropriate vaccines for them. The legal requirement for a medical prescription for certain vaccines may result in a more complex and cumbersome process that may deter some people from getting vaccinated.

The FIP 2020 survey found that only 12% of respondents reported that pharmacists are authorised to prescribe vaccines and 21% of respondents reported that pharmacists can prescribe some vaccines.[4] The inability of pharmacists to prescribe vaccines hinders their ability to improve vaccine coverage and help high-risk groups get recommended vaccinations.

2.8 Administering vaccines

In some countries pharmacists are allowed to administer vaccines, inside or outside of the pharmacy premises. Vaccine administration requires proper training and licensure to ensure the quality of this professional service. Pharmacists can offer immediate support to patients seeking vaccination because most pharmacies do not require an appointment in order to administer vaccines. Pharmacies are often open on evenings, holidays and weekends, thus providing greater convenience for getting a vaccine on-demand rather than having to make an appointment.

Appropriate actions to be performed by pharmacists or other pharmacy workforce members in vaccine administration can be divided into pre-administration, administration and post-administration phases.

The pre-administration phase starts in the dispensing area, when interacting with an individual and acknowledging their intention to be vaccinated. Then follows the evaluation of the patient's eligibility and need to receive a specific vaccine (including administrative criteria and clinical criteria, such as verifying that there are no contraindications), the registration of the vaccination in the appropriate registry, hand hygiene, and the preparation of the materials, which should take place in a separate and private room in the pharmacy. The pharmacist also needs to explain any potential adverse events to the patient before starting the administration phase.

Before administering a vaccine, pharmacists must be aware of the appropriate administration route for each vaccine and be familiar with the administration technique. The route of administration of vaccines is

determined during the pre-approval phase, and is based on their composition and immunogenicity. Vaccines should be administered at sites where they induce an adequate immune response and where the possibility of injury (local, neurological or vascular) is minimal. To avoid local or systemic adverse reactions and to ensure an adequate immune response, manufacturers' recommendations for administration, including those regarding the anatomical site, should be followed.[7]

Post-administration, pharmacists play an important role in monitoring patients after they receive a vaccine. Patient, in most cases, are asked to wait for a period of time on-site after getting a vaccine in order to be monitored for any potential negative side effects, including anaphylaxis. If a patient has a negative reaction to a vaccine, the pharmacist must know how to manage it properly and arrange for the patient to receive proper care.

Pharmacists also need to know how to properly dispose of waste products related to the administration of vaccines. Waste management is crucial to know because a lot of the waste products from vaccine administration is biohazardous. Management of hazardous materials and waste was reported by 76% of respondents in the 2020 FIP survey, showing that a large majority of pharmacists are involved in the proper disposal of vaccine waste products.[4]

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3 Enabling our workforce to deliver vaccination-related services

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Chapter 2 described the key roles that pharmacists play in relation to vaccination. In order to deliver vaccination-related services and the various roles that that entails, we must transform and enable our workforce to evolve and expand into those roles. Chapter 3 describes key workforce policy enablers that have been identified as key to vaccination service provision and workforce participation.

The development of pharmacists' knowledge and skills (and continuing education) relies entirely on workforce participation, and workforce participation is dependent upon policy enablement. National as well as regional pharmacy leadership bodies, pharmacy practitioners and policy-makers can take note of those enablers identified by FIP in order to progress the agenda of pharmacy-led vaccination services through legislation change and advocacy on a local level.

3.1 Identifying policy enablers for workforce qualification and participation

The FIP TV programmes recognised that workforce enablement and incorporating vaccination qualifications into pharmacist workforce education — both undergraduate and continuing development — are needed to ensure all pharmacists in all settings are capable of delivering vaccines as a standard part of pharmacy practice. This was the focus of the 2020 programme, which brought together workforce and education experts to outline key priorities, supplemented by policy enablers that were mapped to the 21 FIP DGs.

The TV programme was the first digital transformation series to use the FIP DGs to unify vaccination in pharmacy across the entire profession. The TV programme discussed mechanisms and drivers to progress the most relevant DGs in the context of transforming vaccination in pharmacy. These were identified across the three elements of practice, science and workforce and education across all the goals.

Table 1 summarises key policy enablers for workforce and education across the FIP DGs that can support the transformation of vaccination in pharmacy and can serve as an action plan that could be adopted and adapted by regions and countries worldwide.

Table 1. Summary of the key policy enablers for workforce and education to transform vaccination

FIP Development Goal	Workforce and education policy enabler to transform vaccination
	Engagement with pharmaceutical higher education development policies and ready access to leaders in all sectors of pharmacy practice and pharmaceutical science, in order to support supply-side workforce development in the areas vaccination training and service delivery
	Foundation training infrastructures in place for the early post-registration (post-licensing) years of the pharmaceutical workforce as a basis for consolidating initial vaccination education and training, and progressing the workforce towards qualification in vaccination service delivery

FIP Development Goal	Workforce and education policy enabler to transform vaccination
	Transparent, contemporary and innovative processes for the quality assurance of needs-based education and training systems, service delivery, and maintaining competence in vaccination delivery by pharmacists
	Education and training infrastructures in place for the recognised advancement of the pharmaceutical workforce as a basis for enhancing competency of existing pharmacist workforce, in the area of vaccination delivery
	Clear and accessible developmental frameworks describing competencies and scope of practice for pharmacist vaccinators
	Strategies and programmes in place that develop professional leadership skills (including clinical and executive leadership) relevant to the delivery and promotion of vaccinations
	A patient-centred and integrated health services foundation for workforce development, relevant to social determinants of health and needs-based approaches to workforce development for the implementation of pharmacist-delivered vaccination services
	Clearly identifiable elements of collaborative working and interprofessional education and training in vaccination service delivery, development of programmes and policy development
	Existing workforce will be empowered to undertake professional development that results in the capacity of the pharmacist workforce to deliver vaccination services in all settings
	Clear strategies for addressing equity and diversity inequalities in pharmaceutical workforce development, continued education and training, and career progression opportunities in the areas of vaccination service delivery

FIP Development Goal	Workforce and education policy enabler to transform vaccination
	Evidence of the impact of the pharmaceutical workforce within health systems and health improvement in the delivery of vaccination services by pharmacists
	An international strategy and corresponding actions to collate and share workforce data and workforce planning activities that promotes the development and implementation of pharmacist-delivered vaccination services
	Clear and manageable strategies to develop the pharmaceutical workforce to implement pharmacist-delivered vaccination services and address regulatory and attitudinal barriers to pharmacist-delivered vaccination services
	Strategies and systems in place to prepare and train a workforce that can deliver expertise in vaccines and pharmacist-delivered vaccination services
	Strategies in place to develop pharmaceutical education and the workforce to support the delivery of people-centred care in practice, with particular focus on debunking misinformation and disinformation about vaccination
	Education and training infrastructures in place to develop a workforce prepared to deliver quality services around communicable and vector-borne diseases through the development of pharmacist-delivered vaccination services
	Strategies and systems in place to develop pharmacist-delivered vaccination services as a supportive process to delivering antimicrobial stewardship through the prevention or eradication of vaccine-preventable infections
	Strategies in place to widen access to vaccinations through pharmacist-delivered vaccination services, utilising a responsive, capable, available and well-distributed pharmaceutical workforce

FIP Development Goal	Workforce and education policy enabler to transform vaccination
	Workforce and education strategies linked to patient safety mechanism and reducing medication-related harm in practice and delivery of pharmacist-led vaccination services
	Enablers of digital transformation within health infrastructure being leveraged to assist the pharmacy workforce to implement effective processes for accessing and contributing to shared digital health records, assisting with the efficient utilisation of pharmacist-delivered vaccination services
	Strategies and systems in place that utilise the workforce to enhance sustainable pharmacist-delivered vaccination services

This reference guide inherently provides tools and resources that directly respond to some of the enablers in the table particularly for DG 1 (Academic capacity), DG 2 (Early career training strategy), DG 5 (Competency development) and DG 9 (Continuing professional development strategies).

FIP recognises the varying legal, political and governance structures across countries and regions and so these drivers and mechanisms can be adopted and adapted by pharmacy leaders, and aligned to local contexts and needs. FIP works with our members not only to identify their needs and barriers but also to discuss barriers to policy enablement and strategies to overcome them. These lessons, coupled with policy enablers, can provide a powerful mechanism to transform vaccination locally, regionally and globally.

4 Knowledge and skills reference guide to vaccination for undergraduate pharmacy education

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Background
Within Chapter 4, Table 2, Table 3 and Table 5 have built on existing FIP resources on vaccination to date, current learning and teaching tools, curricula and expert review through a reference group (see acknowledgments, p35). The reference group — made up of educators and practitioners with experience in education, training or professional development in vaccination — reviewed this chapter and agreed on the content.

Summary

- It is important that pharmacists are vaccination-ready upon graduation and registration, regardless of a country's regulations on allowing pharmacists to administer vaccines. Vaccination and related services go beyond vaccines administration as pharmacists have a mandatory public health role.
- Undergraduate vaccine education and training should be based on emerging needs of patients, practice and the profession within the country.
- The knowledge and skills required for a pharmacist from graduation or registration, as well as existing undergraduate pharmacy education programmes on vaccination, are described in Chapter 4. These have varied educational methods, settings, timings and content to provide knowledge and skills.
- Not all existing undergraduate pharmacy education programmes cover all the required knowledge and skills for pharmacists in vaccination. There is a room for improvement in existing undergraduate pharmacy education programmes on vaccination to provide the following knowledge and skills to pharmacy students: vaccine supply, policies/regulations/guidelines about vaccines, multidisciplinary patient-centred care and ethical practice.
- A programme-based approach or specialisation in undergraduate education about vaccination and immunisation, with an experiential and hands-on approach, would valuably increase the knowledge and skills of pharmacy graduates.

4.1 Introduction

Pharmacists are highly trusted health professionals who practise in all healthcare settings throughout the world, and are highly accessible across all our communities. Pharmacists, as healthcare professionals on the front lines of patient care, can play a key role in vaccination and increasing immunisation coverage, including in the development and regulatory approval of safe, quality and efficient vaccines, and the safe manufacture, supply and dispensing of vaccines. Pharmacists are patients' principal source of information about vaccination and play a key role in the acceptance of vaccines and the fight against vaccine hesitancy.[1,2]

These roles are all in line with pharmacists' public health responsibilities in the prevention and treatment of diseases. Yet the role of pharmacists in the delivery of vaccination services has been hampered by several factors, one of which is that undergraduate pharmacy degrees do not always include vaccination and immunisation as a core component of the qualification.[3] When pharmacists require supplementary training, they are less likely to offer vaccination or related services.[1,4–6] However, in terms of vaccine manufacture, supply and dispensing, education and training are still necessary in countries where vaccination is not delivered by pharmacists.

FIP called pharmacists, pharmaceutical academics, workforce planners and professional regulators to action for evolving undergraduate qualifications, workforce development, and professional regulations to ensure and maintain ongoing capacity (professionally and logistically) and competence by pharmacists in all settings to administer vaccines and provide vaccine-related services, ranging from supply to community education and awareness.[3]

The FIP DG 16 (Communicable diseases) workforce and education element states that globally we must have education and training infrastructures in place to develop a workforce prepared to deliver quality services around communicable and vector-borne diseases.[7]

The FIP TV programmes in 2020 and 2021 identified workforce and education mechanisms to implement DG 16 in the context of vaccination, immunisation and related pharmaceutical services. The TV programme identified two key mechanisms to transform vaccination via DG 16:

1. Ensure adequate education and training for the effective performance of vaccine manufacture, regulation, delivery and related roles as part of foundation and early career training of the pharmaceutical workforce as well as in postgraduate and CPD pathways.
2. Identify competencies for vaccine manufacture, regulation, delivery and related roles as part of undergraduate education and/or CPD pathways wherever the regulatory frameworks for pharmacists' scope of practice supports the delivery of these services — FIP DG 5 (Competency development) & FIP DG 7 (Advancing integrated services) workforce elements.

Chapter 4 focuses on initial pharmacy education and training to prepare "vaccine-ready" pharmacy graduates for providing vaccination, immunisation and related pharmaceutical services.

4.2 How to use this chapter

This knowledge and skills reference guide for undergraduate pharmacy education can be useful for:

- Developing the curriculum on vaccination for undergraduate pharmacy education;
- Supporting pharmacy schools in assessing their current curricula and making the case for integrating vaccination in their undergraduate pharmacy education curricula;
- Understanding areas of improvement in undergraduate pharmacy education for vaccination; and
- Learning about country examples in vaccination education and training in undergraduate pharmacy education.

Expectations from pharmacy students in vaccination education might be different from those graduate pharmacists who are undertaking CPD education. Therefore, the roles and services and required knowledge and skills are slightly different in Chapter 4.

4.3 Knowledge and skills requirements for vaccination in undergraduate education

FIP's extensive work to date on vaccination and immunization[8–10] outlines the roles and services that pharmacists provide, which can contribute towards improving vaccination coverage rates and access to vaccination services across all ages and population groups. These roles and services are:

- Advocacy;
- Patient education;
- Communication skills and teamwork;
- National vaccination schemes;
- Vaccine production, supply and storage;
- Vaccine regulations and policies;
- Vaccination records and facilitation of vaccination appointments;

- Vaccination administration;
- Patient follow-up; and
- Ethical practice.

As part of the pharmaceutical public health cluster in the FIP Global Competency Framework,[11] the health promotion competency of pharmacists is associated with behaviours to advise and provide services directly associated with public health provision, disease prevention and control (e.g., vaccination services provision), and healthy lifestyle advice.

Aligned with the identified roles and services, and the competency related to health promotion, knowledge that is relevant to undergraduate pharmacy education to prepare the ''vaccine-ready'' pharmaceutical workforce is outlined in Table 2.

Table 2. Knowledge guide for undergraduate vaccine education and training

Body systems	
Immune system	Demonstrates knowledge and understanding of:
Immunology	• The basic immunological concepts and mechanisms of the immune system in allergic reactions, autoimmune diseases and transplantation survival. • The different types of immunity (passive immunity and active immunity including natural immunity and vaccine-induced immunity). • Key terms (immunity, vaccine, vaccination, immunisation).
Vaccines	Demonstrates knowledge and understanding of:
Medicines: common vaccines	• All aspects of common vaccines, including: indications; mechanism of action; pharmacology; pharmacokinetics; pharmaceutical aspects; adverse effects, contraindications, precautions and interactions; usual doses and routes of administration; place in therapy; and monitoring requirements.
Medicines: anaphylaxis medicines	• All aspects of antihistamines, corticosteroids, bronchodilators, adrenergic agonists and vasoconstrictors, including: mechanism of action; pharmacology; pharmacokinetics; pharmaceutical aspects; adverse effects, contraindications and interactions; usual doses and routes of administration; place in therapy; and monitoring requirements.
Common vaccines	• The main types/groups of vaccines, including the differences between live and inactivated vaccines; childhood vaccinations; and being able to advise on the most appropriate vaccination regimens, protocols for supply and the precautions that need to be observed with respect to timing when administering more than one vaccine from the same group or different groups.
Vaccine-preventable diseases	Demonstrates knowledge and understanding of:
Aetiology, transmission and diseases	• Aetiology; toxin mechanism of action; types; risks; pathogenesis and virulence; clinical features; epidemiology; transmission; and diseases and complications caused by common vaccine-preventable diseases. • Common vaccine-preventable diseases, including: cholera, diphtheria, haemophilus influenza, hepatitis A and B, human papilloma virus, influenza, measles, meningococcal disease, mumps, pertussis, pneumococcal disease, poliomyelitis, rabies, rotavirus, rubella, tetanus, typhoid, varicella (chickenpox), zoster (shingles), yellow fever, some cancers, tuberculosis and malaria.
History of vaccines and vaccination	• The history of vaccines, and how vaccination has mitigated or eradicated many infectious diseases, e.g. smallpox.
Vaccine development	• The development, production and pharmaceutical regulation of vaccines.

Public health	• Local and national vaccination/immunisation schedules and regimens.
Vaccine use	Demonstrates knowledge and understanding of:
Timing and spacing of vaccines	• The differing actions of available vaccines and which vaccine is appropriate for the patient. • Timing and spacing of vaccines, including: the interval between doses of the same vaccines; and simultaneous and non-simultaneous vaccine administration.
Vaccine pharmacology	• Appropriate vaccine doses and dosage forms used to prevent disease. • Vaccine-drug interactions and corresponding warnings associated with their use. • Appropriate considerations for special population groups, e.g., pregnant persons, patients with co-morbidities, children etc. • The side effects associated with vaccines. • Vaccines additives that may trigger allergic reactions in susceptible patients. • Vaccine administration routes, i.e., oral, intranasal, subcutaneous, intramuscular, intradermal, and the corresponding appropriate administration techniques.
Patient screening	• The need for pre-screening and patient consent before receiving vaccination. • The need for patient counselling before vaccination.
Vaccine information	Demonstrates knowledge and understanding of:
Answering vaccine information enquiries	• Common information sources used when answering enquiries about immunisation programmes in the country, and health protection for persons travelling abroad, including their advantages and disadvantages. • Standard questions to ask to obtain the relevant background information when answering enquiries about immunisation programmes in the country and health protection for persons travelling abroad.
Vaccine production and supply	
Vaccine production	Demonstrates knowledge and understanding of:
Vaccines manufacturing and regulation	• Vaccine manufacturing and quality control processes. • Standardisation of starting materials, production and quality control testing to guarantee vaccine identity, purity, sterility, efficacy and safety. • The regulatory requirements of the entire manufacturing process from start to finish. • Vaccines formulation and active ingredient manufacturing. • Vaccines filling, packaging and lot release processes. • Good manufacturing practices for vaccines.
Vaccine storage and handling	Demonstrates knowledge and understanding of:
Vaccine cold chain	• The vaccine cold-chain and how it can affect vaccine efficacy.
Transport, storage and handling	• Stability of vaccines. • Vaccine delivery systems.
Administration	Demonstrates knowledge and understanding of:
Pre-administration phase	• The timing and spacing of vaccines. • Assessment of needed vaccines. • Consent before vaccination according to the requirements of the state, territory or region of practice • Pre-administration precautions. • Good pharmacy practice in the pharmacy, which includes having a vaccination specific place or room, a refrigerator specifically for vaccines, a temperature monitor, a portable refrigerator in case of power failure, an anaphylaxis response kit, an anaphylaxis management poster or guidance, a safety box, a medical waste bin, and materials for hand sanitisation and surface cleaning.

Administration phase	• Administration site recommendations for infants, toddlers, children, adolescents and adults. • Contraindications to vaccination and associated adverse events following vaccination. • The risks of complications when administering vaccines via specific routes. • Infection control during vaccine administration including aspects of: personal protective equipment; proper vaccine preparation to maintain integrity; vaccine inspection; and selection of supplies for administering vaccines. • Administration considerations for specific risk groups, including: barriers to access to vaccination; effectiveness of vaccines; and strategies to improve effectiveness. • Pain management during the vaccination procedure.
Post-administration phase	• Patient care after vaccine administration, including possible acute reactions and vasovagal episodes. • Common errors in the post-administration phase; errors that require revaccination. • Strategies to ensure safe vaccination, and how to report vaccine administration errors. • Correct handling of sharps and prevention of needle stick injuries. • Proper documentation and vaccination records, including electronic universal health records. • Creation and implementation of quality improvement programmes. • Patient follow-up strategies, such as the recall system, standing orders and automatic reminders.
Vaccine safety	Demonstrates knowledge and understanding of:
Adverse events following immunisation (AEFI)	• The types of adverse events and reactions following immunisation. • Assessment of causality. • Assessment and monitoring of vaccine safety. • Adverse drug reactions notifications to pharmacovigilance specialised authorities and vaccine safety programmes in ensuring vaccine safety.
Emergency management of AEFI	• Management of anaphylaxis and allergies. • First aid procedures and basic life support, including use of an automated external defibrillator.
Vaccination provider's role	• Ensuring safety and efficacy of vaccines, including benefit and risk communication, and managing adverse reactions after vaccination.
Patient/pharmaceutical care	
Special population groups	Demonstrates knowledge and understanding of:
Adults	• Vaccines needed by all adults regardless of whether they were received during childhood (e.g., hepatitis B, influenza, varicella, MMR, and DPT vaccines). • Changes in susceptibility to contracting vaccine-preventable diseases in adulthood. • Reminder/recall systems and standing orders in enhancing access to immunisation. • Methods of dealing with vaccine hesitancy.
Children	• All considerations for vaccination in children, including age, co-existing medical conditions or any higher risk (children with chronic heart or lung disease, immunosuppression or HIV infection and preterm babies are a high priority for immunisation.
Elderly	• The need for additional vaccines for people who are aged 65 years and older, including COVID-19, influenza, pneumococcal and zoster, and the scheduling regimen and frequency. • The possibility of reduced vaccine effectiveness and multimorbidity in the elderly. • The difference in vaccine adjuvants (composition) for the elderly. • Methods of dealing with vaccine hesitancy among the elderly.

Immunocompromised patients	• Contraindications and precautions for vaccines in immunocompromised patients (e.g., HIV/AIDS, chemotherapy, autoimmune disease, primary or secondary immune deficiency) and those with medical conditions that weaken the immune system (cancer, sickle cell disease) or on immunosuppressants, including steroids. • The reduced effectiveness of vaccines in immunocompromised patients, depending on the type of vaccine and the degree of immune dysfunction.
Immigrants	• Aspects related to the vaccination status of immigrants, for whom vaccination may be incomplete and documentation missing, and the need to begin catch-up vaccination in children.
Healthcare providers	• The need for healthcare providers to be vaccinated annually against influenza, be up-to-date with vaccines in national immunisation programmes to protect themselves and their patients. Other vaccines and booster doses include: tetanus toxoid, diphtheria toxoid, measles, mumps, rubella, varicella and hepatitis. • Methods of dealing with vaccine hesitancy.
Pregnant and lactating women	• Immunisation routinely recommended for women during pregnancy including inactivated trivalent influenza vaccine. • The need for women to receive all recommended vaccines that could not be or were not administered during pregnancy. • Valid contraindications and precautions for immunising pregnant women.
Travellers	• Immunisation requirements and recommendations for travellers.
Patient education	Demonstrates knowledge and understanding of:
Communication	• Sources and ways of dissemination of information on vaccination. • Vaccination myths and methods of dispelling such myths i.e., the ABC (acknowledge, bridge, communicate) framework.[12] • Communication skills to disseminate proper information about vaccination and vaccines.
System-based barriers	• System-based barriers to vaccination, including: missed opportunities; limited access to healthcare; low awareness on vaccines and their benefits; complicated adult immunisation schedules; and vaccine costs and reimbursement.
Vaccine hesitancy	• Reasons for vaccine hesitancy, including: safety concerns; efficacy concerns; moral or philosophical concerns; and misinformation. • Methods of addressing vaccine hesitancy, including: adjusting communication styles; communication content; and addressing and preventing misinformation. • Patient-focused strategies that improve patient confidence such as strong vaccination recommendations, taking time to answer questions, and adopting the SHARE (share, highlight, address, remind, explain) framework.[13] • Practice-focused strategies that are designed to overcome physical and psychological barriers.
Public health	Demonstrate knowledge and understanding of:
Advocacy	• Methods of advocacy relevant to the area of practice.
Health promotion	• Health promotion strategies through immunisation quality improvement projects. • Developing strategies to address public health needs and disease prevention. • Common public health strategies theories and critical appraisal strategies around public health.
Multidisciplinary care	Demonstrate knowledge and understanding of:
Patient-centred interactions and patient involvement	• The need for consistent patient education and counselling on vaccines and vaccination.

	• Culture and religion appropriate language when communicating with patients on vaccination. • The benefits of patient-centred interaction and involvement in improving healthcare intervention outcomes and building patient confidence.
Individualisation of vaccine therapy	• Vaccine therapy individualisation based on age, sex, patient history and immune state.
Professional development in an interdisciplinary approach	• The need for continuous education and professional development on vaccination. • Interdisciplinary efforts in improving immunisation coverage and building patient confidence and trust in vaccination.
Ethical practice	• Demonstrate knowledge and understanding of:
Pharmacy code of ethics	• How the pharmacy code of ethics applies to pharmacist-patient interactions, patient informed consent and access to patient data. • Ways to deal or interact with patients of varying health literacy levels.
Policies, regulations and guidelines	
Vaccine policies and regulations	• Demonstrate knowledge and understanding of:
Government-funded vaccination programmes	• Government-funded vaccination programmes in their area of practice.
Paediatric vaccination scheme/schedules	• Paediatric immunisation schedules as recommended by government health ministries or other national and international expert bodies, e.g., the World Health Organization. • Recommended minimal intervals between vaccine doses for children.
Geriatric vaccination scheme/schedules based on comorbidities	• Recommended geriatric vaccination schedules in the context of existing comorbidities such as cancer, chronic kidney disease, chronic liver disease, chronic kidney disease, heart conditions, dementia, and diabetes.
Mandatory vaccines	• Contexts where vaccination is mandatory as required by laws or government directives, e.g., before international travel.
Pharmacovigilance of vaccines in monitoring and management	• Pharmacovigilance and vaccine safety programmes in ensuring vaccine safety.

Aligned with the identified roles and services, and competency related to health promotion, skills that are relevant to undergraduate pharmacy education to prepare the "vaccine-ready" pharmaceutical workforce are described in Table 3.

Table 3. Suggested skills, techniques, quality assurance and procedures for undergraduate vaccine education and training

Vaccination-related role or service	Skills, techniques, quality assurance and procedures
Patient education	• Cordially welcomes patients, establishes rapport, and answers any questions they may have. • Provides an explanation of the vaccine and how it will be administered. • Adequately accommodates any language, literacy, cultural or religious barriers, including any special needs that the patient or carer may have to help them feel comfortable and informed about the procedure. • Verifies that the patient has received the vaccine information statements for indicated vaccines. • Conducts screening for contraindications. • Reviews comfort measures and provides after-care instructions to the patient, allowing for any questions.

Vaccination-related role or service	Skills, techniques, quality assurance and procedures
	• Uses the ABC framework to dispel vaccination myths. • Adopts the SHARE framework in tackling vaccine hesitancy.[13]
Advocacy	• Builds trust and confidence with the community and establishes the crucial nature of vaccines. • Applies health promotion and disease state management aspects in vaccination advocacy and education. • Addresses vaccination concerns and beliefs in a respectful manner and develops group-specific materials to address patients' concerns. • Participates in or conducts regular assessments of immunisation coverage rates in their area of practice.
Communication skills and teamwork	• Provides advice to immunisation committees and engages in multidisciplinary vaccination campaigns.
Vaccine administration	• Identifies the location of requisite medical protocols that may be useful to the vaccination process. • Identifies location of medicines useful in case of anaphylaxis, their administration techniques and situations where they would be necessary. • Maintains up-to-date first aid and cardiopulmonary resuscitation certification. • Reports sharps and needle stick injuries and maintains a sharps injury log. • Makes use of a sharps bin for used needles, syringes and vaccine containers. • Checks vial expiration dates before administration. • Monitors vaccine vial monitor thermochromic labels to ensure vaccine vials are kept in their safe temperature range. • Double checks vial labels and contents before drawing up. Visually inspects vaccine for any obvious defects. • Maintains aseptic techniques throughout the administration process. • Shakes vaccine vial or reconstitutes and mixes with diluent supplied. Also inverts vial and draws up the correct dose of vaccine (as applicable). • Labels each filled syringe or uses a labelled tray for ease of identification. • Handles vaccine properly, including protection from light where necessary, and adequately logs refrigerator temperatures. • Conducts appropriate client assessment before vaccination, including: health status; vaccine history; contraindications; and adverse event history. • Identifies and responds to unique immunisation needs of special population groups i.e., children, immunocompromised patients, elderly and pregnant or lactating persons. • Obtains appropriate consent from patients aged 18 years of age and over to receive the vaccine. For paediatric patients, appropriate consent has to be obtained from a parent or legal guardian. • Rechecks prescription/schedule against prepared syringes. • Washes hands and put on disposable gloves to maintain aseptic techniques. • Identifies the appropriate route of administration for each vaccine. • Positions patient and locates anatomical sites specific for the route of administration. • Prepares the administration site with alcohol wipes and allows the alcohol to dry. • Controls disinfected area with free hand and inserts needle quickly and straight into the skin. Aspires, and slowly injects content of the syringe into the skin before taking the needle out quickly and disposing of it in a sharps bin. • Properly disposes of vaccine vial. • Encourages comfort measures before, during and after the procedure. • Makes use of screening tools, such as questionnaires, to identify vaccination opportunities in patient populations. • Effectively communicates and works with other healthcare providers to promote vaccination uptake and immunisation coverage. • Works collaboratively with other healthcare professionals to improve outcomes for patients. This includes assessing and recommending appropriate vaccines, administering the vaccine, and reporting administered vaccine to primary care provider or vaccination recording systems.
Vaccination records and facilitation of vaccination appointments	• Fully documents each immunisation in patient chart, including date, lot number, manufacturer, site, date, and name or initials. • Uses computer to call up patient record, assess what is due, and update computer immunisation history. • Asks for and updates patient's record of immunisation and reminds them to bring it to each visit or access their electronic immunisation records. • Adequately uses reminder/recall systems where available for patient follow-up.
Patient follow-up	• Adequately handles adverse reactions to vaccines. • Identifies the cause of the most common adverse reactions post-administration.

Vaccination-related role or service	Skills, techniques, quality assurance and procedures
	• Reports any significant adverse effect to the national or regional pharmacovigilance unit. • Implements good pharmacy practice standards throughout the vaccination process
Ethical service provision	• Serves the healthcare needs of patients and contributes to efficient health systems while considering professional ethics as a guide to access and use of patient data.
Vaccine policies and regulations	• Facilitates or participates in national and global routine immunisation programmes and practices. • Contributes to research projects related to vaccines through data sharing, data collection and other methods.
Vaccine production, supply and storage	• Facilitates or participates in vaccines manufacturing and quality control testing processes • Implements good manufacturing practice standards throughout the vaccine production processes • Provides regulatory oversight to the entire manufacturing process from start to finish.
National vaccination schemes	• Implements national and global routine immunisation strategies and programmes. • Informs public about national vaccination schemes based on their applicability for vaccination. • Suggests vaccination based on national vaccination schemes.

4.4 Country examples on vaccination education and training in undergraduate pharmacy education

For many years, influenza vaccination has been offered by pharmacists in countries such as the United States of America, the United Kingdom, Canada, Portugal, Ireland and New Zealand.[1] Influenza vaccination started to be administered by pharmacists in Australia beginning in 2014.[14]

According to the FIP report on immunisation coverage,[15] pharmacists can administer vaccines in Argentina, Bolivia, Congo, Costa Rica, Denmark, Finland, Iceland, Lebanon, Netherlands, Philippines, South Africa and Switzerland. After coronavirus disease of 2019 (COVID-19) pandemic, which is in early 2020, pharmacists are allowed to administer vaccines in countries including Brazil, Chad, Estonia, France, Greece, Hong Kong/China, Indonesia, Israel, Kenya, Malta, Nepal, Norway, Paraguay, Sierra Leone, Sweden and Venezuela.[15]

When an authority enables pharmacists to administer vaccines, more education and training strategies are required to be put in place to ensure the quality and sustainability of the service. Pharmacists' active role in immunisation and administration of various types of vaccine has expanded over the past few years, especially with the COVID-19 pandemic, owing to the greater need to vaccinate entire populations.[15,16]

Moreover, some states within the countries allow pharmacy students to vaccinate so that they will graduate both with vaccination certification and experience.[17,18] Offering certification to pharmacy students is also the rationale for where there is an anticipated regulation change to expand the scope of practice to enable vaccination by pharmacists.[19,20]

Therefore, to provide immunisation services and make students ready to meet the changing needs of practice and the profession, pharmacy schools are including immunisation training as part of their core or elective curricula to ensure students' skills and competencies are in place. Such training provides a valuable opportunity to practise injection technique, develop patient assessment skills, and assist in public immunisation efforts for students.[21]

We have conducted a literature review on the undergraduate pharmacy education programmes on vaccination. Country examples on this and related services are listed in Table 4. The country examples are mapped against the required knowledge and skills for pharmacists in vaccination and related services, which was described in Chapter 3.

Table 4. Country examples on undergraduate pharmacy education on immunisation and vaccination

Authors	Country	Publication year	Description of the curriculum content	Knowledge	Skills
Bushell *et al*.[19]	Australia	2020	• Teaching includes both face-to-face and non-face-to-face learning opportunities and delivery of content. • Students are given access to the online content at semester commencement. This learning material could be completed by students in an asynchronous fashion prior to the intensive workshops. • The face-to face content is delivered over four intensive whole day sessions. • Students are taught the knowledge and skills to administer both intramuscular and subcutaneous vaccinations and how to appropriately manage anaphylaxis. • To simulate environments and prepare students for real experience, the training program uses the following: role-plays, mannequins, standardized patients, and mixed reality. Students have to role play and administer vaccinations to both a paediatric and adult low fidelity mannequin.	☐ Body systems ☒ Vaccines ☐ Vaccine-preventable diseases ☒ Vaccine use ☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☐ Policies/regulations/ guidelines	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork ☒ Vaccine administration ☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☐ Vaccine production, supply and storage ☐ National vaccination schemes
Hanrahan and Carroll[22]	Australia	2020	• The programme includes both pharmacy and nursing students with 7 online modules and a six-hour interprofessional practical workshop. • The programme content includes immunology, influenza and influenza vaccines, adverse reactions and management of anaphylaxis, government funded vaccination programs, contraindications, pre-screening and consent, set-up of vaccination area, correct handling of sharps and prevention of needle stick injuries, and intramuscular and subcutaneous injection techniques.	☒ Body systems ☒ Vaccines ☒ Vaccine-preventable diseases ☒ Vaccine use ☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☒ Policies/regulations/ guidelines	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork ☒ Vaccine administration ☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☒ Vaccine policies and regulations ☐ Vaccine production, supply and storage ☐ National vaccination schemes

Authors	Country	Publication year	Description of the curriculum content	Knowledge	Skills
Mills *et al*.[23]	Australia	2021	• The programme is provided for the final year students. • It includes an online module (six to eight hours) and passing a pre-learning knowledge assessment, followed by a one-day face-to-face workshop and demonstrating competence in a practical assessment. • Immunization concepts, including communication and service implementation, are also embedded in relevant units of study to facilitate consolidation and application of knowledge.	☐ Body systems ☒ Vaccines ☐ Vaccine-preventable diseases ☒ Vaccine use ☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☐ Policies/regulations/ guidelines	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork ☒ Vaccine administration ☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☐ Vaccine production, supply and storage ☐ National vaccination schemes
Lepiller *et al*.[24]	France	2020	• All healthcare students from medicine (3rd year), pharmacy (5th year), midwifery (4th year), physiotherapy (4th year), and nursing (2nd year) participate in shared training by e-learning on major issues in primary prevention/health promotion/intervention and public health, such as nutrition and physical activity, vaccination and hygiene, and addiction. • Vaccination training is based exclusively on videos explaining the history of vaccination, its principles and mechanisms of action, the various types of vaccines, and the main controversies surrounding vaccination in the general population. • Healthcare students prepare and manage a primary prevention intervention for various target audiences around one topic between nutrition and physical activity, vaccination and hygiene, and addiction (e.g. alerting primary school children to the danger of microbes through games or alerting university students to the risk of addiction, the benefits of fruits and vegetables, or the consequences of vaccine-preventable diseases).	☒ Body systems ☒ Vaccines ☒ Vaccine-preventable diseases ☒ Vaccine use ☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☒ Policies/regulations/ guidelines	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork ☒ Vaccine administration ☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☒ Vaccine policies and regulations ☐ Vaccine production, supply and storage ☐ National vaccination schemes
Wirth and Azzopardi[25]	Malta	2021	• The course is mandatory for the first-year pharmacy students and it is all hand-on.	☐ Body systems ☒ Vaccines	☒ Patient education ☒ Advocacy

Authors	Country	Publication year	Description of the curriculum content	Knowledge	Skills
			• The didactic parts cover the history, development of vaccines, and public health measures within the pharmacy practice module. • Techniques in parenteral drug administration have been included in the clinical skills lab for the past 10 years. • In October 2021, this lab session was expanded to cover three sessions in the lab where students practise on mannequins and another two sessions in a vaccination centre. The 2-hour session is for clinical observation and practice within the National Immunisation Service-Primary Healthcare. • Upon completion of the programme, a pharmacy-based immunisation certificate is issued.	☒ Vaccine-preventable diseases ☒ Vaccine use ☒ Vaccine production and supply ☒ Patient/pharmaceutical care ☐ Policies/regulations/ guidelines	☒ Communication skills and teamwork ☒ Vaccine administration ☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☐ Vaccine production, supply and storage ☒ National vaccination schemes
Hak *et al*.[26]	USA	2000	• Two hours are allotted to specific immunisation information; 1 hour and 10 minutes to legal issues, marketing strategies, and reimbursement; 45 minutes to emergency management and injection technique demonstration; and 2 hours and 30 minutes to seven case scenarios that cover didactic material from all aspects of immunisations, including adult and paediatric schedules, vaccine related adverse effects, vaccine relative and absolute contraindications, and emergency management of allergic reactions. • Emergency management and injection technique are taught using a group discussion, role playing and demonstrations. • Students have an opportunity to practise on a dummy model before performing an injection on their partner.	☒ Body systems ☒ Vaccines ☒ Vaccine-preventable diseases ☒ Vaccine use ☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☐ Policies/regulations/ guidelines	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork ☒ Vaccine administration ☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☐ Vaccine production, supply and storage ☒ National vaccination schemes
Turner *et al*.[27]	USA	2007	• Education module includes traditional didactic lectures, online blended learning content and assessment, demonstration and practical hands-on modelling of vaccine delivery and counselling, including patient after-care.	☒ Body systems ☒ Vaccines ☒ Vaccine-preventable diseases	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork

Authors	Country	Publication year	Description of the curriculum content	Knowledge	Skills
			• The vaccine administration module includes subjects on pharmacy practice and sterile dosage forms. • Online blended learning content and assessment from the Australasian Society of Clinical Immunology and Allergy is incorporated into the module. • Demonstration and practical simulation of vaccine delivery and counselling, including management of adverse effects, is performed using placebo vaccines and mannequins, which enables students to experience, practise and be assessed on simulated vaccine delivery.	☒ Vaccine use ☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☐ Policies/regulations/ guidelines	☒ Vaccine administration ☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☐ Vaccine production, supply and storage ☐ National vaccination schemes
Donohoe *et al*.[28]	USA	2012	• The programme is provided to 3rd year pharmacy students in the pharmacy practice skills laboratory. • The skills laboratory is a 1- credit course to improve acquired skills and gain additional skills necessary to be a competent, caring pharmacist. • 2-hour laboratory sessions are offered 4 times per week with 1 common hour or lecture time once weekly. • The laboratory activity is divided into 6 immunisation stations: influenza (intramuscular and intradermal) vaccines; nasal influenza vaccine (FluMist); pneumococcal vaccines; shingles vaccine; paediatric vaccines (influenza and pneumococcal); and a managing anaphylactic reactions station. • Each station is carefully designed to incorporate specific scenarios that pharmacists may be faced with in practice.	☐ Body systems ☒ Vaccines ☐ Vaccine-preventable diseases ☒ Vaccine use ☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☐ Policies/regulations/ guidelines	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork ☒ Vaccine administration ☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☐ Vaccine production, supply and storage ☐ National vaccination schemes
Skoy *et al*.[29]	USA	2013	• The programme is provided to 3rd year students. • Students are required to complete a 2-part immunisation certificate training programme. • Students are enrolled in a 1-credit classroom course which focuses on immunisation schedules, state laws, rules and regulations, emergency procedures, vaccination storage and handling, and immunisation service implementation.	☒ Body systems ☒ Vaccines ☒ Vaccine-preventable diseases ☒ Vaccine use	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork ☒ Vaccine administration

Authors	Country	Publication year	Description of the curriculum content	Knowledge	Skills
			• Students are simultaneously enrolled in a 1-credit pharmaceutical care laboratory where they are taught subcutaneous and intramuscular injection techniques. • Upon successful completion of the classroom and laboratory courses, students receive an immunisation administration certificate, which authorises them to administer vaccines to patients. • Laboratory activities focus on medication therapy management, disease state management, injection administration and patient consultation. • Students receive a 1-hour lecture on injection administration technique, followed by a faculty demonstration of an immunisation consultation, which includes performing a subcutaneous and intramuscular injection. • Following the live demonstration, students are asked to practise their injection technique before administering an intramuscular and subcutaneous injection to a peer.	☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☒ Policies/regulations/ guidelines	☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☒ Vaccine production, supply and storage ☒ National vaccination schemes
Porter *et al*.[30]	USA	2014	• Both 2nd and 3rd year pharmacy students are included in the programme. • A comprehensive immunisation delivery course is scheduled for 50 minutes once a week. • The classroom section is a 1-credit course. • All students are required to attend a hands-on vaccine administration laboratory session as well as to complete and respond to a written vaccine administration question assignment. • Classroom lectures are recorded for an online session and are only available to students registered for that session. Recorded lectures show the instructor's presentation slides and include the audio of the presentation. Students in the online session can watch the lecture at any time and as often as they want.	☒ Body systems ☒ Vaccines ☒ Vaccine-preventable diseases ☒ Vaccine use ☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☐ Policies/regulations/ guidelines	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork ☒ Vaccine administration ☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☐ Vaccine production, supply and storage ☐ National vaccination schemes
Kubli *et al*.[31]	USA	2017	• 1st year pharmacy students participate in an immunisation course. • The course consists of 8 hours of didactic immunisation education and covers topics such as	☒ Body systems ☒ Vaccines ☒ Vaccine-preventable diseases	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork

Authors	Country	Publication year	Description of the curriculum content	Knowledge	Skills
			immunology, schedules, adverse reaction management and storage requirements. • In addition, the course includes 3 hours of technique training aimed at providing students with the knowledge and administration skills to immunise patients as pharmacy interns. • The course includes administering and receiving intramuscular and subcutaneous saline injections to and from fellow classmates.	☒ Vaccine use ☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☐ Policies/regulations/ guidelines	☒ Vaccine administration ☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☐ Vaccine production, supply and storage ☒ National vaccination schemes
Terriff and McKeirnan[32]	USA	2017	• A 1-hour training session includes a 40-minute slide presentation covering paediatric immunisations with an emphasis on emergency and mass vaccination clinics, a 10-min question and answer period, and a 10-min verbal assessment of learning objectives. • Students then pair up and practise preparation, counselling and injection working with a simulated paediatric patient, either large, stuffed toy animals, infant dolls, or both. • Sterile saline is used to simulate a pandemic influenza vaccine and injected into pads moved to the chosen injection site by student vaccinator. • Students are allowed to continue to practise their injection technique until they feel comfortable, with most students finishing within 15–20 minutes.	☐ Body systems ☒ Vaccines ☐ Vaccine-preventable diseases ☒ Vaccine use ☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☐ Policies/regulations/ guidelines	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork ☒ Vaccine administration ☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☐ Vaccine production, supply and storage ☐ National vaccination schemes
Vyas *et al*.[33]	USA	2018	• A 2-week vaccine hesitancy was added students' course. • The vaccine hesitancy unit consists of 2 standardised patient (SP) simulations scheduled 1 week apart with a self-study module in between. • Actors are hired and trained for 4 hours to serve as SPs for the simulation. Each scenario starts with an SP who approached the student pharmacist and	☐ Body systems ☒ Vaccines ☐ Vaccine-preventable diseases ☒ Vaccine use	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork ☒ Vaccine administration

Authors	Country	Publication year	Description of the curriculum content	Knowledge	Skills
			expresses a vague concern about getting themselves or their child vaccinated. • Scenarios are conducted in a small classroom. • Four common vaccine myths as identified by the World Health Organization are selected for this exercise: vaccines overwhelming a child's immune system, vaccines causing the illness they are supposed to prevent, vaccines containing harmful additives such as thimerosal, and vaccines causing side effects.	☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☐ Policies/regulations/ guidelines	☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☐ Vaccine production, supply and storage ☐ National vaccination schemes
Bradley and Vance[34]	USA	2021	• The 12-hour home study and the 8-hour in class portions are incorporated into an existing skills laboratory course that occurs as part of the first-year autumn semester. • Faculty developed up to 3 multiple-choice questions for each hour of content. These questions are presented to students to assess knowledge throughout the in-class portion and to aid in student engagement and attendance. • The immunisation technique check-off component is completed during a skills lab session after the completion of the in-class lecture portion.	☐ Body systems ☒ Vaccines ☐ Vaccine-preventable diseases ☒ Vaccine use ☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☐ Policies/regulations/ guidelines	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork ☒ Vaccine administration ☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☐ Vaccine production, supply and storage ☐ National vaccination schemes
Jacobs *et al*.[35]	USA	2021	• Foundational knowledge related to virology and immunisation practice applied to patient care are provided in the PharmD curriculum. This includes: immunology and anti-infectives; the comprehensive disease management series of courses, seminars, and labs; and community introductory pharmacy practice experience rotations. • In the influenza vaccine clinic, each discipline (pharmacy, nursing and physician's assistant)	☒ Body systems ☒ Vaccines ☒ Vaccine-preventable diseases ☒ Vaccine use ☐ Vaccine production and supply	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork ☒ Vaccine administration ☒ Vaccination records and facilitation of

Authors	Country	Publication year	Description of the curriculum content	Knowledge	Skills
			provides students with the foundational knowledge of basic life support, blood-borne pathogen training, and immunisation certification. • Students learn key skills related to patient screening, assessment, education, needle safety, and vaccine storage and handling. • Public health topics and advocacy are also integrated into the curriculum.	☒ Patient/pharmaceutical care ☐ Policies/regulations/ guidelines	vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☒ Vaccine production, supply and storage ☐ National vaccination schemes
Vally and Khan[36]	South Africa	n/a	• Vaccine education has been embedded in the undergraduate BPharm programme in the 3rd and 4th years as a standard exit level outcome for nearly a decade. COVID-specific information was added in 2020. • The syllabus covers definitions, history of vaccination, immune response, vaccine production, types (classification), vaccine debate, stability and safety, diseases and vaccines, future perspectives, vaccine delivery systems and specific knowledge for the pharmacist. • The course is mandatory as part of the BPharm programme. • There is a short course on "Immunisation for pharmacists". • A hybrid teaching model with practical sessions and didactic teaching is implemented. • Students practise their vaccination skills as part of workplace-based learning embedded in the BPharm curriculum.	☒ Body systems ☒ Vaccines ☒ Vaccine-preventable diseases ☒ Vaccine use ☐ Vaccine production and supply ☒ Patient/pharmaceutical care ☐ Policies/regulations/ guidelines	☒ Patient education ☒ Advocacy ☒ Communication skills and teamwork ☒ Vaccine administration ☒ Vaccination records and facilitation of vaccination appointments ☒ Patient follow up ☐ Ethical service provision ☐ Vaccine policies and regulations ☒ Vaccine production, supply and storage ☐ National vaccination schemes

Besides providing vaccine education and training, existing programmes assessed students' injection knowledge and skills.[19] For example, an objective structured skills assessment was used by an authorised immuniser, who determined student skill competency to administer a vaccination to both an adult and child mannequin and provided feedback at the end.[19] Asking pre- and post-test questions to evaluate students' competency knowledge is another way.[19] The questions can be both Likert scale and open ended questions.[19]

Another way of competency assessment was done by the preceptors, who supervised students at immunisation clinics.[27] They rated students' self-confidence immediately before immunising their first and last patient using a Likert scale.[27] How students administered the injection at the appropriate anatomical site, inserted the needle at the appropriate angle, and injected the vaccine using steady pressure were also evaluated for competency.[29]

Further research is needed to describe different methods to assess students' knowledge and skills in immunisation and vaccination, beyond just administration.

4.5 Key insights for curriculum development

To ensure all graduating pharmacists have the baseline knowledge and skills about vaccination and related services, the following insights — based on the country examples and the literature review — can support the development of curricula in undergraduate pharmacy education in vaccination:

- Immunisation learning opportunities should include skills labs, simulators, and immunisation clinics.[16]
- Pharmacy education institutions should provide their students with immunization training and certification opportunities.[18]
- Alternative teaching methods, such as the flipped classroom (defined as a type of blended learning whereby students are introduced to content at home and practise at school[37]), can be implemented to improve classroom engagement.[18]
- Given that vaccine hesitancy has been declared a top health threat by the WHO, adding a vaccine hesitancy aspect into training is a crucial part of education.[38]
- The laboratory setting is an excellent environment to provide hands-on training in a low-risk active-learning environment.[28]
- Implementing an active learning approach in vaccination education enables pharmacy students to find, process, analyse and apply new information.[28]
- Active learning strategies, wherever possible, enable the gap between the classroom and providing direct patient care to be bridged.[28]
- Applying knowledge to simulated patients helps student increase their confidence before assisting actual patients with vaccination.[28]
- Including immunisation practices and liability as well as more targeted information about state-specific laws governing immunisations should be considered[4]
- Offering online sessions in the immunisation training can make students take ownership of their learning and assume a more active role in learning course material.[33]
- The training can address some of the major barriers that pharmacists and pharmacy students might have during provision of immunisation services.[4] The training should enhance students' willingness to be involved in providing vaccinations as well as their confidence in their knowledge and skills.[4]
- The training must provide an opportunity for pharmacy students to collaborate with other healthcare providers in a multidisciplinary environment.[39]
- Interprofessional immunisation training provides an opportunity to learn and work with students from other health professions.[40]
- It is better not to have a gap between training and practice, so some policy requirements must be considered for pharmacists' involvement in immunisation services, such as allowing them to become immunisers under certain conditions and taking account of proper training, accredited certification and licensed administration facilities.[41]

- Undergraduate vaccination training should ideally allow time for practice within the course, while also ensuring that students have gained requisite knowledge and skills, e.g., immunology sciences and roles of pharmacists, including communicating with patients and obtaining informed consent.
- Various methods can be applied based on the professional needs of students, student scheduling, faculty workload, and current immunisation policies within states and countries.[42]

With regard to equipping pharmacy students with the skills and knowledge to adopt an immuniser role to improve public health, the first intervention came from the American Pharmacists Association (APhA) and the Accreditation Council for Pharmacy Education (ACPE).[43,44] Whereas the APhA provides a pharmacy-based immunisation delivery certificate training programme,[43] the ACPE sets standards for integrating immunisation as a required element of the core didactic curriculum and mentions the need to offer an avenue for students to complete certificates such as immunisation delivery.[34,44] The Australian Pharmacy Council revised its standards to allow pharmacy students and interns to receive appropriate vaccination training within its programme.[45]

These joint interventions from professional and accrediting bodies, particularly on creating the policy drive and enabling regulations, had a major influence on successful preparation of "vaccine-ready" pharmacy graduates, which can demonstrate a good example to other countries that are planning to provide undergraduate education to pharmacy students on vaccination.

As a supplementary guide in developing curricula, suggested learning outcomes for vaccination education and training in undergraduate pharmacy education are described in Table 5.

Table 5. Learning outcomes for a potential undergraduate vaccination curriculum*

Vaccination-related role or service	**Learning outcomes** **At the completion of training on vaccination-related roles and services in pharmacy, a practitioner should be able to:**
Advocacy	• Demonstrate knowledge and understanding of the various types of advocacies in their area of practice. • Demonstrate knowledge and understanding of health promotion, public health and disease prevention, and disease state management services.
	• Actively build trust with their community and establish the crucial nature of vaccines and their public health benefits. • Advise immunisation committees on the best ways to implement local vaccination programmes. • Actively engage in multidisciplinary vaccination campaigns. • Apply health promotion, public health disease prevention and disease state management aspects in advocacy and education on vaccination.
Patient education	• Demonstrate knowledge and understanding of latest research findings and recommendations (e.g., during pandemics and outbreaks). • Demonstrate knowledge and understanding of aspects of evidence-based vaccination information and common myths on vaccination. • Demonstrate knowledge and understanding on research and evaluation methods and processes.
	• Actively build individual and societal trust in vaccines as essential medicines. • Make use of the ABC (acknowledge, bridge, communicate) framework to dispel-vaccination myths. • Participate in scientific studies aimed at determining consumption, costs and impact of vaccines on a specified population. • Obtain, analyse and interpret data corresponding to the vaccine supply process.
Communication skills and teamwork	• Demonstrate knowledge and understanding of roles that other healthcare providers play in ensuring vaccine access and safety.

Vaccination-related role or service	Learning outcomes At the completion of training on vaccination-related roles and services in pharmacy, a practitioner should be able to:
	• Know and understand the importance of vaccination against multiple diseases among healthcare providers. • Demonstrate knowledge and understanding of patient-centred interactions and the importance of patient involvement. • Demonstrate knowledge and understanding of patient-centred care and individualisation of vaccine therapy. • Demonstrate knowledge and understanding of communication etiquette, and verbal and non-verbal cues that are important in patient management. • Demonstrate an understanding of health promotion methods. • Demonstrate awareness of at-risk population groups and the appropriate considerations for each group in vaccination. • Demonstrate knowledge and understanding of ways of building vaccine confidence among general and at-risk populations. • Demonstrate awareness of religious and cultural diversity among their communities.
	• Effectively communicate and work with other healthcare providers to promote vaccination uptake among patients. • Actively engage with, inform and advocate vaccination among healthcare providers. • Utilise their communication skills and expertise in expanding vaccine coverage and improving vaccine compliance. • Individualise vaccination therapy by administering standardised questionnaires to patients. • Apply health promotion methods in improving vaccination coverage in their area of practice. • Actively identify and target patients who are at high-risk of vaccine-preventable diseases and their complications. • Apply communication skills and teamwork to counsel patients, advocate vaccination, and improve vaccine confidence among patients. • Address vaccination concerns and beliefs in a respectful manner and develop group-specific materials to address patients' concerns and beliefs.
Vaccine administration	• Demonstrate knowledge of vaccine timing, route, available population, precautions, contraindications and adverse events. • Demonstrate awareness of common errors during, pre- and post-vaccine administration • Demonstrate knowledge of infection control and pain management during vaccination. • Demonstrate knowledge of patient care after vaccination.
	• Report vaccine administration errors. • Ensure patient safety during, pre- and post-vaccination • Handle sharps or needle stick injuries, adverse events and precautions. • Document vaccination records, including adverse events and electronic universal health records. • Create and implement quality improvement programmes for appropriate patient populations, vaccine routes, timings and contraindications. • Develop patient follow-up strategies, such as the recall system, standing orders, and automatic reminders.
National vaccination schemes	• Demonstrate knowledge and understanding of national and global routine immunisation strategies and programmes.
	• Facilitate or participate in national and global routine vaccination programmes and practices.
Vaccine production, supply and storage	• Facilitate or participate in vaccines manufacturing and quality control testing processes.

Vaccination-related role or service	Learning outcomes At the completion of training on vaccination-related roles and services in pharmacy, a practitioner should be able to:
	• Facilitate or participate in good manufacturing practice standards throughout the vaccine production processes. • Actively provide regulatory oversight to the entire manufacturing process from start to finish. • Demonstrate knowledge and understanding of various vaccine supply chain stages. • Demonstrate knowledge and understanding of roles that a pharmacist can play in supply chain management to improve access and vaccination coverage. • Demonstrate knowledge and understanding of the ideal cold chain storage conditions for COVID-19 vaccines.
	• Actively participate in the supply chain to ensure increased vaccination coverage. • Ensure safety and quality of vaccines under their care.
Vaccine regulations and policies	• Demonstrate knowledge and understanding of the importance and use of vaccination documents available in their area of practice. • Demonstrate knowledge and understanding of good pharmacy practice standards. • Demonstrate knowledge and understanding of patient record keeping and reporting to vaccine national registries.
	• Effectively document, properly maintain and archive vaccination records aligned with countries' data privacy laws. • Implement good pharmacy practice standards throughout the vaccination process. • Effectively document, maintain and report on vaccination administered to the national registries.
Vaccination records and facilitation of vaccination appointments	• Demonstrate knowledge and understanding of available vaccine dosage formulations. • Demonstrate knowledge and understanding of hand hygiene requirements and procedures throughout the vaccination process. • Demonstrate knowledge and understanding of the materials required before vaccine administration. • Demonstrate knowledge and understanding of vaccine administration techniques as they correspond to their route of administration. • Demonstrate knowledge and understanding of methods of managing acute adverse reactions during and after vaccine administration. • Demonstrate knowledge and understanding of various consideration for specific risk groups during vaccine administration. • Demonstrate knowledge and understanding of the need for immediate disposal of used materials and infectious waste after vaccine administration.
	• Effectively administer vaccines via the appropriate route. • Ensure and maintain good hand hygiene practices before vaccine administration. • Effectively prepare all requisite vaccine administration and anaphylaxis management supplies before vaccination to ensure smooth provision of the service. • Safely administer vaccines through the correct administration route. • Apply group-specific considerations and ensure safe and effective vaccine administration. • Effectively manage acute adverse reactions during and after vaccine administration. • Promptly and effectively dispose of used materials and infectious waste after vaccine administration. • Actively detect, report and monitor medication errors related to vaccines.
Patient follow-up	• Demonstrate knowledge and understanding of the importance of adherence to vaccination schedules. • Demonstrate knowledge and understanding of the reminder and recall system of follow-up.

Vaccination-related role or service	Learning outcomes At the completion of training on vaccination-related roles and services in pharmacy, a practitioner should be able to:
	• Demonstrate knowledge and understanding of the various types and subtypes of vaccines available in their region or country of practice. • Demonstrate knowledge and understanding of vaccine components and their role in vaccine composition. • Demonstrate knowledge and understanding of the most likely-adverse reactions following immunisation and their likely causes. • Demonstrate knowledge and understanding of the signs and symptoms of common adverse reactions and ways to minimise them. • Demonstrate knowledge and understanding of reporting mechanisms for adverse reactions that may occur after vaccination.
	• Actively contribute to vaccine coverage and overcome challenges involved in vaccination compliance. • Actively participate in reminder and recall systems to ensure that vaccinations schedules are adhered to. • Apply knowledge acquired in educating and managing patients in adverse reactions. • Apply knowledge acquired in patient management, education and handling of adverse reactions. • Effectively identify the cause of the most common adverse reactions post-vaccination. • Effectively manage the most common adverse reaction post-vaccination. • Detect, report, and follow up on adverse events attributable to vaccines to national or regional pharmacovigilance units.
Ethical practice	• Demonstrate knowledge and understanding of the pharmacy practice code of ethics.
	• Serve patients' healthcare needs and contribute to efficient health systems within the confines of professional ethics as a guide to access and use of patient information.

* This table contains knowledge-based learning outcomes (shaded in blue) and application-based learning outcomes.

4.6 Conclusions

Inclusion of vaccination and immunisation as a core component of undergraduate pharmacy education ensures preparation of a "vaccine-ready" pharmaceutical workforce, which can contribute to increasing immunisation coverage and, ultimately, improving public health outcomes.

Some countries have been preparing vaccine-ready pharmacy graduates through undergraduate education and the findings below can further advance vaccination education, and can help countries build their own undergraduate pharmacy education for vaccination programmes from inception:

- The courses mainly focus on adult vaccination. The courses should include special populations such as children and geriatric population for a life-course immunisation approach.
- Most of the education programmes have been found in USA, Canada and Australia based pharmacy schools. As there are 36 countries where pharmacy-based vaccination and other related services are delivered,[17] we encourage all countries to publish evidence on their undergraduate and continuous education programmes to support other countries and regions.
- In countries where pharmacists are authorised by regulations, and recognised by society and healthcare teams for their vaccination competencies, it is more likely that undergraduate pharmacy education on vaccination is being provided.

- Pharmacists need to be vaccine-ready upon registration, regardless of their countries' regulations on allowing them to administer vaccines, because pharmacists' roles in vaccination go beyond just vaccines administration as pharmacists have a mandatory public health role. It is important also to prepare future-proof and vaccine-ready pharmacists for when services can be introduced by regulations.
- In some countries, core competencies and immunisation content are being taught in different study units within the pharmacy curriculum. A programme-based approach or specialisation in undergraduate education about vaccination and immunisation, using an experiential and hands-on approach, could increase the knowledge and skills of pharmacy graduates.
- Since there are various regulations about vaccine administration, depending for example on population group and type of vaccine, between states and countries, immunisation training must be based on needs assessment and the changing needs of practice and the profession within the country.
- As seen in the USA and Australia country examples, pharmacy schools should consider a collective intervention on integrating vaccination in undergraduate pharmacy education together with professional bodies, policy-makers, students and practitioners.
- Not all undergraduate pharmacy education programmes cover all the required knowledge and skills for pharmacists in vaccination. There is a room for improvement in existing undergraduate pharmacy education programmes on vaccination to provide knowledge and skills on ethical service provision, vaccine policies and regulations, vaccine production, supply and storage, and national vaccination schemes to pharmacy students.

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5 Professional development knowledge and skills reference guide to vaccination for pharmacy practitioners

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Background
Tables 6, 7, and 8 below have built on existing FIP resources on vaccination to date, current learning and teaching tools, curricula and expert review through a reference group (see acknowledgments, p53). The reference group, made up of educators and practitioners with experience in professional development in vaccination, reviewed the statements and agreed on the content.

Summary

- Across various areas of practice, pharmacists are well-positioned in communities and healthcare teams to provide vaccination-related services and interventions based on scopes of practice and regulatory permissions to support patients.
- Pharmacists are expected to acquire and maintain competencies by practising continuing professional development (CPD).
- Building on the need to maintain competence in areas relevant to a pharmacist's area of practice, knowledge and skills must also be acquired and updated to advance competence.
- Knowledge and skills in the area of vaccination for pharmacists are described in Chapter 5. These have been based on existing FIP resources, international guidance and expert input. Knowledge and skills guides encompass pharmacist-led interventions and roles from advocacy, health promotion, vaccine administration and monitoring for adverse effects.
- This guide is intended to help practising pharmacists, CPD providers, educators and trainers supporting CPD design and delivery. It outlines knowledge areas, common skills, techniques and procedures in vaccination, and potential learning outcomes from programmes and courses on vaccination.
- Considerations are shared to support the development and implementation of training, guidelines and transformative CPD programmes that are focused on improving pharmacists' competence and capacity in the area of vaccination.

5.1 Introduction

To date, vaccination is the safest and most effective protection against many deadly and incapacitating diseases. It is described as the best public health intervention, saving millions of lives every year around the world.[1] The World Health Organization (WHO) states that vaccines underpin global health security and are a vital tool in the fight against antimicrobial resistance.[2]

Despite the revolutionary nature of vaccines and the progress made over the years, access to vaccines has been a major setback.[3] This has been further amplified with the outbreak of the COVID-19 pandemic, putting immense stress on global healthcare systems. Vaccine hesitancy is at an all-time high, and misconceptions surrounding vaccination are spreading at a high rate.[4,5] The pandemic has exposed how vulnerable the world is to emerging infectious organisms and disease outbreaks. However, it has taught us the need to prepare ourselves for future pandemics.

Improving access to vaccines around the world is a primary health care goal, and this has been emphasised in the 2018 Astana Declaration on Primary Health.[6] The declaration categorically expressed the need for

prioritising prevention across healthcare policies as a way of reducing the global burden of diseases and allowing for efficient, resilient and sustainable health systems. Vaccines are at the core of this push for prevention. Vaccines are critical in addressing antimicrobial resistance because they reduce the need for antibiotics by lowering the incidence of communicable diseases. In addition, vaccines are important tools in the prevention of certain cancers caused by the human papilloma and hepatitis B viruses.[7]

Pharmacists are most easily accessible and are often the first point of contact for many individuals seeking healthcare services. This allows them to easily identify and target those who may be at a higher risk of vaccine-preventable diseases and their complications. They can also build trust in the community and convey the importance of vaccines. Furthermore, they can ensure the safety, efficacy and quality of vaccines through their understanding of the supply chain and cold-chain storage. In a growing number of countries, pharmacists have the legal authorisation to administer vaccines, manage patient vaccination schedules and organise educational and promotional campaigns.[8,9,10,11] Countries that have pharmacy-based vaccination have shown an improvement in vaccination rates due to increased accuracy, dependability, cost-effectiveness and patients' preferences shifting towards vaccination at a pharmacy.[12] This demonstrates the important role played by pharmacists in improving vaccination uptake and coverage.[12]

These extensive roles place pharmacists as essential contributors to the improvement of vaccination coverage and vaccination access. However, there still exists hesitancy in allowing pharmacists to perform vaccinations. Studies have shown that pharmacists are willing to vaccinate individuals and they are equally ready to get the necessary training and qualifications to do so. However, there is a need for pharmacists' associations and regulators to follow a more active approach in stressing the importance and impact of training for pharmacists who provide vaccination services.[13,14]

For over a decade, FIP has been at the forefront of advocating vaccination by pharmacists. This is based on the conviction that improving vaccination coverage and promoting a life-course approach to vaccination is a global imperative to which pharmacists can contribute. Seventeen of the 21 FIP Development Goals[15] are aligned with promoting vaccination. Specifically, DG 16 (Communicable diseases) primarily focuses on the prevention of communicable diseases, and vaccination is one way of achieving this.[5]

FIP has also authored several publications that are aimed at not only providing useful information to individual pharmacists concerning how they can contribute to improving vaccination coverage[5, 8, 10, 11, 16-18] but also providing effective approaches for tackling vaccine hesitancy and improving their advocacy of vaccination.[5] These have become essential tools in the CPD of pharmacists and pharmaceutical scientists worldwide.

Building on the need to further strengthen the competency of practising pharmacists around the world in vaccination, Chapter 5 aims to:

- Outline the knowledge and skills recommended in vaccination for practising pharmacists;
- Provide key aspects and insights to support and enhance CPD in vaccination; and
- Highlight key quality assurance considerations of training programmes and CPD provider requirements.

To effectively tackle the issue of access to vaccines, it is imperative to improve three key contextual domains:

1. We need to build public trust and provide information that tackles the individual factors associated with vaccine hesitancy and acceptance.[17,19,20,21]These individual factors include, but are not limited to: mistrust of science and medicine; concerns about side effects; negative beliefs about vaccine effectiveness; communication, cultural and religious barriers; fear of injections; and misinformation and disinformation. [19,17,21]These individual factors include, but are not limited to:, mistrust with of science and medicine;, concerns about side effects;, negative beliefs about vaccine effectiveness;, communication, cultural and religious barriers;, fear of injections;, and misinformation, and disinformation.
2. We need to improve vaccination-related services, including the transport, supply, administration, storage, and distribution of vaccines. This can be done by improving vaccine infrastructure,

strengthening surveillance and monitoring systems, and securing political goodwill that emphasises the importance of vaccination.[17] Thus, appropriate mechanisms must be in place at global, regional and national levels to ensure that all people have access to vaccines through principles of equity and solidarity.

3. Enhancing vaccination availability is key to improving overall access to vaccines. This can be done through offering vaccination at multiple locations and times, improving vaccination record systems and, most importantly, partnering with healthcare professionals to provide the service to all. Pharmacists play a crucial role in this area and can contribute to improving vaccine access through multiple roles such as education and promotion of vaccination.[5]

5.2. FIP global competency and professional development frameworks

As medication experts, pharmacists are key members of a patient's healthcare team. Pharmacists must maintain and further their competence to practise and remain responsive to the increasingly complex healthcare environment through continuing professional development (CPD). FIP defines CPD as "the responsibility of individual pharmacists for systematic maintenance, development and broadening of knowledge, skills and attitudes to ensure continuing competence as a professional, throughout their careers."[22]One approach to developing and maintaining competence is by embracing competency-based training, which is a structured approach to training and assessment that is directed toward achieving specific outcomes. Through such an approach, individuals and practitioners must be assisted to acquire skills and knowledge to enable them to perform a task to a specified standard under certain conditions. In competency-based training, the outcomes to be achieved are clearly stated so that learners know exactly what they must be able to do, trainers know what training or learning is to be provided and organisations know the skill levels required of their people. The emphasis in competency-based training is on "performing" rather than just "knowing".[23]

With wide acceptance on implementing competency-based training and education in health professions, competency frameworks are deemed essential in organising educational curricula, regulating career entry, benchmarking standards of practice and facilitating expertise development.[22] FIP developed two global frameworks that describe the generic competencies for foundation and advanced pharmacy practice.

The FIP Global Competency Framework (FIP GbCF)[25], updated in 2020, is a set of competencies and core behavioural statements that are intended to be generally applicable for the pharmacy workforce worldwide, particularly targeting early-career (foundation-level) pharmacists. The FIP GbCF includes 124 behavioural statements grouped under 23 competency domains and four broad competency clusters: pharmaceutical public health; pharmaceutical care; organisation and management; and professional and personal competencies.

The FIP Global Advanced Development Framework (GADF)[26] is a complementary framework to the FIP GbCF. The FIP GADF is intended to support the professional development and recognition of pharmacists and pharmaceutical scientists and maps broad-based advanced practice stages across developmental competencies. Six developmental competency clusters are in the GADF: expert professional practice; working with others; leadership; management; education, training and development; research and evaluation.

The FIP GbCF and the GADF are intended to act as "mapping tools" for individuals to progress towards effective and sustained performance and to pave the way into advanced and specialist practice to enable flexibility and transfer of key knowledge and skills and wider competencies.

As such, FIP recommends that individuals use the knowledge and skills reference guide (see section 5.3) with the FIP competency and developmental frameworks to identify the knowledge, skills and behaviours that will be relevant to support them in developing their practice (Figure 1). A FIP reference guide provides guidance on knowledge and skills on a specific topic. In this way, cross-learning and transfer of key knowledge and skills is encouraged and embedded. The tools provided by FIP which include competency frameworks and knowledge

and skills reference guides inform CPD practices, such as self-assessing one's practice as part of registration or licensing requirements, professional development and self-directed learning.

In the following sections, the knowledge and skills required for professional development in vaccination are introduced (Tables 6 and 7, and a suggested set of expected learning outcomes in Table 8) from training programmes in vaccination for practitioners.

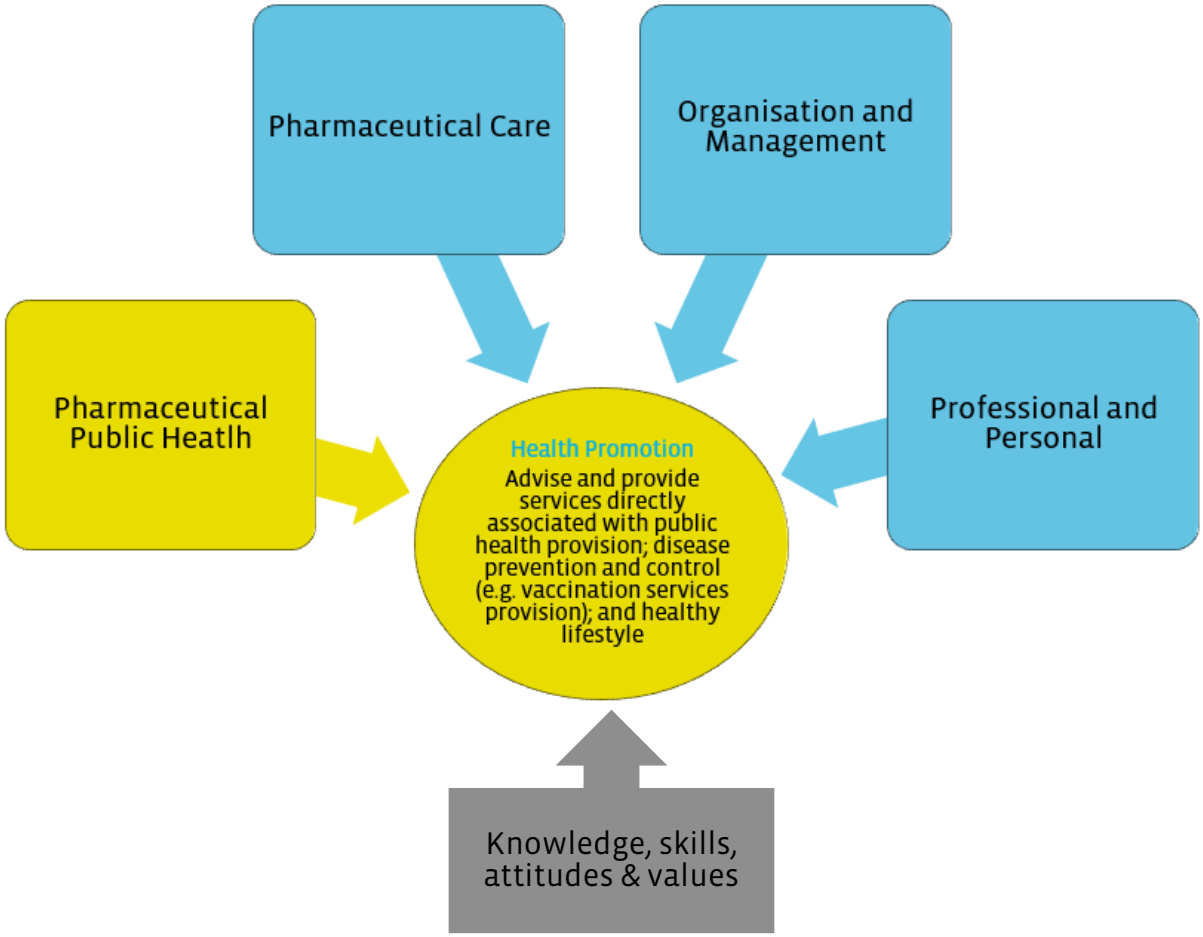

Figure 1. Competencies encompass an array of knowledge, skills, attitudes and values to enable effective performance

In the example shown in Figure 1, as part of health promotion to advise and provide services associated with disease prevention and vaccination, it is expected practitioners will need to harness knowledge, skills, attitudes and values previously acquired and crosscut other competency areas to perform the tasks at hand.

5.3 Practitioner professional development: knowledge and skills reference guide

5.3.1 About the guide content

The reference guide provides a comprehensive list of required knowledge[27] and skills in pharmaceutical and related care to support practitioners to develop, upskill and refresh knowledge in vaccination and related roles in pharmacy. This K&S reference guide is intended to guide practice in the area of vaccination rather than to be a prescriptive list that has to be adhered to in all cases.

5.3.2 How is the information organised?

The guide is organised in three main parts:

The first part (Table 6) describes knowledge required by practitioners in vaccination and vaccination-related roles. In the knowledge guide, topics are grouped into three categories (Figure 2):

- Broad topic area — includes main concepts of body systems, medicines supply and use, patient and disease, patient and pharmaceutical care, and advocacy, ethics and collaborations.
- Core topics — identifies key topic areas (knowledge areas) related to the roles and services provided in vaccination.
- Specific topics — describes specific topics stemming from the core topics.

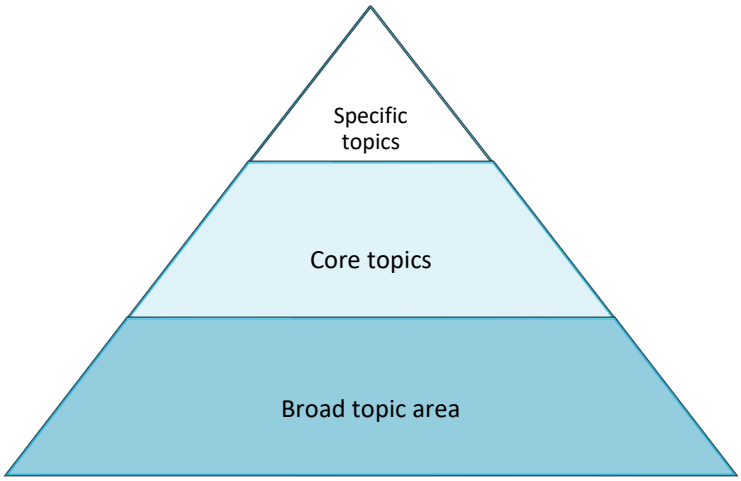

Figure 2. Hierarchy of topic grouping in the knowledge guide

The second part (Table 7) describes skills required by practitioners in vaccination and vaccination-related roles.

The third part (Table 8) outlines knowledge and skills aligned with identified roles and services, and the competency related to health promotion in the FIP GbCF are described in Tables 6 and 7.

5.3.3 Who is it for?

- It is relevant to pharmacists focusing on a specific area(s) of practice and may be relevant at any stage of professional development, depending on the pharmacist's role.
- The guide supplements previous FIP publications on vaccination-related roles in pharmacy[5, 8, 10, 11, 15, 16] and was developed in consultation with a global reference group (see acknowledgments).

5.3.4 How to use it?

This reference guide can be used:

- To support practitioners as they upskill in the area of vaccination and as part of their course of career development.
- To help practitioners with an interest to provide vaccination-related services in practice.
- To inform the design and delivery of education and training programmes by CPD providers.
- To inform the design and delivery of education and training programmes in undergraduate or postgraduate pharmacy education.
- To support pharmacy students, and identify knowledge and training needs in vaccination.

5.3.5 Contextualisation, regulatory and training requirements

It is crucial to recognise that practitioners will have to follow their local, national and jurisdictional requirements for training, certification and regulatory, professional and ethical standards to fulfil their specified roles in vaccination. These may include:

- Codes of conduct.
- Nationally developed certificate training programmes.
- Registration or licensure status.

Table 6. Knowledge guide for practising pharmacists in the area of vaccination

Body systems	
Immune system	Demonstrates knowledge and understanding of:
Immunology[28]	• The basic immunological concepts and mechanisms of the immune system in allergic reactions, autoimmune diseases and transplantation survival. • The different types of immunity (passive immunity and active immunity, including natural immunity and vaccine-induced immunity). • Key terms (immunity, vaccine, vaccination, immunisation).
Vaccines	Demonstrates knowledge and understanding of:
Medicines: common vaccinations	• All aspects of common vaccinations, including: indications; mechanism of action; pharmacology; pharmacokinetics; pharmaceutical aspects; adverse effects, contraindications, precautions and interactions; usual doses and routes of administration; place in therapy; and monitoring requirements.
Medicines: anaphylaxis medicines	• All aspects of antihistamines, corticosteroids, bronchodilators, adrenergic agonists and vasoconstrictors, including: mechanism of action; pharmacology; pharmacokinetics; pharmaceutical aspects; adverse effects, contraindications and interactions; usual doses and routes of administration; place in therapy; and monitoring requirements.
Common vaccinations	• The main types and groups of vaccines; the differences between live and inactivated vaccines; childhood vaccinations; an ability to advise on the most appropriate vaccination regimens, protocols for supply and the precautions that need to be observed with respect to timing when administering more than one vaccine from the same group or different groups.
Vaccine-preventable diseases	Demonstrates knowledge and understanding of:
Aetiology, transmission & diseases	• Aetiology; toxin mechanism of action; types; risks; pathogenesis and virulence; clinical features; epidemiology; transmission; diseases and complications caused by common vaccine-preventable diseases. • Common vaccine-preventable diseases, including cholera, diphtheria, haemophilus influenza, hepatitis A and B, human papilloma virus, influenza, measles, meningococcal disease, mumps, pertussis, pneumococcal disease, poliomyelitis, rabies, rotavirus, rubella, tetanus, typhoid, varicella (chickenpox), zoster (shingles), yellow fever, some cancers, tuberculosis and malaria.
History of vaccines and vaccination	• The history of vaccines and how vaccination has mitigated or eradicated many infectious diseases, e.g., smallpox
Vaccine development	• The main steps involved in the development, production and pharmaceutical regulation of vaccines.
Vaccine use	Demonstrates knowledge and understanding of:

Timing and spacing of vaccines	• The differing actions of available vaccines and which vaccine is appropriate for the patient. • Timing and spacing of vaccines, including interval between doses of the same vaccines, and simultaneous and non-simultaneous vaccine administration.
Vaccine pharmacology	• Appropriate vaccine doses and dosage forms used to prevent disease. • Vaccine-drug interactions and corresponding warnings associated with their use. • Appropriate considerations for special population groups, e.g., pregnant persons, people with co-morbidities, children etc. • The side effects associated with vaccines. • Vaccines additives that may trigger allergic reactions in susceptible patients. • Vaccine administration routes, e.g., oral, intranasal, subcutaneous, intramuscular, intradermal, and the corresponding appropriate administration techniques.
Patient screening	• The need for pre-screening and patient consent prior to receiving vaccination. • The patient screening process in identifying eligible candidates for vaccination. This includes understanding the inclusion and exclusion criteria for patients through familiarity with the patient group directives. • The need for patient counselling before vaccination.
Public health	• Demonstrates knowledge and understanding of local and national vaccination and immunisation schedules and regimens.
Vaccine information	Demonstrates knowledge and understanding of:
Answering vaccine information enquiries	• The use of common information sources used when answering enquiries about immunisation programmes in the country, and health protection for persons travelling abroad, including their advantages and disadvantages. • Standard questions to ask to obtain the relevant background information when answering enquiries about immunisation programmes in the country and health protection for persons travelling abroad.
Vaccine supply	
Vaccine production	Demonstrates knowledge and understanding of:
Vaccines manufacturing and regulation	• Vaccine manufacturing and quality control processes. • Standardisation of starting materials, production and quality control testing to guarantee vaccine identity, purity, sterility, efficacy and safety. • The regulatory requirements of the entire manufacturing process from start to finish. • Vaccines formulation and active ingredient manufacturing. • Vaccines filling, packaging and lot release processes. • The good manufacturing practices for vaccines.
Vaccine storage and handling	Demonstrates knowledge and understanding of:
Vaccine cold chain	• Vaccine cold-chain and how it may affect vaccine efficacy. • Vaccine storage and handling standard operating procedures. • Quality control aspects of vaccines at multiple levels (pre-approval, quality control testing, good manufacturing practice and pharmacovigilance), e.g., potency assays, in-process testing, immunogenicity tests, quantitative polymerase chain reactions, and post-approval clinical studies.
Transport, storage and handling	• Vaccine storage and temperature monitoring equipment, including refrigerators and freezers; temperature monitoring devices; storage unit setup; stabilising temperatures; power supply; and equipment maintenance. • Vaccine transport and inventory management. • Organising and storing vaccines in storage units. • Stability of vaccines. • Vaccine delivery systems.

Administration	Demonstrates knowledge and understanding of:
Pre-administration phase	• The timing and spacing of vaccines. • Assessment for the needed vaccines. • Consent prior to vaccination according to the requirements of the state, territory or region of practice. • Pre-administration precautions. • Good pharmacy practice in the pharmacy, which includes having a vaccination specific place or room, a refrigerator specific for vaccines, a temperature monitor, a portable refrigerator in case of power failure, an anaphylaxis response kit, an anaphylaxis management poster orguidance, a safety box, a medical waste bin, and materials for hand sanitisation and surface cleaning.
Administration phase	• Administration site recommendations for infants, toddlers, children, adolescents and adults. • Contraindications to vaccination and associated adverse events following vaccination. • The risks of complications when administering vaccines via specific routes. • Infection control during vaccine administration including aspects of personal protective equipment; proper vaccine preparation to maintain integrity; vaccine inspection; and selection of supplies for administering vaccines. • Administration considerations for specific risk groups, including barriers to access to vaccination; effectiveness of vaccines and strategies to improve effectiveness. • Pain management during the vaccination procedure.
Post-administration phase	• Patient care after vaccine administration, including possible acute reactions and vasovagal episodes. • Common errors in the post administration phase; errors that require revaccination. • Strategies to ensure safe vaccination, and how to report vaccine administration errors. • Correct handling of sharps and prevention of needle stick injuries. • Proper documentation and vaccination records, including electronic universal health records. • Creation and implementation of quality improvement programmes. • Patient follow-up strategies such as the recall system, standing orders and automatic reminders.
Vaccine safety	Demonstrates knowledge and understanding of:
Adverse events following immunisation (AEFI)	• The types of adverse events and reactions following immunisation. • Assessment of causality. • Assessment and monitoring of vaccine safety. • Adverse drug reactions notifications to pharmacovigilance specialised authorities and vaccine safety programmes in ensuring vaccine safety.
Emergency management of AEFI	• Management of anaphylaxis and allergies. • First aid procedures and basic life support, including use of an automated external defibrillator.
Vaccination provider's role	• Vaccination provider's role in ensuring safety and efficacy of vaccines, including benefit and risk communication and managing ADRs after vaccination.
Patient/pharmaceutical care	
Special population groups	Demonstrates knowledge and understanding of:
Adults	• Vaccines needed by all adults regardless of whether they were received during childhood (e.g. hepatitis B, influenza, varicella, MMR, and DPT vaccines). • Changes in susceptibility of contracting vaccine-preventable diseases in adulthood. • Reminder and recall systems and standing orders in enhancing access to immunisation. • Methods of dealing with vaccine hesitancy.

Elderly	• The need for additional vaccines for people who are aged 65 and older, including COVID-19, influenza, pneumococcal, and zoster, and the scheduling regimen and frequency. • Patient considerations taken during screening and vaccine administration among the elderly because of reduced vaccine effectiveness and multimorbidity. • The difference in vaccine adjuvants (composition) for the elderly. • Methods of dealing with vaccine hesitancy among the elderly.
Immunocompromised patients	• Contraindications and precautions for vaccines in immunocompromised patients (e.g. HIV/AIDS, chemotherapy, autoimmune disease, primary or secondary immune deficiency) and those with medical conditions that weaken the immune system (cancer, sickle cell disease) or on immunosuppressants, including steroids. • The reduced effectiveness of vaccines in immunocompromised patients depending on the type of vaccine and the degree of immune dysfunction.
Immigrants	• Aspects related to the vaccination status of immigrants as vaccination may be incomplete and documentation missing, and the need to begin catch-up vaccination in children.
Healthcare providers	• The need for healthcare providers to be vaccinated annually against influenza, be up to date with vaccines in the national immunisation programme to protect themselves and their patients. Other vaccines and booster doses include tetanus toxoid, diphtheria toxoid, measles, mumps, rubella, varicella and hepatitis. • Methods of dealing with vaccine hesitancy.
Pregnant or lactating women	• Immunisation routinely recommended for women during pregnancy including inactivated trivalent influenza vaccine. • The need for women to receive all recommended vaccines that could not be or were not administered during pregnancy. • Valid contraindications and precautions for immunising pregnant women.
Travellers	• Immunisation requirements and recommendations for travellers.
Patient education	Demonstrates knowledge and understanding of:
Communication	• Sources and ways of dissemination of information on vaccination. • Vaccination myths and methods of dispelling such myths, e.g., the ABC (acknowledge, bridge, communicate) framework.
System-based barriers	• System-based barriers to vaccination, including missed opportunities; limited access to healthcare; low awareness on vaccines and their benefits; complicated adult immunisation schedules; and vaccine cost and reimbursement.
Vaccine hesitancy	• Reasons for vaccine hesitancy, including safety concerns; efficacy concerns; moral or philosophical concerns; and misinformation. • Methods of addressing vaccine hesitancy, including adjusting communication styles, communication content, and addressing and preventing misinformation. • Patient-focused strategies that improve patient confidence such as strong vaccination recommendation, taking time to answer questions, and adopting the SHARE (share, highlight, address, remind, explain) framework.[29] • Practice-focused strategies that are designed to overcome physical and psychological barriers.
Public health	Demonstrate knowledge and understanding of:
Advocacy	• Methods of advocacy relevant to their area of practice. • Advocacy strategy development, including situational analysis tools; stakeholder onboarding; implementation of vaccine services; monitoring implementation and progress; and developing a remuneration model for the service.
Health promotion	• Health promotion strategies through immunisation quality improvement projects.

	• Developing strategies to address public health needs and disease prevention. • Common public health strategies theories and ability to critically appraise strategies around public health.
Multidisciplinary care	Demonstrate knowledge and understanding of:
Patient-centred interactions and patient involvement	• The need for consistent patient education and counselling on vaccines and vaccination. • Culture- and religion-appropriate language when communicating to patients on vaccination. • The benefits of patient-centred interaction and involvement in improving healthcare intervention outcomes and building patient confidence.
Individualisation of vaccine therapy	• Vaccine therapy individualisation based on age, sex, patient history and immune state.
Professional development in an interdisciplinary approach	• The need for continuous education on vaccination and professional development. • Interdisciplinary efforts in improving immunisation coverage and building patient confidence and trust in vaccination.
Ethical practice	Demonstrate knowledge and understanding of:
Pharmacy code of ethics	• How pharmacy codes of ethics apply to pharmacist-patient interactions, patient informed consent and access to patient data. • Ways to deal or interact with patients of varying health literacy levels.
Policies, regulations and guidelines	
Vaccine policies and regulations	Demonstrate knowledge and understanding of:
Government-funded vaccination programmes	• Government-funded vaccination programmes in their area of practice. • Government-supported and other funded programmes that cover the cost of vaccines and their administration for people who do not have adequate resources.
Paediatric vaccination schemes and schedules	• Paediatric immunisation schedules as recommended by government health ministries or other national and international expert bodies, e.g., the World Health Organization. • Recommended minimal intervals between vaccine doses for children.
Geriatric vaccination schemes and schedules based on comorbidities	• Recommended geriatric vaccination schedules in the context of existing comorbidities such as cancer, chronic kidney disease, chronic liver disease, chronic kidney disease, heart conditions, dementia and diabetes.
Mandatory vaccines	• Contexts where vaccination is mandatory as required by laws or government directives, e.g., before international travel.
Pharmacovigilance of vaccines in monitoring and management	• Pharmacovigilance and vaccine safety programmes in ensuring vaccine safety.

5.4 Associated skills for practitioner pharmacists in vaccination-related roles

Table 7. Skills, techniques, and procedures in vaccination[30, 31]

Vaccination-related role or service	Skills, techniques, quality assurance and procedures
Patient education	• Cordially welcomes patients, establishes rapport and answers any questions they may have.

Vaccination-related role or service	Skills, techniques, quality assurance and procedures
	• Provides an explanation of the vaccine and how it will be administered. • Adequately accommodates any language, literacy, cultural or religious barriers, including any special needs that the patient or carer may have to help them feel comfortable and informed about the procedure. • Verifies that the patient has received the vaccine information statements for indicated vaccines. • Conducts screening for contraindications. • Reviews comfort measures and aftercare instructions with the patient, allowing for any questions. • Uses the ABC framework to dispel vaccination myths. • Adopts the SHARE framework[29] in tackling vaccine hesitancy.
Patient advocacy and communication	• Builds trust and confidence with the community and establishes the crucial nature of vaccines. • Advises immunisation committees and engages in multidisciplinary vaccination campaigns. • Applies health promotion and disease state management aspects in vaccination advocacy and education. • Addresses vaccination concerns and beliefs in a respectful manner and develops group-specific materials to address patients' concerns. • Participates in or conducts regular assessments of immunisation coverage rates in their area of practice.
Medical protocols	• Identifies the location of requisite medical protocols that may be useful to the vaccination process. • Identifies the location of medicines to use in case of anaphylaxis, their administration technique, and situations where they would be necessary. • Maintains up-to-date first aid and cardiopulmonary resuscitation (CPR) certification. • Reports needlestick and other sharps injuries and maintains a sharps injury log. • Makes use of a sharps bin for used needles, syringes and vaccine containers. • Coordinates vaccine delivery with other preventive-healthcare services for children, adolescents and adults. • Implements quality improvement programmes to improve immunisation information systems and increase immunisation coverage.
Vaccine handling	• Checks vial expiration date before administration. • Monitors vaccine vial monitor thermochromic labels to ensure vaccine vials are kept in their safe temperature range. • Double checks vial label and contents before drawing up and carries out visual inspection of vaccine for any obvious defects. • Maintains aseptic techniques throughout the administration process. • Shakes vaccine vial or reconstitutes with diluent supplied. Also inverts vial and draws up the correct dose of vaccine. • Labels each filled syringe or uses a labelled tray for ease of identification. • Handles vaccine properly, including protection from light where necessary, and adequately logs refrigerator temperature.
Client assessment	• Conducts appropriate client assessment before vaccination, including health status; vaccine history; contraindications; and adverse event history. • Determines high-risk eligibility for additional vaccines. • Identifies and responds to unique immunisation needs of special population groups e.g., children, immunocompromised patients, elderly, pregnant/lactating. • Obtains appropriate consent from patients aged 18 years of age and over to receive the vaccine. For paediatric patients, appropriate consent has to be obtained from a parent or legal guardian.
Administering vaccines	• Rechecks prescription or schedule against prepared syringes. • Washes hands and puts on disposable gloves to maintain aseptic techniques. • Identifies the appropriate route of administration for each vaccine. • Positions patient and locates anatomical site specific for the route of administration. • Prepares the administration site with alcohol wipes and allows the alcohol to dry. • Controls disinfected area with free hand and inserts needle quickly and straight into the skin. Aspires, and slowly injects content of the syringe into the skin before taking the needle out quickly and disposing of it in the sharps bin. • Uses steady pressure to inject vaccine and withdraw needle at the angle of insertion. • Properly disposes of needle and syringe in sharps container. • Properly disposes of vaccine vial. • Encourages comfort measures before, during and after the procedure.

Vaccination-related role or service	Skills, techniques, quality assurance and procedures
	• Makes use of screening tools such as questionnaires to identify vaccination opportunities in patient populations.
Documentation	• Fully documents each immunisation in patient's chart, including date, lot number, manufacturer, site, date and name or initials. • Makes use of computers to call up patient records, assess what is due and update computer immunisation history. • Asks for and updates patient's record of immunisation and reminds them to bring it to each visit or access their electronic immunisation records. • Adequately uses reminder and recall systems where available for patient follow-up.
Multidisciplinary patient-centred care	• Effectively communicates and works with other healthcare providers to promote vaccination uptake and immunisation coverage. • Individualises vaccination therapy through administration of standardised questionnaires to patients. • Identifies and targets patients who are at high-risk of vaccine-preventable diseases and their complications. • Works collaboratively with other healthcare professionals to improve patient outcomes. This includes assessing and recommending appropriate vaccines, administering the vaccine, and reporting administered vaccine to primary care providers or vaccination recording systems.
Ensuring vaccine safety	• Adequately handles adverse reactions to vaccines. • Identifies the cause of the most common adverse reactions post-administration. • Reports any significant adverse effect to the national or regional pharmacovigilance units. • Implements good pharmacy practice standards throughout the vaccination process
Ethical service provision	• Serves the healthcare needs of patients and contributes to efficient health systems while considering professional ethics as a guide to access and use of patient data.
Vaccine policies and regulations	• Facilitates or participates in national and global routine immunisation programmes and practices. • Contributes to research projects related to vaccines through data sharing, data collection and other methods. • Makes use of available vaccine financing programmes minimising patient out-of-pocket immunisation expenses.
Vaccine production and regulation	• Facilitates or participates in vaccines manufacturing and quality control testing processes. • Implements good manufacturing practice standards throughout the vaccine production processes. • Provides regulatory oversight to the entire manufacturing process from start to finish.

5.5 Expected learning outcomes of CPD courses or programmes in vaccination-related roles in pharmacy

Practitioners involved in implementation of vaccination services need to have adequate knowledge and skills to ensure safe and efficient vaccine administration, monitoring and collaborative interactions with patients and other healthcare workers. FIP recognises that training and professional programmes for pharmacists and health workers play a key role in the development and maintenance of competence in this area. It is recommended that training and professional programmes in the form of CPD include educational material and training on related existing and future pharmacist roles in vaccination. Underpinned by the FIP knowledge and skills reference guide for practising pharmacists, training programmes would focus on vaccination-related roles and services in pharmacy, and at the completion of training a practitioner should be able to demonstrate knowledge and apply skills in the following areas:

- Advocacy;
- Patient education;
- Communication and collaborative strategies;
- Vaccine safety;
- National vaccination schemes (and international recommendations);

- Supply chain management;
- Record keeping and facilitation of appointments;
- Vaccine administration;
- Ethical service provision; and
- Vaccine production and regulation.

Table 8. Learning outcomes of CPD courses or programmes in vaccination*

Vaccination-related role or service	Learning outcomes At the completion of training on vaccination-related roles and services in pharmacy, a practitioner should be able to:
Advocacy	• Demonstrate knowledge and understanding of the various types of advocacy in their area of practice. • Demonstrate knowledge and understanding of health promotion, public health and disease prevention, and disease state management services. • Demonstrate knowledge and understanding of the reminder and recall systems of follow-up. • Demonstrate knowledge and understanding of the importance of adherence to vaccination schedules.
	• Actively build trust with their community and establish the crucial nature of vaccines and their public health benefits. • Advise immunisation committees on the best ways to implement local vaccination programmes. • Actively engage in multidisciplinary vaccination campaigns. • Apply health promotion, public health disease prevention and disease state management aspects in advocacy and education on vaccination. • Actively participate in reminder and recall systems to ensure that vaccination schedules are adhered to. • Actively contribute to vaccination coverage and overcome challenges involved in vaccination compliance.
Evidence-based patient education	• Demonstrate knowledge and understanding of latest research findings and recommendations (e.g., during pandemics and outbreaks). • Demonstrate knowledge and understanding of aspects of evidence-based vaccination information and common myths on vaccination. • Demonstrate knowledge and understanding on research and evaluation methods and processes.
	• Actively build individual and societal trust in vaccines as essential medicines. • Make use of the ABC framework to dispel-vaccination myths. • Participate in scientific studies aimed at determining consumption, costs and impact of vaccines on a specified population. • Obtain, analyse and interpret data corresponding to the vaccine supply process.
Communication and collaborative strategies	• Demonstrate knowledge and understanding of roles that other healthcare providers play in ensuring vaccine access and safety. • Know and understand the importance of vaccination against multiple diseases among healthcare providers. • Demonstrate knowledge and understanding of patient-centred interactions and the importance of patient involvement. • Demonstrate knowledge and understanding of patient-centred care and individualisation of vaccine therapy. • Demonstrate knowledge and understanding of communication etiquette, and verbal and non-verbal cues that are important in patient management. • Demonstrate an understanding of health promotion methods. • Demonstrate awareness of at-risk population groups and the appropriate considerations for each group in vaccination. • Demonstrate knowledge and understanding of ways of building vaccine confidence among general and at-risk populations.

Vaccination-related role or service	Learning outcomes At the completion of training on vaccination-related roles and services in pharmacy, a practitioner should be able to:
	• Demonstrate awareness of religious and cultural diversity among their communities.
	• Effectively communicate and work with other healthcare providers to promote vaccination uptake among patients. • Actively engage, inform and advocate vaccination among health care providers. • Utilise their communication skills and expertise in expanding vaccine coverage and improving vaccine compliance. • Individualise vaccination therapy by administering standardised questionnaires to patients. • Utilise their skills and expertise in expanding vaccine coverage and vaccine compliance among patients. • Apply health promotion methods in improving vaccination coverage in their area of practice. • Actively identify and target patients who are at high-risk of vaccine-preventable diseases and their complications. • Apply communication skills and teamwork to counsel patients, advocate vaccination and improve vaccine confidence among patients. • Address vaccination concerns and beliefs in a respectful manner and develop group-specific material to address patients' concerns and beliefs.
Vaccine safety	• Demonstrate knowledge and understanding of the various types and subtypes of vaccines available in their region or country of practice. • Demonstrate knowledge and understanding of vaccine components and their role in vaccine composition. • Demonstrate knowledge and understanding of the most likely adverse reactions following immunisation and their likely causes. • Demonstrate knowledge and understanding of the signs and symptoms of common adverse reactions and ways to minimise them. • Demonstrate knowledge and understanding of reporting mechanisms for adverse reactions that may occur after vaccination.
	• Apply knowledge acquired in patient management, education and handling of adverse reactions. • Effectively identify the cause of the most common adverse reactions post-vaccination and effectively manage them. • Report and follow up on adverse events attributable to vaccines to national or regional pharmacovigilance units. • Report medication errors related to vaccines.
National vaccination schemes	• Demonstrate knowledge and understanding of national and global routine immunisation strategies and programs.
	• Facilitate or participate in national and global routine vaccination programmes and practices.
Supply chain management	• Demonstrate knowledge and understanding of various vaccine supply chain stages. • Demonstrate knowledge and understanding of roles that a pharmacist can play in supply chain management to improve access and vaccination coverage. • Demonstrate knowledge and understanding of the ideal cold chain storage conditions for certain vaccines (e.g., COVID-19).
	• Actively participate in the supply chain to ensure increased vaccination coverage. • Ensure safety and quality of vaccines under their care.
Record keeping and facilitation of appointments	• Demonstrate knowledge and understanding of the importance and use of vaccination documents available in their area of practice. • Demonstrate knowledge and understanding of good pharmacy practice standards.

Vaccination-related role or service	Learning outcomes At the completion of training on vaccination-related roles and services in pharmacy, a practitioner should be able to:
	• Demonstrate knowledge and understanding of patient record keeping and reporting to vaccine national registries.
	• Document, properly maintain and archive vaccination records. • Implement good pharmacy practice standards throughout the vaccination process. • Document, maintain and report on vaccines administered to the national registries (where available).
Vaccine administration	• Demonstrate knowledge and understanding of available vaccine dosage formulations. • Demonstrate knowledge and understanding of hand hygiene requirements and procedures throughout the vaccination process. • Demonstrate knowledge and understanding of materials required before vaccine administration. • Demonstrate knowledge and understanding of vaccine administration techniques as they correspond to their route of administration. • Demonstrate knowledge and understanding of methods of managing acute adverse reactions during and after vaccine administration. • Demonstrate knowledge and understanding of various considerations for specific risk groups during vaccine administration. • Demonstrate knowledge and understanding of the need for immediate disposal of used materials and infectious waste after vaccine administration.
	• Effectively screen and select patients eligible for vaccination (supported by screening tools such as questionnaires). • Effectively prepare all requisite vaccine administration and anaphylaxis management supplies before vaccination to ensure smooth provision of the service. • Ensure and maintain good hand hygiene practices before, during and after vaccine administration. • Safely administer vaccines through the correct administration route. • Apply group-specific considerations and ensure safe and effective vaccine administration. • Effectively manage acute adverse reactions during and after vaccine administration. • Promptly and effectively dispose of used materials and infectious waste after vaccine administration.
Ethical service provision	• Demonstrate knowledge and understanding of the pharmacy practice code of ethics.
	• Serve patients' healthcare needs and contribute to efficient health systems within the confines of professional ethics as a guide to access and use of patient information.
Vaccine production and regulation	• Demonstrate knowledge and understanding of vaccine manufacturing, quality control tests, good manufacturing practices, and regulatory aspects of vaccine manufacturing
	• Facilitate or participate in vaccine manufacturing and quality control testing processes. • Facilitate or participate in good manufacturing practice standards through the vaccine production processes. • Actively provide regulatory oversight to the entire manufacturing process from start to finish.

* The table contains knowledge-based learning outcomes (shaded in blue) and application-based learning outcomes.

5.6 Key insights and concluding remarks

Pharmacists play an invaluable role in the provision of vaccination and related roles and services. Despite the fact that pharmacy-based vaccination scopes of practice and regulatory infrastructures may vary between nations (including jurisdictions within nations) and regions, pharmacists remain key players in ensuring the safe supply and administration of vaccines. They are also crucial in leveraging their position to educate and advocate vaccination to their communities, fellow pharmacists and pharmacy students[32] as a public health priority. As such, serious and ongoing efforts are evident to further advance the role of pharmacists in vaccination in different regions[33] — to develop new policies and instigate regulations to authorise pharmacist-led vaccination services and equip the pharmaceutical workforce with the knowledge and skills required to fulfil their roles. Furthermore, there is a need to empower pharmacists to take up vaccination roles, to support the development and maintenance of competence and workforce development and evolve the graduate pharmacist knowledge and skillset building on undergraduate education (as described in Chapter 5).

The following key insights, derived from various FIP resources[5, 8, 10, 11, 15, 16, 31, 32] will support the development and implementation of robust training, guidelines, and transformative CPD programmes that are focused on improving the competence and capacity of practitioners in vaccination.

1. Needs-based approach to addressing education, CPD and training gaps

CPD on vaccination should be focused on addressing local and national needs, which should be reflected in individual professional development needs and learning endeavours.[29]

- Pharmacists play a critical role in expanding immunisation services and meeting urgent needs during outbreaks and pandemics.[33]
- CPD is lifelong and must be relevant to one's area of practice. As such CPD on vaccination should focus on addressing individual professional needs and provide a holistic approach to gaining knowledge, learning skills and embracing attitudes and values that allow pharmacists to satisfactorily execute their vaccination roles.

2. Foster national and international collaborations on vaccination training projects

Collaboration on vaccination training projects for practising professionals allows for:

- Reduction in skill gaps in immunisation between high-income and low-income countries;
- Sharing of resources to allow the development of training programmes on immunisation for countries unable to create one for themselves; and
- Increased inclusion of relevant international organisations, such as the WHO, UNICEF and FIP, in lobbying key decision makers to legalise pharmacy-based vaccination.

3. Quality assurance and accreditation of training programmes

CPD programmes on vaccination require accreditation to demonstrate that the learning activities have achieved the required standards and benchmarks set by regulatory or professional bodies. This not only ensures that the learning value is of high quality but also that it meets the expectations of practitioners, employers and the community at large. Accreditation of training courses and programmes facilitates standardisation of key knowledge and skills required to upskill.

4. CPD providers and the FIP Seal for programmes

The FIP Provision and Partnerships Programme provides a global platform to help FIP members address professional support and development of the pharmaceutical workforce according to local and national needs and priorities. FIP can identify with members transformative opportunities to accelerate the advancement of pharmacy across all sectors and roles. By offering a global platform for collaboration and partnerships among members and partners, FIP provides an opportunity to bridge training and professional development gaps.

In 2021, following expert consultation and an iterative process, FIP developed criteria to assure the quality of professional development and training programmes and their alignment with FIP's mission, goals and the DGs. The overall quality and alignment of a programme is recognised by the FIP Seal. Application forms and details of the process to be followed are available to interested parties to undertake self-assessment for the FIP Seal upon request (email Dr Dalia Bajis at dalia@fip.org) and in the FIP handbook for providers of programmes[35].

5. Addressing national or organisational barriers to providing pharmacists with the support and training opportunities in vaccination

Some of the organisational and national barriers to providing pharmacists with support and training needed for vaccination include:

- Perceived lack of competence on vaccination by pharmacists and other healthcare providers;
- Lack of appropriate facilities in the community pharmacy for vaccination;
- Economic unsustainability; and
- Lack of supporting legislation or guidelines for pharmacy-based vaccination.

Tackling these barriers will require the implementation of national and local-specific enabling factors that have already been thoroughly outlined in the FIP Transforming Vaccination programme.[33] Some of these enabling factors relevant to CPD include:

- The development of postgraduate vaccination qualifications to make pharmacist competent to administer vaccines;
- Collaboration between all healthcare professionals to ensure improved vaccination coverage;
- Creation of guidelines for vaccination by pharmacists beyond non-obligatory vaccines such as the influenza vaccine;
- Creation of a framework for pharmacist roles in vaccination within healthcare systems;
- Accreditation of training programmes on vaccination for pharmacists;
- Education to empower pharmacists as accountable persons in vaccination; and
- Training on the technical requirements for vaccination at the pharmacy, ie.g., patient records and cold chain maintenance.

In conclusion, the importance of vaccines as lifesavers cannot be overstated. Similarly, pharmacy workforce readiness is paramount to the effectiveness and impactful change needed in global health.[13,36,37] FIP recognises that pharmacy-based vaccination is key in improving and sustaining immunisation coverage around the world. It also recognises, and emphasises, the potential that pharmacy-based vaccination can have in supporting global health goals that are geared towards improving vaccination and, most importantly, tackling communicable and non-communicable diseases. Therefore, it remains the imperative of FIP to provide frameworks and resources that allow practising pharmacists around the world to adequately execute their role as vaccinators.

The expanded and comprehensive knowledge, skills, and learning outcomes outlined above are geared towards providing pharmacists with a baseline against which they can measure their capacity in vaccination and vaccination-associated roles. This, in combination with the FIP Global competency framework, is meant to be a point of reference for CPD programme design, delivery and standardisation. As comprehensive as the above guides are, we acknowledge that they may not be entirely relevant to all areas of pharmacy practice. As such we encourage practising pharmacists and CPD providers to individualise their programmes to fit the roles and needs of practising pharmacists.

For its part, FIP remains an unequivocal supporter and advocate of CPD in vaccination for practising pharmacists.

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