FIP digital health in pharmacy education

Developing a digitally enabled pharmaceutical workforce

2021

20 DIGITAL HEALTH

FIP Development Goals

fip
International Pharmaceutical Federation

Colophon

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Cover image A-image

Recommended citation International Pharmaceutical Federation (FIP). FIP Digital health in pharmacy education. The Hague: International Pharmaceutical Federation; 2021.

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Forewords

Foreword by the FIP President

Welcome to the "FIP digital health in pharmacy education" report.

Healthcare systems around the world have entered a decade of sweeping digital revolution catalysed by the coronavirus disease (COVID-19) pandemic. Digital healthcare has been becoming, more than ever, common practice in hospitals, community pharmacies and many other sites of pharmaceutical care, as well as an integral part of pharmaceutical research and development.

It is important to see digital health as a supportive mechanism and part of existing healthcare systems, rather than as a stand-alone topic. Digital health is increasingly seen as an integral part of the solutions to many health and well-being challenges, enabling effective integration of care. Digital health seeks to improve people's ability to self-manage their health and well-being while it helps healthcare professionals to deliver high-quality, safe, efficient, and cost-effective care.

We have seen that, in order for healthcare professionals to benefit from digital health technologies, uptake is critical, and they should adopt and appropriately adapt them into their practice. An increased focus, concerted action and investments are needed on education, training and skills development for healthcare professionals to understand and use digital health to realise the anticipated benefits.

Education is at the centre of advancing our profession to improve the health and well-being of our populations. There is no "health for all" without workforce, and there is no workforce without education. A confident, capable, agile, and digitally enabled pharmaceutical workforce is required to make use of the full potential of digital health. Only with education and training can the pharmaceutical workforce keep up with the pace of digital health transformation.

This report is a great resource in providing a global picture on the areas of focus for digital health education and skills development of the pharmaceutical workforce. The intention is to provoke further immediate actions and provide good practices to readers that may fit into their situations. FIP will undertake further work concentrating on the pharmaceutical sciences education and scientific workforce as well as the digital health applications in pharmaceutical science.

The task to become digitally enabled and increase adoption and adaption of digital health is now with pharmacists, pharmaceutical scientists, students, educators, professional organisations and all pharmacy leaders, and FIP commits to leading the way to this promising future of healthcare as "One FIP" — with trust, solidarity and actions.

Long live pharmacy! Long live FIP!

Dominique Jordan
FIP President

Foreword by the Chair of the FIP Technology Forum

We are living in fascinating times.

Digitisation brings unprecedented transformation to the healthcare landscape and compels us to fully rethink healthcare for the digital age. This is a challenging exercise.

The COVID-19 crisis has provided circumstantial evidence on how IT developments in interoperability and the use of e-Health and m-Health technologies allow systems and processes to be more fluid, more transparent, more accessible and closer to patients' and health professionals' expectations. The use of such technologies as e-prescribing, electronic health records, telehealth, telecare and telemedicine, as well as the use of mobile health, wearables, remote monitoring sensors or artificial intelligence (enabled medical devices) has demonstrated having a better continuity of healthcare for patients which would not have been possible otherwise due to lockdown travel restrictions. This finally resulted in more patients being treated.

As technological advances and innovations are expanding applications of digital technologies in healthcare is a trend which is not going to stop. An important aspect is that these new technologies are becoming more and more complex and difficult for health professionals to embrace, particularly in case of convergence of digital technologies with other technologies — the future 3D printing combined with genomic technology being one example. Moreover digital solutions continuously need to be updated regularly, sometimes requiring alignment of their potential impact on the digital environment.

In the light of these considerations, there is a risk that the rate of technology innovation and its complexity may outpace healthcare providers' ability to integrate it and healthcare professionals' ability to implement and adopt it. This will be particularly true in case of a disruptive technology — a technology which changes the work process model used so far.

Here lies the purpose of this FIP report. Here is the concern of FIP in the workforce element of FIP Development Goal 20 (digital health). And here is one of FIP Pharmaceutical Technology Forum's major topics of reflection.

Incorporating digital health into pharmacy education is key for future pharmacists and for the future of pharmacy, and willingness to adopt digital health technologies is addressed within this report. Technology readiness, open mindedness and adaptability will be decisive personality qualities for future generations of pharmacists willing to enter the digital world. Not only must they be competent in their knowledge and skills, they must also feel open, secure, comfortable and confident about technology in order to be creative and innovative as they enthusiastically usher pharmacy towards its digital future.

"Digital technologies will shape the future of global health," states the World Health Organization in its strategy on digital health 2020–2024 report. As WHO Director-General Dr Tedros Adhanom Ghebreyesus said: "Digital technologies are vital tools to promote health, keep the world safe, and serve the vulnerable."

May our future pharmacists use their digital expertise to accelerate progress in health at the global level, for FIP DG 20, and ultimately on the way towards universal health coverage.

Jacqueline Surugue
Vice President of FIP
Chair of the FIP Pharmaceutical Technology Forum

Foreword by the Chair of FIP Education

The Fourth Industrial Revolution is upon us and has already caused significant changes in our personal and professional lives. The COVID-19 pandemic has accelerated the technological revolution in how we live, communicate, educate and provide healthcare. As my colleagues have noted in their foreword comments, technology is now embedded in many facets of healthcare including pharmacy and enables advances in science and patient care. But advances in technology come with increasing rapidity and keeping pace with those that should be adopted and adapted to improve health can be challenging. Education and training of students and practitioners will necessarily be a continuous process to remain current with advances in health technologies to assure we optimise the benefits of digital health.

Digital health education is a major focus of FIP Education (FIP*Ed*) and in addressing FIP Development Goal 20: Digital health. This project on "Digital health in pharmacy education" lays the foundation of our current status in pharmacy education for us to build upon and provides a guide for our future work in assuring the pharmacy workforce is prepared to manage and utilise new technologies to improve health.

As case studies in the report exemplify, there are two fundamental aspects to digital health education. The first aspect of digital health education is the use of educational technologies to enhance the learning process for pharmacy and pharmaceutical science education. These technologies range from learning management systems to remote learning platforms, virtual reality, gamification, adaptive learning and assessment tools and more.

The second and wider ranging part of digital health education is learning about digital health technologies, and how to evaluate and use them to optimise health and wellness. This includes such areas as: health informatics and data science to enable evaluation and analyses of digital health technologies and application of the data generated by such technologies; health information technologies to improve efficiencies and accuracy of pharmacy and healthcare operations; mobile health devices and consumer wearables that monitor health status, including educating the public on the use and limitations of such devices; digital therapeutics and their role in improving medicines use; telemedicine/telepharmacy; the role of machine learning and artificial intelligence in optimising medication therapies and inherent biases that may exist in these applications; predictive therapeutics and precision medicine; regulatory affairs in health technologies; ethical considerations; and more. And interested persons need to learn how to develop technology applications to address gaps in pharmacy and healthcare. One also might ask whether pharmacy should be attracting students from technology fields who have wide knowledge and experience in technologies and also have an interest in digital health but who need to learn about pharmacy and healthcare.

A third and critically important aspect of digital health education is the disparities that exist in education support and expertise throughout the world. It is an issue that needs to be addressed to elevate and enhance global digital health education in pharmacy to assure we have a competent and capable workforce everywhere in the world so as to improve health and wellness of all people.

What is clear from this report is that there are many aspects to digital health education, and it is most likely that we do not have the full spectrum of expertise in all of our pharmacy programmes to meet these needs. To achieve the goal of providing digital health education and training for students and practitioners, we will have to work together, and share our expertise and best practices. FIP and FIP*Ed* serve as an ideal platform to accomplish this laudable and vital goal.

Ralph J. Altiere
FIPEd Chair

Preface

The digital era is rapidly evolving, providing pharmacists and pharmaceutical sciences across the world with new opportunities to provide and improve pharmaceutical care. Implementation of new technologies in daily pharmaceutical practice, however, is still relatively limited even though current times require pharmacists to find alternative ways of providing pharmaceutical care. Implementation largely depends on the willingness and ability to use these tools by pharmacists.

Pharmacy schools can play an important role in accelerating uptake by educating the future generation of pharmacists. They should not only teach them adequate knowledge about the technical aspects of these technologies, but also help them understand how to integrate these technologies in pharmaceutical care. Pharmacy and pharmaceutical sciences education should also include aspects of change management, for example, and focus on important competencies such as leadership.

Building on the FIP Technology Forum's work to date and FIP's report on "Use of mobile health tools in pharmacy practice", this "FIP Digital health in pharmacy education" report investigates and describes the readiness, adaptability and responsiveness of education programmes to train the current and future pharmaceutical workforce on digital pharmaceutical care. This report showcases examples of ongoing initiative and explores students' and pharmacists' needs for further training and education on digital health.

Chapter 1 emphasises how digital technologies have transformed health paradigms. It focuses on the impact of digitalisation on the provision of pharmaceutical care and the pharmacy profession, with a particular focus on COVID-19 and pharmaceutical policies. In this chapter, we argue that the unique competency profile of pharmacists will enable them to support and lead patients adequately, with the right digital tools.

Chapter 2 describes the current state of digital health education across different disciplines. It links Sustainable Development Goal 4 (quality education) to FIP Development Goal 20 (digital health). It also provides an overview of different perspectives — student and faculty perspective, among others — on digital health in pharmacy education.

In chapter 3, we describe the methodology used, including the survey which was circulated among members of FIP Academic Institutional Membership, individual members of FIP across all sectors, including practitioners and faculty members, and pharmacy students. This chapter presents the main findings per surveyed group, discusses these findings and provides insights.

Chapter 4 provides an overview of case studies across all WHO regions: course descriptions, examples of assignments and learning activities on digital health from pharmacy schools. The case studies indicate which outcomes have been achieved and what lessons have been learned. These examples can serve as a model for other schools or universities to develop their own programmes.

Finally, in the "way forward" chapter, we build on all the findings of this report and outline areas of development for the long-term vision of digital health in pharmacy education and practice.

I hope you will enjoy reading this report and will be inspired by its findings to identify gaps in existing education programmes and to increase knowledge and skills of students and practitioners alike to incorporate digital health in education and practice. It is clear that there is an urgent need for more education in this area in the upcoming decade(s).

I would like to express my sincere thanks to the report project team members, authors and FIP officers who have provided their contributions, the FIP Technology Forum, the FIP Young Pharmacists' Group, and the International Pharmaceutical Students' Federation, whose members have contributed to development of this report or provided valuable feedback on its content. I hope that your heartfelt enthusiasm for this subject will inspire pharmacy schools, faculty members and others around the globe to introduce and strengthen education in the field of digital health.

Prof. Aukje Mantel-Teeuwisse
FIP Digital Health in Pharmacy Education Report Chair

Acknowledgements

The development of this report was led by the co-editors Aukje Mantel-Teeuwisse (The Netherlands), Bidhata Khatri (India), Sherly Meilianti (Indonesia and United Kingdom) and Nilhan Uzman (The Netherlands).

FIP thanks the "FIP Digital health in pharmacy education" survey and report core, analysis and extended team members for leading and supporting the development and dissemination of the survey and the report: Aukje Mantel-Teeuwisse (The Netherlands), Sherly Meilianti (Indonesia and United Kingdom), Nilhan Uzman (The Netherlands), Bidhata Khatri (India), Jaime Acosta Gomez (Spain), Whitley Yi (United States), Lilian Azzopardi (Malta), Claudia Rijcken (The Netherlands), Karima Bennara (Algeria), Gizem Gulpinar (Turkey), Hamsa Hassan, Alison Ubong Etukakpan (Nigeria), Acacia Leong Pik Kay (United Kingdom), Timothy Aungst (United States), Parisa Aslani (Australia), Ardalan Mirzaei (Australia), Ayodeji Matuluko (Nigeria), Renly Lim (Australia) and Xiao Yu Wang (Canada).

This report was co-created with input from the following co-authors (in order of appearance): Bidhata Khatri (India), Asmaa Alhaqan (Kuwait), Dalia Bajis (Australia), Shepard Mhlaba (Zimbabwe), Ian Bates (United Kingdom), Jaime Acosta Gomez (Spain), Claudia Rijcken (The Netherlands), Timothy Aungst (United States), Lilian Azzopardi (Malta), Karima Bennara (Algeria), Sherly Meilianti (Indonesia and United Kingdom), Whitley Li (United States), Xiao Yu Wang (Canada), Aukje Mantel-Teeuwisse (The Netherlands) and Nilhan Uzman (The Netherlands).

FIP thanks FIP Technology Forum chair Jacqueline Surugue (France) and all FIP Technology Forum members for their support and engagement in the project and the following colleagues for their specific input and feedback both on the survey and report: Zuzana Kusynova (The Netherlands), Paul Fahey (Ireland), Eeva Teräsalmi (Finland), Carla Beaton (Ireland), Sini Eskola (Belgium) and Ema Paulino (Portugal).

FIP acknowledges the work of translators and reviewers who supported the translation of the survey and its findings into eight different languages: Jaime Acosta Gomez (Spain), Jorge Schlottke (Argentina), Gonzalo Miguel Adsuar Meseguer (Spain), Yulia Ladutko (Russian Federation), Clement Haeck (France), Gizem Gulpinar (Turkey), Xiao Yu Wang (Canada), Dalal Hammoudi (Lebanon), Abla Albsoul (Jordan), Pierre Moreau (Kuwait), Mohamad Rahal (Lebanon), Silvana Leite (Brazil), Monerah Al-Soraj (Kuwait), Omama Al-Farisi (Kuwait) and Khaled Orabi (Kuwait).

FIP acknowledges the work of FIP YPG media team 2019–2020 for their support with the media materials on survey and the report.

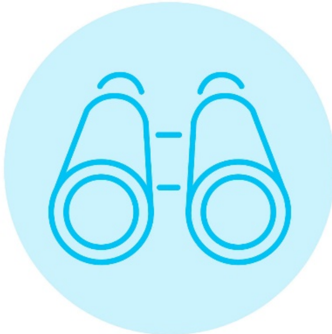
The report was reviewed by FIP President Dominique Jordan (Switzerland), FIP Chief Executive Officer Catherine Duggan (The Netherlands) and FIP Education executive committee members Ralph J. Altiere (United States), Pierre Moreau (Kuwait), Ian Bates (United Kingdom), John Pieper (USA), Wayne Hindmarsh (Canada), Ema Paulino (Portugal) and Giovanni Pauletti (United States).

FIP thanks respondents of the FIP digital health in pharmacy education survey. Academic institutions that participated in the survey and requested to be acknowledged in the report are listed in Annex 1.

Executive summary

Setting the scene

- Digital health technologies save lives, improve health and well-being, increase access to care and lead to effective health systems and healthier populations. With increased complexity of health conditions and ageing populations, digital health can be the key to many unmet needs in health and related services.
- Digital health is a top priority across major policy and health organisations focusing on adoption of digital health and improving standards of digital literacy. The World Economic Forum has emphasised that "few industries have the potential to be changed so profoundly by digital technology as healthcare".
- Recent technological achievements have revolutionised clinical practice, from prevention through diagnosis, monitoring to disease management, and enabled unprecedented public interest and engagement in self-care and well-being.
- The COVID-19 pandemic accelerated the digital health transformation, which will have a lasting impact on healthcare services. Important lessons can be learned from this digital health transformation.



"Few industries have the potential to be changed so profoundly by digital technology as healthcare."

Digital health and education

Many digital health technologies strongly depend on uptake and appropriate use by healthcare professionals. It is evident that an increased focus, concerted action and investments are needed in education, training and skills development for healthcare professionals to understand and use digital health to realise the anticipated benefits.

- Universities and education providers have been providing digital health education with most of the programmes being focused on certificate provision models. There is a deficit in digital health education and training, and a national focus or a professionally driven initiative can be the impetus for integration into education.
- Pharmacy as a profession historically has embraced information technologies. Therefore, it has the ideal predisposition and competencies to provide increasingly more digital health services to patients. A confident, capable, agile and digitally enabled pharmaceutical workforce is required to make use of the full potential of digital health. Only with enhanced education and training can the pharmaceutical workforce maintain the pace of digital health transformation.
- Digital health is mostly shaped by experts outside of the healthcare space and this represents an opportunity for interdisciplinary collaboration to develop a digital health education framework.
- Pharmacy and pharmaceutical sciences education must be needs-based to meet existing and emerging requirements in digital health. These requirements must reflect the needs in all sectors of and career levels in pharmacy and pharmaceutical sciences, from clinical pharmacy to drug research, of all members of the pharmaceutical workforce putting patients and the community at the centre.
- Early career pharmacists and pharmaceutical scientists and students are the most embedded within the digital transformation era. Their engagement with digital health education processes

"Health technologies strongly depend on uptake and appropriate use by healthcare professionals."

represents significant opportunities as they support the adoption and promotion of these digital health technologies.
- Few studies have been conducted to understand the digital health skills, knowledge and competencies among undergraduate pharmacy students. Since most of the studies conducted are from countries such as United States, United Kingdom and Australia, the global situation of digital health in pharmacy schools is not fully understood.

Key findings from FIP digital health in pharmacy education survey

Readiness and responsiveness of pharmacy education and training

- A large proportion of pharmacy schools and faculties do not offer any digital health education. Similarly, only a small fraction of surveyed students and practitioners have received digital health education or training as part of their continuous education.
- There was a misperception among the surveyed students and faculties, with digital health education and online education being considered interchangeable terms.
- Around half of the academics agreed that their students were equipped with the competencies to deliver digital health services and their individual school was able to readily identify and include new digital health skills into the curriculum as these emerge in practice. While this finding shows progress towards digital health education, there is still much to do in establishing a ready and responsive pharmacy education to meet the fast-paced changes in digital health.
- Integrating digital health in undergraduate pharmacy initial education is a critical strategy to increase digital health competencies overall as it is likely to promote greater awareness and life-long learners of digital health. There was a greater likelihood of receiving digital health education as part of continuous professional development if pharmacists had previously received digital health education in school.
- The most common challenges related to digital health education reported by schools and faculties were a lack of experts followed by a lack of resources.

"There is still much to do in establishing a ready and responsive pharmacy education to meet the fast-paced changes in digital health."

Knowledge and skill gaps of the pharmaceutical workforce

- Practitioners' responses suggested a lack of familiarity with emerging digital health technologies such as blockchain technology, bots, digital medicines and artificial intelligence.
- A key gap in digital health education is the skillset and knowledge of how to apply technology to solve existing clinical problems and improve care.
- Expectations of practitioners around the clinical benefits of digital health in practice remained low. This might be because implementation of digital health tools in clinical care were among the least likely concepts to be included in pharmacy education, based on academics' perspectives.
- Existing digital health education appears to be tailored more towards providing administrative and functional competencies for facilitating business processes and improving operational efficiency.

"Responses suggested a lack of familiarity with emerging digital health technologies."

Challenges and enablers for robust digital health education and skills development

- Pharmacy schools, faculties, students and practitioners all indicated a need for support from national organisations, schools, workplaces and student associations to provide guidance, training, infrastructure and education resources on digital health.
- Guidance on how to implement digital health tools was a key need cited by students and practitioners.
- Lack of enabling policies, lack of access to digital health tools and data, as well as technical limitations were reported as the biggest challenges in using digital health in practice.

"Guidance on how to implement digital health tools was a key need cited by students and practitioners."

The way forward

This report is first of its kind in providing a global overview on digital health in pharmacy education to investigate the readiness and responsiveness of pharmacy education and identify the knowledge and skills gaps of the pharmaceutical workforce. We believe this report will catalyse further research and developments in the area to increase the adoption of digital health by the pharmaceutical workforce.

The findings of this report are leading to the ways forward presented on the following page.

Capitalising on the benefits of digital health

If digital health is well understood by pharmaceutical workforce, particularly its higher purpose of providing good health and well-being, pharmacists will benefit from the potentials offered by digital health and become designers of it.

Digital health education and training for the pharmaceutical workforce

There has been insufficient attention made to workforce development for implementing new systems of digital health delivery. Employers and universities can unlock the potential of the pharmaceutical workforce through education strategies. Digital health education must ensure provision of experiential and practical elements.

All pharmacy and pharmaceutical sciences students need to graduate with basic knowledge and skills in digital health. In order to upskill and train the existing workforce with digital health skills, continuous education, continuous professional development and specialisation are critically important.

This report provides an initial evaluation of pharmaceutical education and workforce and provides statements more relevant to pharmacy education. Further work and research are required on the scientific workforce as well as on digital health in pharmaceutical sciences education.

The impetus for integrating digital health into pharmacy education and practice

A professionally driven advocacy effort can ensure integration of digital health into pharmacy education and support digital health to be included in educational and accreditation standards.

Developing the digitally enabled pharmaceutical workforce and FIP global curriculum and training resources for digital health education

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Building on the digital literacy competencies in the FIP Global Competency Framework, FIP will be designing and developing a global curriculum and training resources for digital health in initial pharmacy education. This will facilitate national, regional and global implementation of FIP Development Goal 20 (digital health).

1 Digital health

Key messages

- Digital health is a top priority across major policy and health organisations focusing on adoption of digital health and improving standards of digital literacy.
- Recent technological achievements have revolutionised clinical practice, from prevention through diagnosis, monitoring to disease management, and enabled unprecedented public interest and engagement in self-care and well-being.
- The COVID-19 pandemic accelerated the digital health transformation, which will have a lasting impact on healthcare services. Important lessons can be learned from this digital health transformation.
- New digital health technologies must be people-centred, high-quality, evidence-based, effective, efficient for both provider and user, sustainable, inclusive, equitable and trustworthy in order to be integrated into practice.
- Many digital health technologies strongly depend on their uptake and appropriate use by healthcare professionals. It has become essential for healthcare professionals to be equipped with digital health skills to provide new and emerging models of health services.
- Pharmacy historically has embraced information technologies. Therefore, it has the ideal predisposition and competencies to provide increasingly more digital health services to patients.

1.1 Introduction and global perspectives

Author

Bidhata Khatri, FIP Digital Health in Pharmacy Education Report Co-lead, FIP YPG Health and Medicines Information Section Liaison, FIP Health and Medicines Information Section Secretary, India

According to the World Health Organization (WHO), digital health is "the field of knowledge and practice associated with the development and use of digital technologies to improve health". Technology and digital transformation are rapidly changing information ecosystems and health systems design. The utilisation of various digital technologies such as artificial intelligence and machine learning offers great opportunities for improved health services, access to healthcare, health workforce and health outcomes.[1]

While digital health has been around for a while with eHealth (electronic health records) oriented technologies, the rapid growth of technology over the past several years has created a new and exciting field of digital health including mobile health applications (mHealth), wearable technologies, telehealth and telemedicine, artificial intelligence, advanced robotics and genomics. Digital health also encompasses other uses of digital technologies for health such as the internet of things, advanced computing and big data analytics. While these have the potential to bring significant benefits, there are also risks involved, particularly in terms of health inequities, data privacy and limitations of artificial intelligence.[2] Digital health is a broad term and its definition will continue to change as new health technologies emerge.[3]

Patients are getting more attracted towards mHealth solutions, feeling empowered by their ability to manage their health, with easy access to medical information and advice in a convenient, timely and affordable way. Recent studies have demonstrated that patients using digital health technologies are more interested in their health and feel better equipped to have discussions with healthcare providers. Within the next decade, technologies such as telemedicine, smartphone applications, wearables and artificial intelligence (AI) are likely to be widely integrated in healthcare. One study revealed that up to 45% of USA citizens report using a mobile phone or tablet to manage their health.[4]

Health strategists worldwide promote the adoption of digital health to support patient care through collaborative working. The adoption of digital health and standards of digital literacy are key themes of interest at the international level. The current digital health transformation provides an excellent accelerator for reaching the health-related United Nations (UN) Sustainable Development Goals (SDGs). The 2030 Agenda for Sustainable Development highlights that the spread of information and communications technology and global interconnectedness has great potential to accelerate human progress, to bridge the digital divide and to develop knowledge societies.

UN SDGs, particularly SDG 3 (good health and wellbeing), explain that ensuring healthy lives and promoting well-being at all ages is essential for sustainable development. More efforts are needed to fully eradicate a wide range of diseases and address many different persistent and emerging health issues. Digital health provides sustainable health ecosystems, ensures efficiency in health systems and services and this can lead to the achievement of SDG3, healthier populations.

SDG 4 (quality education) promotes change in education and learning systems to match the rapidly changing world with technological shifts.

Achievement of SDG 9 (industry, innovation and infrastructure) can lead to dynamic and competitive economic forces that generate employment and income. Such economic forces can be useful for innovation and can play a key role in introducing and promoting new technologies.[5]

Supporting the SDGs, the impact of digital technologies was highlighted in the UN 75th-anniversary report as one of five megatrends. This megatrend has shaped economic, social and environmental dimensions of sustainable development and can be shaped to maximise its positive impacts for society's benefit. It is also linked to the achievement of many of the UN SDGs.[6]

The WHO has developed a "Global strategy on digital health"[6] to improve health for everyone, everywhere by accelerating the development and adoption of appropriate, accessible, affordable, scalable and sustainable person-centric digital health solutions, developing infrastructure and applications that enable countries to use health data to promote health and wellbeing, and to achieve the health-related SDGs.

The vision explains that digital health will be valued and adopted if: it is accessible and supports equitable and universal access to quality health services; it enhances the efficiency and sustainability of health systems in delivering quality, affordable and equitable care; and it strengthens and scales up health promotion, disease prevention, diagnosis, management, rehabilitation and palliative care, in a system that respects the privacy and security of patient health information.

The vision further seeks to enhance research and development, innovation and collaboration across sectors. It recognises that digital health can significantly change health outcomes if it is supported by sufficient investment in governance, institutional and workforce capacity to enable the changes in digital systems and data use training, planning and management that are required as health systems and services are increasingly digitised. With this essential investment in people and processes, in line with national strategies that lay out a vision for the digitalisation of the health sector, digital health can improve the effectiveness of care.

Harnessing new technologies is one of the top priorities of the WHO's urgent health challenges for the next decade.[1] Exploring the potential of global solutions and shared services should be considered as part of the national health strategy of countries, at the same time as generating evidence on the implications for access, cost, quality, safety and sustainability of applying these global solutions in health systems within vastly different country contexts. It should be borne in mind that implementation of digital health technologies may be difficult to accomplish especially in low- and middle-income countries.[1]

The Organisation for Economic Co-operation and Development (OECD) in its latest report mentioned that digitally enhanced health services can improve access and help move away from reactive towards proactive approaches to preserving health. Health workers could be relieved from time consuming routine tasks and interact better with patients. Patients could become more engaged and improve self-care skills. However, despite some successes as well as the recent acceleration in uptake of digital technologies, successful digital transformation in the health sector requires a complex adaptive change in human skills as well as in the organisation of work and the related legal and financial frameworks.[7]

The World Economic Forum has emphasised that "few industries have the potential to be changed so profoundly by digital technology as healthcare".[8] The COVID-19 pandemic has revealed the urgent need for digital innovation in all areas, including healthcare.[5] There will be important lessons learned from digital health transformation with COVID-19 and it will have a lasting impact on healthcare.

1.2 The FIP perspective

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The FIP Development Goals are a key resource for transforming the pharmacy and pharmaceutical sciences over the next decade globally, regionally and nationally. They align with FIP's mission to support global health by enabling the advancement of pharmaceutical practice, sciences and education and are set to transform pharmacy in alignment with wider global imperatives underpinning the UN SDGs.

In this document, "pharmaceutical workforce" refers to the whole of the pharmacy related workforce (e.g., registered pharmacist practitioners, pharmaceutical scientists, pharmacy technicians and other pharmacy support workforce cadres, and pre-service students/trainees) working in a diversity of settings (e.g., community, hospital, research and development, industry, military, regulatory, academia and other sectors) with a diversity of scopes of practice. FIP Development Goal 20 (digital health) specifically focuses on enablers of digital transformation within that pharmaceutical workforce and on effective processes to facilitate the development of a digitally literate workforce by the following mechanisms:

- Development of courses, training material and experiential learning opportunities in initial education and early career training to prepare a digitally literate workforce;
- Incorporation of digital health and literacy competencies and skills in pharmaceutical competency, advanced and specialist frameworks;
- Development of multidisciplinary learning strategies for digital health literacy that include interprofessional education;
- Provision of opportunities for continuous education and development to ensure the workforce remains up to date with digital health changes and innovations; and
- Incorporation of digital health within workforce development policies, including employment policies such as employment opportunities in digital health sector.[9]

In response to the fast-shifting health landscape, pharmacists will be able to join leaders in health and digital technologies to navigate towards a future of health care that is relevant, sustainable and patient/consumer-centred. However, the pharmaceutical workforce is still significantly lacking in digital skills, and raising these skills must be prioritised by pharmacists, educators, regulators and managers in order to enable the implementation of FIP Development Goal 20 (digital health).

In 2019, the FIP Workforce Development Hub (WDH), working with FIP WDH Global Leads on Early Career Training Strategy (FIP Global Development Goal 2[9]), conducted a review of the 2012 Global Competency Framework (GbCF).[10] Over eight months, the core team (comprising the FIP WDH Director, WDH Leads and external experts) conducted an iterative, consensus-driven review process to update the GbCF. It became apparent that inclusion of enhanced training for digital skills and digital literacy would be extremely valuable for improving patient outcomes.[11] In addition, such skills positively affect pharmacists' professional development and job satisfaction.[12]

A set of four behavioural statements related to competency in digital literacy was included in the updated GbCF,[13] located in the Professional and Personal cluster of the foundation competencies (Figure 1[13]). The behavioural statements describe a generic set of competencies considered necessary for the scope of practice for early career pharmacists (within around three years from licensure); these competencies would also apply to pharmacists needing a baseline guidance on digital competencies. The new foundational competencies represent actions that pharmacists can perform when dealing with digital enquiries/services/products particularly related to digital health provision. These competencies outline what pharmacists may need to identify and manage to critically appraise and participate in digital health, and to maintain privacy and security of digital information. Due to the generic nature of the statements, they can be adopted and adapted to various practice situations and to enrich learning and development opportunities for pharmacists and their teams. These competencies are a useful reference for educators and managers seeking to provide continuing professional development pathways in digital health and technological advances — particularly for early career pharmacists.

Digital heath literacy is a broad concept and it encapsulates a wider set of competencies and skills than those presented in the earlier version of the GbCF. However, a digital health literacy approach can build early career pharmacists' confidence to develop digital skills. The purpose is to better enable pharmacists, in the interests of their patients and clients, to access appropriate data and information and improve the quality and outcomes of healthcare services.

It is vital to consider digital health literacy in undergraduate pharmaceutical education as integral to initial education and training and not as a stand-alone set of topics. Educators and academics can use the GbCF as a mapping tool for competency-based initial education and training.

Without a digitally literate pharmaceutical workforce, innovative advancements will lag in implementation, and without a clear purpose for innovative digital advancement, sustainable and responsive systems aimed to improve primary health care delivery will struggle to emerge. In the "Way forward" chapter of this report, we explain how the findings of the report will build on the GbCF digital literacy competencies.

4. Professional/Personal	
Competencies	**Behaviours**
4.3 Digital literacy	4.3.1 Identify, manage, organise, store, and share digital information
	4.3.2 Critically appraise, analyse, evaluate, and/or interpret digital information and their sources
	4.3.3 Where applicable, participate in digital health services that promote health outcomes and engage with digital technologies (e.g. social media platforms & mobile applications) to facilitate discussions with the patient and others
	4.3.4 Maintain patient privacy and security of digital information related to the patient and workplace

Figure 1: Digital literacy behaviour statements, GbCF Version 2, 2020[13]

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1.3 General overview of digital health and impact of COVID-19

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1.3.1 General overview of digital health

Today, everything is affected by the digital revolution. The impact of new technology on improving the health and well-being of individuals, communities and populations is unprecedented. Recent technological achievements have revolutionised clinical practice, from prevention through diagnosis, monitoring to disease management, and enabled unprecedented public interest and engagement in self-management and well-being.

The past decade has seen a rapid expansion in technology adoption. As of January 2020, 4.54 billion people around the globe were active internet users,[1] while the number of smartphone users worldwide today surpasses three billion and is forecast to further grow by several hundred million in the next few years.[2] As the number of smartphone users grows, big data powers the internet of things (IoT), with connected devices projected to amount to 75.44 billion worldwide by 2025,[3] and as data connectivity evolves into 5G networks and wi-fi capabilities expand, the "big" in big data grows even bigger.[4]

Global health has improved dramatically in recent decades. However, the current model for providing healthcare is being slowly torn apart by the opposing forces of an ageing population and greater restraints on government spending. Maintaining the status quo is not an option. Few industries have the potential to be changed so profoundly by digital technology as healthcare. Regulatory barriers, economic hurdles and difficulties in effectively digitising patient data awaits those who wish to launch pioneering services. To deliver continued improvements to the world's health, healthcare will need to be transformed, with digital playing a vital role. The healthcare system of the future will look vastly different, with a crucial change being the move to "consumer-centric" healthcare, allowing citizens to have much more responsibility for managing their healthcare and that of their families. A truly digital healthcare industry would revolutionise diagnosis and treatment, with a shift in focus to prevention and management. Perhaps the most noticeable changes for a citizen would be that significantly fewer trips to a physician, hospital or pharmacy would be required. Citizens would become more engaged to manage their own health and care. Through self-care and monitoring of vital signs, an individual's health could be continuously tracked. If needed, a virtual care consultation could be arranged, so that citizens could receive advice without leaving their homes. Should further medical care be necessary, the treatment plan would be personalised for each individual, maximising the chances of a successful outcome.[5]

Digital health is defined as the "use of information and communications technologies to improve human health, healthcare services, and wellness for individuals and across populations".[6]

Digital health interventions can be effective tools that help promote better health. Common digital health interventions include those that encourage healthy behaviours, provide management tools for long-term and chronic conditions, or facilitate access to services that improve patient outcomes.[7]

Some of the most common digital health tools, as included in the survey of this report in chapter 3, are summarised in the following graphic:

Electronic health record

An electronic health record (EHR) is a digital version of a patient's paper chart. EHRs are real-time, patient-centred records that make information available instantly and securely to authorised users.

E-prescribing and e-dispensing

e-Prescribing is a prescriber's ability to electronically send an accurate, error-free and understandable prescription directly to a pharmacy from the point of care. It is an important element in improving the quality of patient care. e-Dispensing is defined as the act of electronically retrieving a prescription and giving out the medicine to the patient as indicated in the corresponding e-prescription.

Blockchain

A blockchain is a continuously growing list of records, called blocks, that are linked and secured through the use of cryptography. A blockchain can serve as "an open, distributed ledger" or "shared record book" that can record transactions between multiple parties efficiently and in a verifiable and permanent way.

Online pharmacy

An online pharmacy is an internet-based vendor that sells medicines and may operate as an independent internet-only site, an online branch of "bricks-and-mortar" pharmacy, or sites representing a partnership among pharmacies.

Wearable technology

A wearable healthcare device refers to technology that can be appropriately placed on the body by the end-user and can monitor relevant aspects of health at an actionable standard.

Bots

A bot (also known as a web robot or internet bot) is a software application that uses steps or scripts to automate a task. After adding clinical triage and medical content into a bot framework, the resultant virtual personal health assistants can interact with the user on topics regarding well-being, experienced health, questions on diseases, and information about healthcare interventions.

Mobile applications

Mobile applications can help people manage their own health and wellness, promote healthy living, and provide access to useful information when and where people need it. These tools are being adopted almost as quickly as they can be developed.

Digital medicine

A digital medicine system has currently four main components: an ingestible sensor embedded within an inert tablet, a non-medicated wearable sensor (patch) worn by the patient, a mobile application (app); and a web-based dashboard.

Digital therapeutics

Digital therapeutics (DTx) represents a new treatment modality in which digital systems such as smartphone apps, digital sensors, wearable devices, certain virtual reality, or artificial intelligence devices are used as regulatory-approved, prescribed therapeutic interventions to prevent, manage or treat medical conditions.

Remote patient monitoring

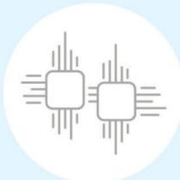
Remote patient monitoring (RPM) uses digital technologies to collect health data from individuals in one location, such as a patient's home, and electronically transmit the information to healthcare providers in a different location for assessment and recommendations.

Online/remote (patient) counselling and telemedicine/ telehealth/ virtual care

Telepharmacy has many recognisable benefits such as the easy access to healthcare services in underserved, remote and rural locations, economic benefits, patient satisfaction as a result of effective patient counselling, and minimal scarcity of local pharmacist and pharmacy services.

Artificial intelligence

Artificial intelligence (AI) is a field of computer science that aims to mimic human intelligence with computer systems.AI is set to revolutionise pharmaceutical care through connecting different pharmaceutical data sets, analysing platforms of medical and pharmaceutical records, designing holistic treatment plans, or signalling adverse events or non-adherence.



Big data

Big data can be defined as digital data that are generated in high volume and high variety and that accumulate at high velocity, resulting in datasets too large for traditional data-processing systems. Large quantities of patient information are regularly collected and shared between providers and pharmacy staff to ensure that patients receive the care that they need.

Each digital health tool is explained in detail below:

Electronic health record

An electronic health record (EHR) is a digital version of a patient's paper chart. EHRs are real-time, patient-centred records that make information available instantly and securely to authorised users. While an EHR does contain the medical and treatment histories of patients, an EHR system is built to go beyond standard clinical data collected in a provider's office and can be inclusive of a broader view of a patient's care. [8]
EHRs can: contain a patient's medical history, diagnoses, medications, treatment plans, immunisation dates, allergies, radiology images, and laboratory and test results; allow access to evidence-based tools that providers can use to make decisions about a patient's care.; and automate and streamline provider workflow.

One of the key features of an EHR is that health information can be created and managed by authorised providers in a digital format capable of being shared with other providers across more than one healthcare organisation. EHRs are built to share information with other healthcare providers and organisations — such as laboratories, specialists, medical imaging facilities, pharmacies, emergency facilities, and school and workplace clinics — so they contain information from all clinicians involved in a patient's care.

Pharmacists provide care to patients across the healthcare continuum and should be active participants in the EHR, seeking and documenting information. EHR use and implementation are driven by funding and policy changes, and pharmacists need to be part of the design and implementation teams. As health information technology proliferates and EHRs are designed and implemented in the healthcare setting, it is imperative that pharmacists' workflow and information needs are met within EHRs to optimise medication therapy quality and patient outcomes. While pharmacists use many different advanced functions in the EHR, the literature describes three main uses: documentation, medication reconciliation, and patient evaluation and monitoring.[9]

e-Prescribing and e-dispensing

e-Prescribing is a prescriber's ability to electronically send an accurate, error-free and understandable prescription directly to a pharmacy from the point of care. It is an important element in improving the quality of patient care.[10] e-Dispensing is defined as the act of electronically retrieving a prescription and giving out the medicine to the patient as indicated in the corresponding e-prescription. Once the medicine is dispensed, the dispenser reports via software information about the dispensed medicine(s).[11] The benefits of both technologies include enhanced patient safety, reduced drug costs, increased access to patient prescription records, and improved pharmacy workflow.[12]

Blockchain

A blockchain is a continuously growing list of records, called blocks, that are linked and secured through the use of cryptography. A blockchain can serve as "an open, distributed ledger" or "shared record book" that can record transactions between multiple parties efficiently and in a verifiable and permanent way. Once blockchain enters the pharmaceutical environment, a number of pharmacists' activities may be further automated, such as patient record management, patient information distribution, and reimbursement management.[13]

Online pharmacy

An online pharmacy is an internet-based vendor that sells medicines and may operate as an independent internet-only site, an online branch of "bricks-and-mortar" pharmacy, or sites representing a partnership among pharmacies.[14] From a consumer's point of view, online pharmacies seem to offer much potential value, although not necessarily on price. For housebound patients, the option of ordering medicines from home and having these delivered is obvious. For those living in remote areas, and consumers who are short of time and for whom reaching the pharmacy is difficult, ordering online has obvious advantages. There are also those seeking personal products who prefer anonymity.[15]

Wearable technology

A wearable healthcare device refers to technology that can be appropriately placed on the body by the end-user and can monitor relevant aspects of health at an actionable standard. These devices may obtain data through tracking physiological parameters non-invasively, or sense substrates from body sites in a minimally invasive fashion.[16] These technologies may pave the way for increased opportunities for medication oversight by pharmacists with an eye on improved clinical outcomes and patient safety.[17]

Bots

A bot (also known as a web robot or internet bot) is a software application that uses steps or scripts to automate a task. Through a variety of toolkits available, chatbots utilise Natural Language Understandings (NLU) services. With NLU, chatbots focus on the use of a conversational interface, one that permits a user to interact using their natural form of speaking.[18] After adding clinical triage and medical content into a bot framework, the resultant virtual personal health assistants can interact with the user on topics regarding well-being, experienced health, questions on diseases, and information about healthcare interventions. Bots may help optimise adherence by answering drug-related questions, by telling a patient what to expect during the first weeks a medicine is taken, or by reducing the potential for the medicine to be taken other than as prescribed.[19]

Digital medicine

A digital medicine system has currently four main components: an ingestible sensor embedded within an inert tablet, a non-medicated wearable sensor (patch) worn by the patient, a mobile application (app); and a web-based dashboard. On interaction with stomach fluids, the ingestible sensor is activated and communicates with the wearable sensor, which sends a signal to a mobile device where it can be viewed by patients or be subsequently viewed by healthcare providers and caregivers using secure mobile-based and cloud-based software.[20] It also has the ability to record other behavioural and physiological metrics such as physical activity, heart rate, skin temperature and sleep.[21]

Digital therapeutics

Digital therapeutics (DTx) represents a new treatment modality in which digital systems such as smartphone apps, digital sensors, wearable devices, certain virtual reality, or artificial intelligence devices[22] are used as regulatory-approved, prescribed therapeutic interventions to prevent, manage or treat medical conditions.[23] DTx products have a spectrum of different potential functions, including modifying use of medicines, modifying patient behaviour independent of the use of a pharmaceutical product, and treating a medical condition or affecting the underlying physiological response of the patient. Many also have the capacity to provide data to healthcare providers.[24]

Remote patient monitoring

Remote patient monitoring (RPM) uses digital technologies to collect health data from individuals in one location, such as a patient’s home, and electronically transmit the information to healthcare providers in a different location for assessment and recommendations.[25] Community pharmacist services are traditionally linked to a product, but pharmacists are skilled in medication management, disease state evaluation and patient counselling, which are skills that can contribute to an elevated RPM program.[26]

Online/remote (patient) counselling, and telemedicine/ telehealth/ virtual care

Telepharmacy has many recognisable benefits such as the easy access to healthcare services in underserved, remote and rural locations, economic benefits, patient satisfaction as a result of effective patient counselling, and minimal scarcity of local pharmacist and pharmacy services.[27]

Artificial intelligence

Artificial intelligence (AI) is a field of computer science that aims to mimic human intelligence with computer systems. This mimicry is accomplished through iterative, complex pattern matching, generally at a speed and scale that exceed human capability.[28] AI can strongly influence and shift our focus from the dispensing of medicines toward providing a broader range of patient-care services.[29] Improvements in budgeting, lower operational costs, and improved overall organisational efficiency will be seen as positive results of AI data analysis.[30] AI is set to revolutionise pharmaceutical care through connecting different pharmaceutical data sets, analysing platforms of medical and pharmaceutical records, designing holistic treatment plans, or signalling adverse events or non-adherence. Also, AI may help automate repetitive pharmacy tasks, such as checking prescriptions or reviewing poly-pharmaceutical drug profiles (signalling, for example, overconsumption or interactions).[19]

Big data

Big data can be defined as digital data that are generated in high volume and high variety and that accumulate at high velocity, resulting in datasets too large for traditional data-processing systems.[31] Data science can be defined as the set of fundamental principles that support and guide the principled extraction of information and knowledge from data.[32] The pharmaceutical facet of healthcare is full of data. Large quantities of patient information are regularly collected and shared between providers and pharmacy staff to ensure that patients receive the care that they need. While these data have traditionally been used simply to ensure that the right prescription in the correct dosage is distributed to the proper patient, key stakeholders are finding that the information can also be leveraged to improve several other important areas of pharmacy practice. Specifically, data use is affecting pharmacy practice in terms of managing healthcare plan expenditures, monitoring consumer use of prescription drugs and advancing research and development efforts.[33]

Mobile applications

Mobile applications can help people manage their own health and wellness, promote healthy living, and provide access to useful information when and where people need it. These tools are being adopted almost as quickly as they can be developed.[34] Through the use of mobile applications, pharmacists can stay up to date with disease state guidelines, maintain adequate pharmacy stock inventories, access drug information systems, review patient health information and use tools to calculate individual drug doses and to accurately convert between units of measurement. Mobile devices may also assist pharmacists by converting smartphones into point-of-care diagnostic tools, such as otoscopes or blood pressure monitors. Mobile applications can also help patients manage disease states, improving their medication adherence and logging important health history.[35]

1.2.2 COVID-19 pandemic catalysing distant care and digital transformation across pharmacy

The coronavirus disease (COVID-19) pandemic has been a powerful stimulus in catalysing the use of technology. In the era of digital health technologies, the focus on new models has shifted to virtual visits, virtual care, remote patient monitoring, and websites and chatbots (for risk assessment, screening, triage).[36] This pandemic has showed the usefulness of digital health solutions and constitutes an opportunity to insert these solutions into our healthcare systems. Digital technologies and distant care became embedded more than ever in our everyday lives and, importantly, within healthcare roles. As a result, the digitalisation of healthcare practices is growing exponentially.[37]

Under its National Health Plan for COVID-19, the Australian Government has accelerated the delivery of electronic prescriptions.[38] Australian pharmacists have been able to undertake different remunerated services (MedsChecks, Diabetes MedsChecks, Home Medicine Reviews and Residential Medication Management Reviews) via telehealth.[39]

In Canada, new pharmacy distant services have been implemented since COVID-19 (Figure 1): counselling (Manitoba, Ontario, British Columbia, and Alberta), assessments in order to prescribe (Manitoba), MedsCheck services if they cannot be delayed (CAD60–75/claim, CAD25/follow-up), witnessing the ingestion of specific treatments, demonstrating the use of a medical device (Ontario), provide deprescribing consultations, medication reviews, medication counselling (Newfoundland and Labrador), counselling and prescribing services, drug information services, conduct certain steps in the dispensing process (Nova Scotia), assessments for minor ailments prescribing, Saskatchewan Medication Assessment Program, smoking/tobacco cessation services (Saskatchewan), care to assess patients and prescribe a treatment (Alberta), and extend prescriptions (Yukon).[40]

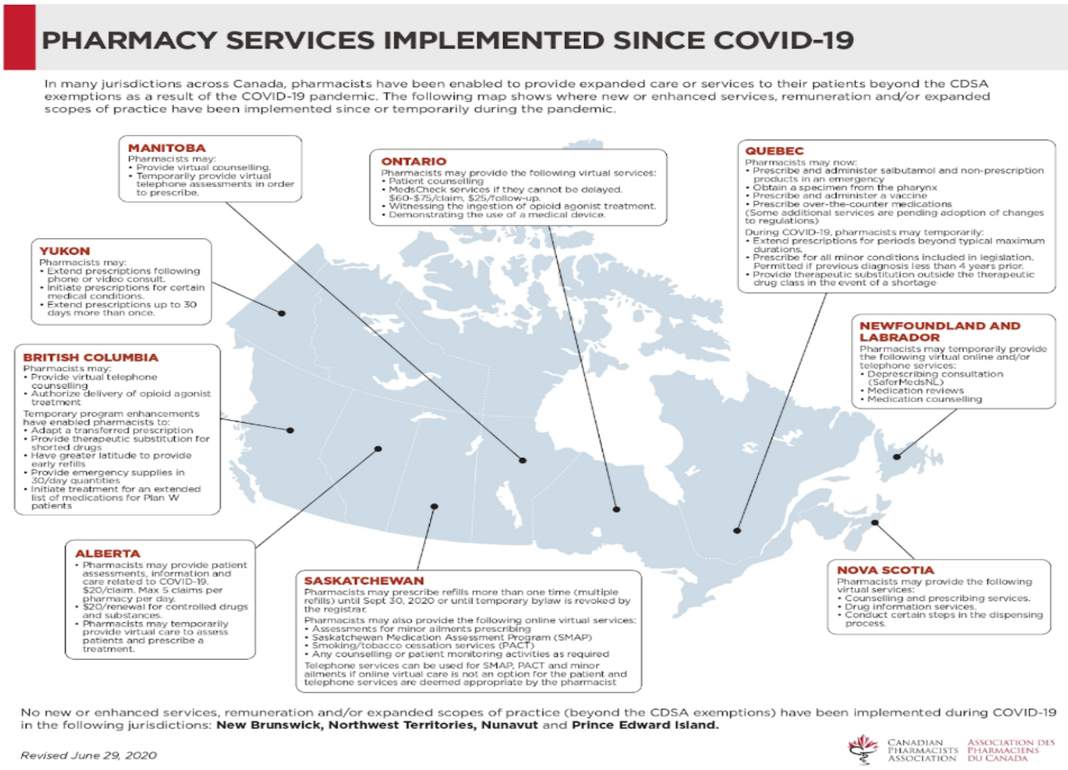


Figure 2: COVID-19 and pharmacy services in Canada[40]

In England, under the Community Pharmacy Consultation Service (following NHS111 (community pharmacist consultation service) referral), some patients have been dealt with over the phone, while pharmacies have still been able to claim the usual fee.[41]

The digital transformation induced by the COVID-19 pandemic creates an urgent need for researchers, policy makers and healthcare professionals to implement digital solutions in practice. There is a need to leverage the momentum the COVID-19 pandemic has provided on digital health and emphasise the need for solidarity among healthcare professionals in harnessing the use of technology for digital health.[41] There will be important lessons learned from this digital health transformation with COVID-19 and it will have a lasting impact on healthcare services.

1.4 Impact of digital health from pharmacy practice and policy perspectives

The impact of digitalisation of health services has been profound and is expected to be even more profound in the future. To evaluate this, a broad perspective should be taken. Attainment of the broad health system goals, including quality, accessibility, efficiency and equity, is an objective against which to judge new digital health services.[42]

Decisions to adopt new digital health services, at different levels of the healthcare system, are ideally based on evidence regarding their performance considering health system goals. These goals in a broad sense are unaltered by the process of digitalisation. Governance should be designed and tailored in such a way to capture all relevant changes in an adequate way.[43]

The World Health Assembly requested the WHO director-general to provide normative guidance in digital health, including “through the promotion of evidence-based digital health interventions”. The WHO subsequently issued its guideline with 10 evidence-based recommendations on digital interventions for health system strengthening.[44]

The scale of impact, areas affected and complexity of the interactions of digital aspects with health service provision are illustrated in the topic tree shown in Figure 2.[42]

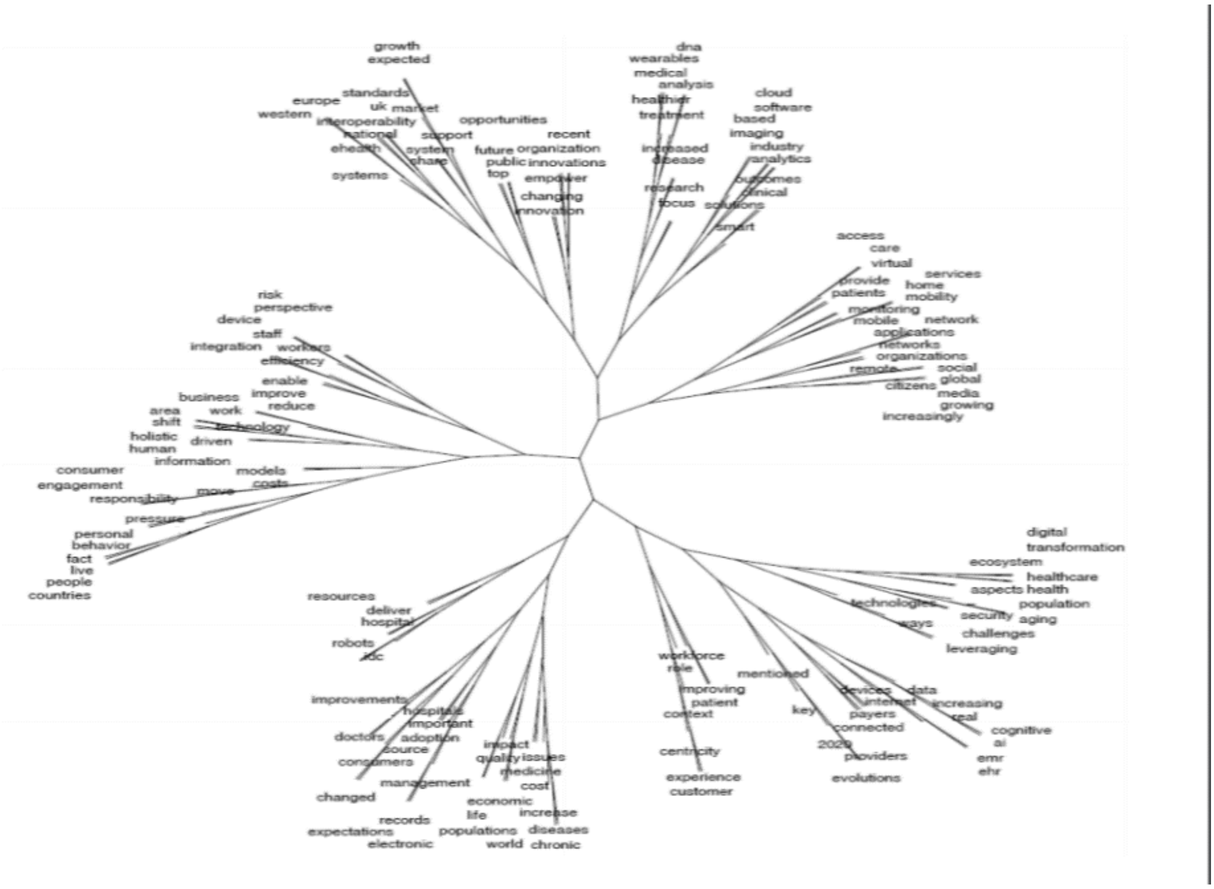


Figure 3: The complexity of the digital transformation of health services[42]

Many digital health technologies strongly depend on their uptake and appropriate use by healthcare professionals. This may lead to new healthcare professions, as well as to existing healthcare professionals acquiring new skills and competencies to work with new digital health services. Co-creation in developing new digital health services can be useful to increase acceptability and user friendliness, also in practice. Professionals' experiences with using the technologies are also crucial to monitor and consider in any evaluation.[43] If digital health technologies are understood, designed and implemented well, health professionals can co-exist with them, which has the potential to ease some of the burden to allow more time with patients or carrying out lifesaving research.

Digital health systems can also empower and engage patients, making them co-designers of care. This shared decision-making between health workers and patients demands trust, a sense of partnership and transparency in their interactions. Healthcare professionals become collaborators in a patient's journey to health, while still providing empathy and a human touch in support of patients' well-being.[45]

Healthcare professionals need to adapt their practice, with the magnitude and speed of impact described in Figure 3.[46]

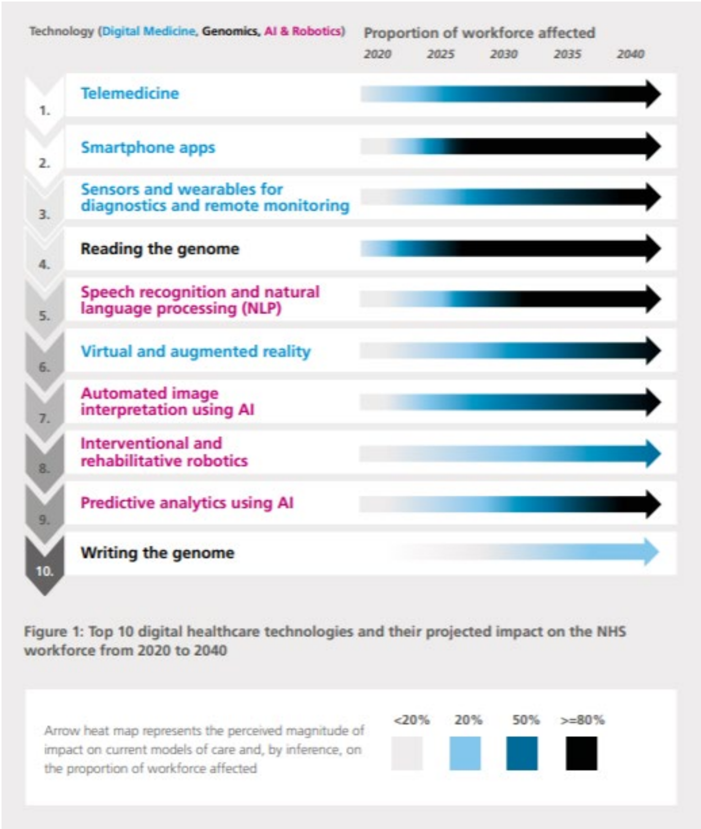


Figure 4: Technological advances impacting healthcare and the magnitude of disruption in the NHS[46]

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1.5 Forward-looking areas in digital health

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Around 30 years ago, the centennial of the existence of the motor car (also called an automobile) was celebrated. The first car had a petrol (gasoline)- or diesel-powered engine on wheels, with and there were few ways to understand the status of the vehicle or the durability of the components. One would start driving, unsure of whether one would arrive at one's destination, not being aware of the pitfalls that could arise during the trip.

Gradually, technical systems improved, and cars were maintained to ensure they would keep moving when required. It is only recently that cars have been equipped with technology that provides a real-time updated dashboard about the status of the engine, predicts the thickness of the tires and prevents accidents by a safe-drive-control system.

1.5.1 How digital technology transformed health paradigms

Just like in the motor industry, technology has gradually infused into healthcare systems. Whereas in previous days care and cure were provided for patients who got ill for various reasons, increasingly our journey in life tends to receive guidance and direction through technology — with the map of the human genome, the ability to measure and analyse continuous health data, the sharing of data by social health networking.[1]

Five billion people globally own a mobile phone (of which 3.5_billion use a smartphone), and this has changed how we approach health nowadays. The annual medical check-ups are becoming less common, , as continuous collection of integrated health data through mobile applications provides a continuum of care. If we deviate from our health norms, we get a digital signal warning us to take action to prevent worsening of our illness.

As healthcare gradually moves from hospital to home, this warning system is becoming increasingly active in our private environment, prominently via our phones. The COVID-19 pandemic has given impetus for countries to accelerate this process, as physical contact had to be reduced to the minimum and telemedicine, online health information seeking, and broad health data sharing has expanded more than ever in 2020.

Personal health applications (PHAs) in our phones are becoming our vital dashboard, in other words a convergence platform for all health and well-being data that a patient is generating. Data from healthcare IT systems, including electronic health records in hospitals and medication data in pharmacies, are increasingly becoming connected into these PHAs. Moreover, the merged datasets are being augmented by patient recorded outcomes and alternative life data that can contribute to predicting how to stay as healthy as possible for as long as possible.

Thus, analysis of these combined datasets can lead to services that provide active support to improve healthcare delivery, self-management by patients and wellness by providing clear and complete information 24/7 in a person's pocket.

Provided that many citizens have access to and understanding of their own PHAs, patients will become increasingly in charge of their own health, and making co-decisions on treatment pathways jointly with care providers is becoming a truly attainable option for the future.

1.5.2 Paradigm shift in healthcare policy

Patients' continual access to information about their ongoing health status has fueled a change in thinking around global health policy. Many (if not all) global healthcare systems have traditionally adopted policies where healthcare providers are reimbursed through a fee-for-service model. This concept is nowadays becoming regarded as potentially promoting a slightly perverse incentive. It promotes a healthcare system that is asked to just "do more" in case of illness. Nowadays, healthcare systems tend to prefer the idea of value-based care, i.e., systems where healthcare providers are paid (and do more) to keep people healthy. That concept expects healthcare teams to be more proactive and focused on preventing health problems long before they occur.

Technology is a vital support tool in this changing paradigm, as data-driven insights on well-being and the adoption of decision-support tools in treatment guidelines can augment care providers with knowledge on how to prevent patients at best from becoming ill.

Digital health technology can help healthcare organisations to meet benefits in all pillars of the Institute for Healthcare Improvement's Quadruple Aim (Figure 4[2]), a successor of its Triple Aim. The Triple Aim is defined to "improve the patient care experience, improve the health of a population, and reduce per capita healthcare costs".

Figure 5: The Quadruple Aim[2]

While the Triple Aim model has worked well in guiding the optimisation of health systems, recently an additional aspect has been adopted by many healthcare professionals — i.e., improved clinical experience — leading to the creation of the Quadruple Aim. The idea is that without an improved clinical experience on the provider side, the three other patient-centric aspects cannot reach their full potential.

Thus, when researching the value of health technology innovation, its added value would need to be proven on all four pillars of the Quadruple Aim in order to gain a solid position in the future standard of care.

1.5.3 Health technologies of the 2020s

The number of technologies relevant for healthcare has been exploding in recent years. The annual "Digital health hype cycle", as shown in Figure 5,[3] is the health extrapolation of the annual branded graphical presentation developed and used by the American technology firm Gartner. The extrapolation represents the maturity, adoption and social application of specific health technologies.[3]

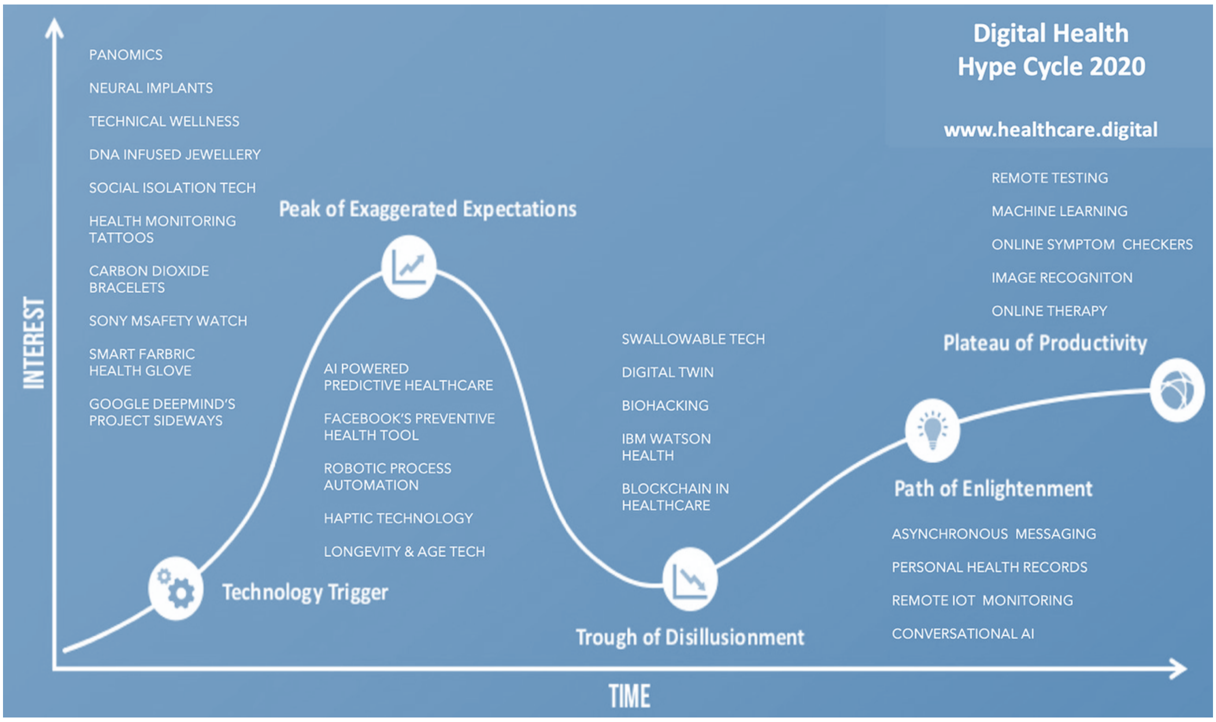

Figure 6: Digital Health Hype Cycle

According to the WHO, digital health interventions can be organised into the following overarching groupings based on the targeted primary user:[4]

- **Interventions for clients:** Clients are members of the public who are potential or current users of health services, including health promotion activities. Caregivers of clients receiving health services are also included in this group.
- **Interventions for healthcare providers:** Healthcare providers are members of the health workforce who deliver health services.
- **Interventions for health system or resource managers:** Health system and resource managers are involved in the administration and oversight of public health systems. Interventions within this category reflect managerial functions related to supply chain management, health financing and human resource management.
- **Interventions for data services:** Data services are consisted of crosscutting functionality to support a wide range of activities related to data collection, management, use, and exchange.

1.5.4 The impact of digitisation on the work of the pharmaceutical healthcare provider

In many countries, pharmacists have been one of the first healthcare providers to adopt all four pillars of information technology systems mentioned above for optimising the provision of pharmaceutical care services. Managing the many thousands of drugs in stock, checking drug-drug interactions and supporting adherence by analysing refill rates are some reasons for why, often far in advance doctors adopting electronic prescription systems, pharmacists were already used to working with computers. Pharmacists display structured thinking, derived from a rigorous educational pathway. They like to analyse data and to be supported by decision-tools derived from reliable data systems.

The pharmacy profession is clearly one that has some sort of a tech-savvy aura. Therefore, it has the ideal predisposition and competencies to provide increasingly more digital health services to patients.

Some key areas in which digital technologies will have an impact on the pharmacy profession can be summarised as follows:

- **Wearables data integration in decision making:** As more and more wearable devices are able track an increasing amount of health and wellbeing data from patients, those data can be used as digital biomarkers in pharmaceutical decision making. Digital biomarker data can be described as objective, quantifiable data collected by wearables, portables or even implanted or digestible health tracking devices. Think about smart watches with validated ECG applications that can support a pharmacist determining the efficacy and safety of a cardiac treatment. Or a meditation device giving data about the mental relaxation status of the patient, providing input in the efficacy of potential migraine treatment. Many examples can be given here, whereby pharmacists can ask themselves how they can use these data to augment their services by predicting outcomes, adverse events and patient satisfaction. Once pharmacists get access to these data, they can interpret patients' vital signs in real-time and communicate these to a primary or specialty care physician to optimise pharmaceutical care if needed. Nowadays, getting such access should be feasible, however, it is not widespread.

- **Health app usage:** As healthcare moves to phone-based access models, patients will carry an increasing number of digital biomarker data with them 24 hours a day. Global interoperability of these data is increasing due to growing standardisation of health data. This, combined with the fact that computers get faster and mobile phones more powerful, the mobile environment of the patient is going to be the centre point of care information. As with the impact of wearables, pharmacy information and communications technology systems should ideally be able to connect to these patient environments, interchange with informed consent patient data and process them into valuable tools for providing digital pharmaceutical care through the health apps the patient is already using. This becomes ultimately important when digital therapeutics (DTx) is becoming more integrated in standards of care. DTx delivers evidence-based therapeutic interventions to patients that are driven by high quality software programs to prevent, manage or treat a broad spectrum of physical, mental and behavioural conditions.[5] DTx augments traditional care and thus is relevant for pharmacists to be acquainted with.

- **Robotic support:** Automated dispensing processes with robots, packaging systems to create individualised dosing, and chatbot information technology to answer frequently asked questions are all examples of robotics which can improve the efficiency of the pharmaceutical process. Robotics can also reduce the number of dispensing errors, leading to avoidable hospitalisations, deaths and costs in healthcare systems.

- **Artificial intelligence (AI):** The immense pool of health data gives an opportunity for applying more AI and machine learning in pharmacy practices, solving significant issues concerning medication management and use. Trend analysis in big data sets can reveal individual patient risks of adverse events, behavioural aspects, compliance profiles and so on. The pharmacist is the professional expert who can augment the data scientist's expertise to build the services. Understanding the terminology and concepts used in AI will support pharmacists to constructively communicate with data scientists and collaborate with them on developing models that augment patient care.

1.5.5 The future of pharmacy practice

Do we need this change in paradigm towards "digital where possible and human where required"? When Henry Ford was asking people whether they would like a car, many of them responded with the fact they would prefer to have their horses running faster, instead of having a car. Who would have foreseen that nowadays we have cars that have an auto-drive pilot, that predict when the tyres have to be changed and that ask for maintenance long before the car breaks down?

This car analogy may be relevant for pharmacy as well. The future will show how robots will help with dispensing, how drones and other innovative carriers will provide delivery and how AI-driven pharmaceutical care services will give 24/7 mobile phone support. Nevertheless, the human aspect in pharmaceutical service provision will become of higher value, once digitisation has solved the more standardised activities now performed in pharmaceutical services. Pharmacists and pharmacy staff are trusted caregivers and guardians of the medication profiles of patients.

It will be this blended care approach, that will enable the staff to cope adequately with the complexities in the growing demands of an ageing population that takes more medicines. Pharmacists have been adequately trained in making decisions in the moral dilemmas that occur in their practice. It is expected that the implementation of more digitisation will bring a magnitude of ethical and philosophical questions on privacy, on autonomy, on data-sharing responsibilities and requirements, and on accessibility and solidarity.

It is the unique competency profile of future pharmacists that will enable us to guide patients adequately in the proper use of medicines. That should be the holy grail in the future of pharmacists: supporting patients who rely on a profession that is knowledgeable, professional, ethical and has the right tools and data in digital health, making sure that the outcome of a pharmaceutical treatment pathway is optimised by the most individualised approach to every unique case.

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2 Digital health and education

Key messages

- There is a particular deficit of formalised education and training on digital health.
- Most of the work undertaken so far by universities and education providers focuses on certificate models. A national focus or professional driven initiative can be the impetus for digital health integration within education.
- Digital health is mostly shaped by experts outside of the healthcare space and this represents an opportunity for interdisciplinary collaboration to develop a digital health education framework.
- In addition to implementing digital health in undergraduate education, continuing education is essential to solve the intrinsic issue of how to get existing and incoming health workforce up to par.
- Pharmacy and pharmaceutical sciences education must be needs-based to meet existing and emerging requirements in digital health. These requirements must reflect the needs in all sectors of and career levels in pharmacy and pharmaceutical sciences, from clinical pharmacy to drug research, of all members of the pharmaceutical workforce putting patients and the community at the centre.
- Established standards, optimised curricula, trained academics, educational and infrastructural resources and experiential learning opportunities have been key facilitators towards implementation of a new topic into the curricula which can be applied to integrate digital health in pharmaceutical education. New educational models may have to be developed to fully embrace digital health education.
- Early career pharmacists and pharmaceutical scientists and students are the most embedded within the digital transformation era. Their engagement with digital health education processes represents significant opportunities as they support the adoption and promotion of these digital health technologies.
- Few studies have been conducted to understand the digital health competencies among pharmacy students. Since most of the studies conducted are from countries such as United States, United Kingdom and Australia, the global situation of digital health in pharmacy schools is not fully understood.

2.1 Digital health in education

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Digital health has garnered a high level of interest across multiple industries in the past decade. While eHealth and mHealth (mobile health) were topics of interest in the late 1990s and early 2000s, the maturation of wireless technology and the internet of things (IoT) has led to expanded opportunities across life sciences, business, biopharma, and associated health-focused industries as a potential business opportunity to address patient care. Considering this, much discussion has focused on generating digital health specialists or experts to engage in companies or organisations seeking to leverage next-generation practices and technologies.

While of high importance, there is a particular deficit of formalised knowledge and academic training within digital health at this time. Moreover, despite many conversations in the healthcare field around digital health, most movers and shakers have come from outside the healthcare space. These individuals represent a rich background in the tech space, primarily due to their knowledge of the hardware and software development needed to make digital health technologies function. With the rise of the smartphone in the mid-to-late 2000s, a shift towards mobile applications (mobile apps) yielded further inroads by others new to the health space bolstered by the low-bar entry creating health and medically related apps. With the spread of wearables and IoT empowered health devices, this has only been escalated at large.

2.1.1 Current digital health education frameworks

At this time, there has been little to no formal development of digital health as a profession or sub-set degree in higher education.[1] A shift will likely occur in the 2020s, where we may expect digital health-specific master programmes and perhaps sub-set doctorates focused on digital health endeavours (e.g., behavioural health, health economics and outcomes research, informatics, business), compared with a current focus on telemedicine and telehealth due to the disruption in healthcare caused by the COVID-19 pandemic.[2] As it stands, the majority of such classes or education is focused around certificate models adapted across several institutions. Peripheral observations on currently offered material reinforce that many classes are targeting future entrepreneurs or management for digital health integration into mainstream business practices.

Historically, looking across the past 20 years, we have seen disparate offerings of digital health-focused educational material that have occurred sporadically across the globe. Arguably, the USA, Europe, and particular Asian nations have demonstrated substantial technical development around data analytics and hardware capacity that spilled off into the health tech sector. From this, specific brain capital and partnerships with health systems and academic centres helped create nascent digital health material offerings for particular learners. Arguably, this has focused on tech hubs worldwide with strong academic medical groups in the surrounding area (e.g., San Francisco, Boston), but also expanding in nations that are embracing digital health (e.g., UK, Germany) based upon financial incentives for growth or utilisation of novel technologies. Nonetheless, this then presents a bold opportunity to develop a digital health education framework due to the fragmented approach currently ongoing.

2.1.2 A focus on digital health entrepreneurship and communication

The high attraction for business capital, venture capitalist funding, and the pursuit of a dream IPO (initial public offering) has led to the digital health space seeing a boom among newcomers seeking to create the "next big thing in health". Given that 2020 saw the highest amount of digital health investments in the past decade and noticeable acquisitions, such as PillPack for USD753m in 2017, it is undeniable that new entrepreneurs are attracted to health tech.[3] Given that, we have seen a sizeable educational focus on this population with multiple US certificates focused on this population. This can be seen in Table 1, highlighting current programmes across the United States and Europe in digital health. Overall, most programmes identified were certificate-based, with some offerings built into optional degree pathways, and offered primarily online over a six to 12-month period. Programmes identified targeted those interested in digital health, especially those in or pursuing business management or healthcare communication. Most educators in these programmes are lecturers from digital health companies, public health experts, informatics experts, or business schools adopting digital health material. The COVID-19 pandemic will likely be a force multiplier in increasing interest in digital health job development and market shift, seeing more programmes coming to the market.

Table 1: Digital health programmes not focused on healthcare professionals

Institution/programme	Description and target learners	Goals	Format	Cost
UC San Diego Extension/ Digital Health Certificate	Develop expertise in data science, mHealth, internet of medical things, AI, regulatory, behavioural medicine aspects for digital health. Programme developed for professionals currently working in the healthcare ecosystem and background entrepreneurship.	Gain expertise in broad topics related to digital health and develop entrepreneurial focus in digital health exploration.	Online course across six courses that lasts 12–18 months.	USD3,900
Boston University/ Online Visual & Digital Health Communication Graduate Certificate	The programme aims to apply design aspects through the creation of digital media in order to help propagate health information via mobile apps, branded content, websites, etc. Audience includes	Gain knowledge on digital media and to design communication strategies for audiences by interpreting and presenting health information through digital	Online 16-credit course (four courses) that takes 8–12 months to complete.	N/A

Institution/programme	Description and target learners	Goals	Format	Cost
	anyone with a previous bachelor's degree but appears geared towards those interested in merging communication and health sciences.	visual tools (e.g., infographics, data visualisation).		
Tufts School of Medicine — Public Health/ Certificate in Digital Health Communication	The programme is targeted towards those in communication to train them in using technology to apply behavioural theory in digital communication focused on public health materials.	Gain knowledge in social media and mobile health design aspects for patient information dissemination focused on writing and digital media generation.	Online 12-credit course with a one week-in person course at Tuft's Boston campus that can be completed in one to two years.	N/A
University of Denver/ Digital Health Certificate	Based on the public health and health informatics programme, the certificate is targeted towards those with an interest in digital health to understand the premise and role. No focused learning group for this certificate. Appears to target the creation of digital health solutions experts or specialists for management roles in organisations.	Establish knowledge in digital health and healthcare information systems, alongside topics related towards cybersecurity and clinical outcomes.	Evening or online courses (either 4 or 6 course track) taken over 6–12 months.	USD11,680 (4 courses) USD17,520 (6 courses)
Deggendorf University of Applied Sciences/ Master of Science in Medical Informatics	Interdisciplinary and multicultural programme focusing on digital health. Targeted towards those with a bachelor's degree in health sciences or computer sciences.	Aim to create a firm knowledge base across multiple areas of digital health interests.	Full time live programme running 1.5 years over 3 semesters.	N/A

Considering that most of these programme goals were to foster the growth of knowledge in digital health and engage in business-related outcomes associated with creating or expanding a business, the material identified in the training and teaching was not of high clinical development. This reflects the early adopters of digital health being outside of the traditional healthcare space and represents an opportunity for collaboration or integration with an interdisciplinary programme designed for the future. This could be best represented by the growth of medical-themed hackathons that have appeared worldwide focused on integrating health technology and business creation around ideas to solve relevant problems facing the healthcare environment.[4] These instances present opportunities for individuals across multiple segments (e.g., business, IT, health professionals, undergraduate students) to collaborate on projects that may launch a new product-service platform utilising digital health without formal education via advisors or mentees present. Latching onto novel educational or live platforms such as these may be another way in which informal digital health knowledge and experiences will be shared going into the future.

2.1.3 Focusing on digital health education for the public

Aside from mainstream focused education of digital health for higher education, there is also a noticeable push for digital health knowledge and literacy at younger populations.[5] This is relatively novel, as it indicates that current educators of children under 12 years of age recognise the significant role of mobile devices, social media, and IoT play on the next generation's health. This perhaps is best represented by the issues surrounding the COVID-19 pandemic, whereby mass misinformation has been propagated online to the detriment of public health initiatives due to low digital literacy on health information being shared.

Likely we are seeing public health initiatives inclined to address the public perception and ability to critically assess online health information, alongside government agencies enabling evidence-based medical information dissemination through health organisations in society.[6] Due to the likely growth and reliance on technology for healthcare going forward, a focus on future generations is paramount. Integrating digital health literacy is being explored in school-age children before graduation from high school or similar to enable them to understand online health information and navigate their health through digital tools. However, it remains to be seen if a government initiative, public health platform or healthcare professionals will be the guiding hand for this.[7,8]

2.1.4 Next steps for digital health education

Given at this time that digital health educational inroads have at large targeted those in the healthcare space with programmes and certificates centrally focused upon the creation of further business expanse, there is an opportunity for healthcare professions to either look to integrate with current programmes or seek to establish their domains. Either strategy will likely focus on expanding clinical utility and usefulness around digital health technologies with their professional undertakings and roles and responsibilities (e.g., medical with diagnostics, pharmacy with pharmaceutical care). Nonetheless, interprofessional endeavours would likely generate the highest uptake across multiple sectors, including the incumbent tech companies (which also possess the capital for development) pioneering digital health innovation and the health professions themselves with the clinical background to create a feasible future health system that leverages digital health. It is then essential to assess how healthcare education can integrate digital health into its current and future offerings.

2.2 Digital health in healthcare education

Digital health education for healthcare professionals is quickly becoming a hot topic. Again, it has been on the periphery of the medical community since the late 1990s with the rise of the internet. Arguably, health technology has been an insular premise for the healthcare community, regarded as a subset of technology assets to foster patient care through internal services. This includes expanding communication with other health professionals, documentation, diagnostics, robotics, automation and other IT-related services. Perhaps the rise of EHR systems stands out to many health professionals as the most recent technological shift in the healthcare space. However, when looking at the rise of online patient communities and the e-Patient movement, the biohacker movement and related patient endeavours, it stands to reason that a parallel movement has been occurring for the past 20 years. Both patients and health professionals have co-opted technology for their own use to perform self-care or care for others. Perhaps the most novel facet is that digital health finally provides an intercession between both movements, where mass data and the rise of machine learning and analytic tools can now streamline and utilise patient-generated data for utilisation of healthcare professionals.

This perception of the duality of health technology and recent advancements in society regarding mobile technology may explain the large focus of healthcare professionals on the opportunity for digital health in patient care moving forward, compared to the past agnostic approach.[9–12] This can be seen with multiple peer-reviewed journals (e.g., *The Lancet*, *Nature*) offering their own digital health segments for publication, medical media highlighting novel technological health advances from the tech industry, and a focus on social media on digital health endeavours. This traction, which has taken time to build, is now gaining significant momentum as governments and regulatory bodies are now giving credence to these tools and services, which implies healthcare professionals will need to monitor and utilise them in patient care. As such, training and education are paramount at this time.

2.2.1 Current digital health education offerings for healthcare professionals

Compared with the range of business focus educational endeavours of digital health globally, there is a significant lack of educational course development within the healthcare education arena. Multiple universities and colleges with health profession education have a digital health or mobile health lab/research centre at this time, though vary in terms of utilisation for formal education. Rather, they seem more focused on the research angle and partner with digital health companies, and likely serve as a resource for staff, faculty and learners. Table 2 outlines formal individual programmes available targeting healthcare professionals regarding digital health. As seen, a mix of certificates, stand-alone programmes and educational tracts within institutions is currently available, but to a smaller extent than in section 2.1. Overall, a focus is on medical doctor programmes, with some elective programme's offerings to mid-level or allied health professionals.

Table 2: Digital health programmes/course for healthcare professionals

Institution/programme	Description
Weill Cornell Medicine via eCornell/ Telemedicine	This is a course designed to instruct newcomers to telemedicine, including healthcare practitioners (e.g., physicians, licensed healthcare professionals). Material follows the Association of American Medical Colleges telehealth competencies. Two-week course that takes 3–5 hours a week online. Costs USD999.
Thomas Jefferson University Institute of Emerging Health Professions/Connected Care: Telehealth & Digital Health Innovation	Graduate certificate that guides students to evaluate strategies to improve healthcare outcomes using digital health. Online programme that runs for three semesters. Learners gain an understanding of how to initiate and manage telehealth programmes and the legal and regulatory limitations.
Thomas Jefferson University Institute of Emerging Health Professions/Telehealth Facilitator Certificate	An introductory course for telehealth, spurred by the COVID-19 pandemic. Learners gain expertise to serve as a facilitator for telehealth services as part of an interdisciplinary team and apply them in their own institution.
Brown Alpert Medical School	Elective course designed to prepare liberal medical education and medical students for an understanding of digital health by engaging with local experts. Uses student leaders under a faculty advisor with a digital health background.
Rocky Vista University College of Osteopathic Medicine	Digital health track that trains students in AI, remote monitoring, ethics, informatics, telemedicine, analytics, and entrepreneurship. Available for medical students only.

2.2.2 Issues surrounding digital health education for healthcare professionals

While a significant interest in building digital health education programmes is becoming vastly apparent in the healthcare educational environment, there are multiple limitations for implementation.[1] This is multifactorial and needs to be addressed before the metaphorical lever can be pulled, and suddenly health professionals can engage in training and education on the topic. The following are highlighted areas to be evaluated and addressed to initiate widespread digital health education in the healthcare professions:

- **Lack of standards:** Currently, there are little to no best practices in terms of what digital health education is required for healthcare professionals. As many schools and degrees require a core curriculum for accreditation until such bodies deem the need for digital health integration, it is likely that adoption will be sporadic, and uptake will be undertaken by those that have the brain capital or academic interest to create courses or programmes within their schools. Given this, it can be expected to see various approaches on what digital health topics or subjects would be taught, which could vary based on the expertise of faculty or perceived need within their individual professions.[13] As such, we are currently in a transitory phase where early adopters will create material that may or may not influence the eventual adoption of formalised cross-professionalism training.

- **Lack of trained academics:** Perhaps one of the most considerable limitations is that there is a shortage of academics in the healthcare environment with both experience and knowledge to propagate digital health education at large.[14] While interest is building, similar to the issue around standardisation, it is challenging to determine to what extent an academic is sufficiently trained to develop that knowledge in others. This is detailed further along on potential steps to remedy this current situation.

- **Partnerships:** Healthcare education institutions cannot teach digital health topics alone. By its nature, it is an interdisciplinary endeavour spanning across multiple market sectors and requires expertise in fields of science and backgrounds that are not traditionally thought of being directly medical-related. This includes issues beyond regulatory oversight and validation of the technology in health, but implications of behavioural sciences, user interface/user experience design, mathematical insight on AI/machine learning construction, gamification design and more. For healthcare academics to effectively teach digital health or integrate it into their institutions, creating and directing partnerships with these experts will be vital to fostering growth and hands-on experience in the digital health space.

- **Materials and samples:** Teaching digital health involves another issue in regard to the technology needs for hands-on instruction. Similar to issues now challenging healthcare academics to integrate EHR constructs into their teaching and course work to mimic current practice, identifying and then utilising digital health technologies as teaching material will prove a logistical hurdle.[15] This may be remedied via the formation of partnerships but determining what technologies to have on hand will take much decision making. Take, for instance, adherence devices: procuring such devices to showcase or utilise in a laboratory setting will be difficult or costly, and as marketed combination products (e.g., smart insulin pens, smart inhalers) come to market, there may be competition for demos from manufacturers. Other considerations include the multiple connected devices on the market for vital sign collection, alongside novel tools used in digital biomarker assessments. If an institution elects to procure them at direct costs, it may be costly, and updates on technology hardware from new iterations may pose a barrier. This becomes further confounded with other digital health technologies such as virtual reality and digital therapeutics, whereby utilisation is confined with particular hardware and would open up conversations on whether "bring your own device" would suffice, or an institution would need to create a space for their utilisation and teaching.

- **Laboratory spaces:** Lastly, in the same issue with the acquisition of devices and software for teaching as just discussed, the creation of a digital health space to house relevant technologies and be utilised may be an issue. Obvious issues will be that if an institution decides to acquire and store such technology, it will need to be secured due to the high value they intrinsically possess. Also, training a faculty to update and maintain such technology would need to be considered. This requires a designated space and their utilisation, which may pose a barrier for certain health professions.

In summary, there are multiple considerations that currently must be addressed for the integration of digital health into formal healthcare educational programmes. This is likely a cause for limited uptake and focuses on the limited integration of digital health topics at this time.

2.2.3 Creating digital health enabled healthcare educators

As identified, to initiate digital health in formal education, we will require a subset of health academics across all spectrums of healthcare (e.g., pharmacy, nursing, medicine, physical therapy) trained as specialists to pass on digital health knowledge to learners effectively. This will require some form of decision-making, likely from individual professional bodies, to identify what material and topics are relevant for each programme's learners. Stakeholders could be approached to devise these topics, whereupon a formalised approach could be initiated to then train academics interested in taking up this challenge. Feedback could be created to continue to utilise internal (e.g., professional associations or societies, academic professional organisations, accreditors) and external (e.g. employers, governmental agencies) stakeholders to identify changes that need to be implemented due to continual advances in technology or structural changes to the healthcare environment local to each nation.

As each of these specialised health academics is trained, they may then disseminate their expertise internally to their healthcare programmes for educational adjustments to courses or subjects taught. In essence, they would become a "superuser" of digital health technologies and the contact person internally to help with policy design and choices required for development. It is likely that these superusers would need to be selected by an administration to gauge their academic nature to prevent training and then the individual using their knowledge to leave their institution to pursue external career paths (due to the current apparent lack of clinically trained experts in the present time), thus negating the intended utilisation of their knowledge. As time progresses and digital health becomes more standardised and adopted, this risk will decrease the importance of continuing academic needs for a programme. Figure 6[1] details how this may be initiated and then continued until a saturation point is reached for digital health internal academic expertise.

This may include formalised certificate programmes, or continuing education credits, or other processes. Each would have its own limits but would accomplish current needs. Lastly, a need for a formal designation is unlikely at this time and would likely be of limited use in an academic sense.

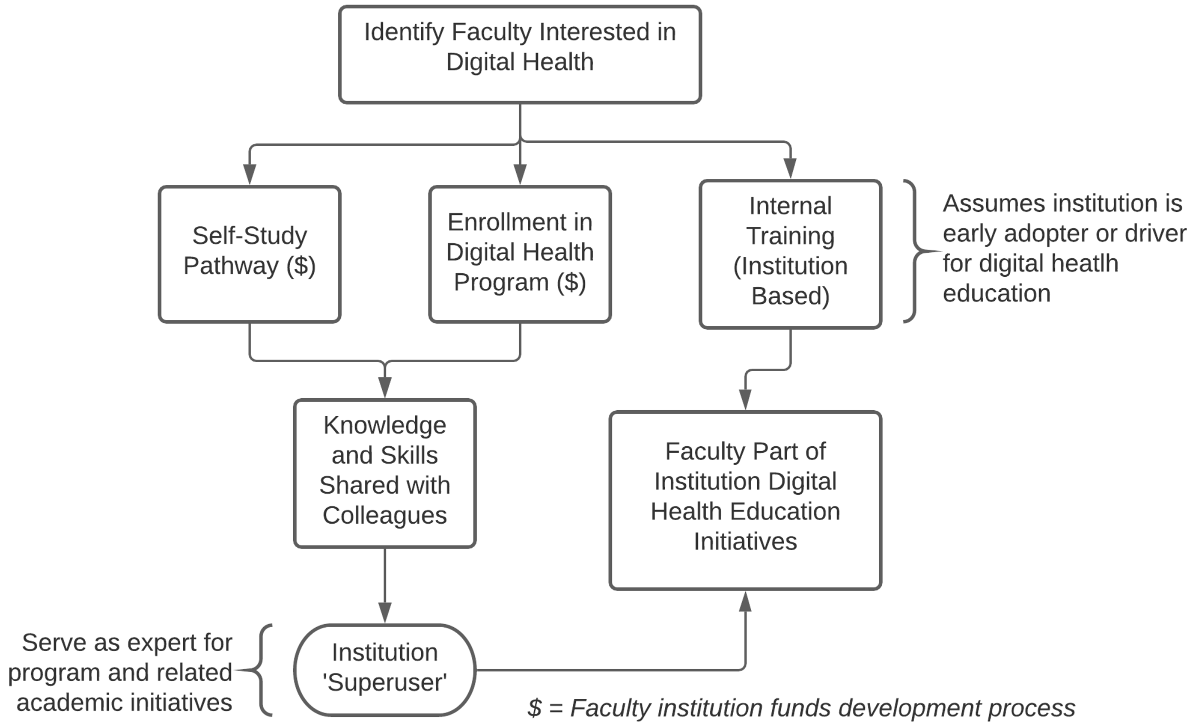

Figure 6: Digital health academic preparation[1]

An institution that chooses to engage in digital health may select a faculty for training, and if it already possesses digital health infrastructure it may then train them internally. Otherwise, funds are utilised to then train staff at other programmes or via their own guidance. That knowledge is then brought back to the institution, whereby it becomes a "superuser" of digital health and can help with internal training and ultimate delivery of digital health education for their learners.

2.2.4 Implementation of digital health in health professional education

The initiation of digital health education, as identified, is already under way, but will need serious work.[16] Digital health education is mostly offered to those learners who are interested. Nonetheless, a line will be drawn in the future whereby all learners will likely need a baseline knowledge skillset to integrate into healthcare roles.[17–19] We are seeing this now with the rise of EHR systems requiring users to navigate and document within them effectively and the expansion of telehealth, which will require new communication and assessment skills from a virtual perspective rather than in person like we are presently used to. Suppose digital health is to be integrated at scale for healthcare programs. In that case, it will be necessary to overcome limits previously identified and achieve a level of expertise within internal academic circles to maintain appropriate levels of educational outcomes.

Figure 7[1] outlines a framework to accomplish this given current methods currently being undertaken, along with potential expansions of programmes. This highlights different phases, such as the present time where digital health is being explored via early-adopting programmes, certificates or similar delivery methodologies. As the exploration phase ends, then the initiation phase begins during which adoption across healthcare educational programmes is enacted. This phase will require continuous feedback to determine appropriate educational delivery mechanisms. After this, a standard phase would be accomplished where digital health is available across all healthcare sectors and becomes the norm.

Over several phases digital health education may develop for an institution. At the exploratory phase an elective track or adjunctive degree is offered to students, with a capstone (please see Annex 3 for definition) to demonstrate knowledge. As the initiation phase is incurred, then material is built into the programme. By a standardisation phase, knowledge is spread throughout the profession.

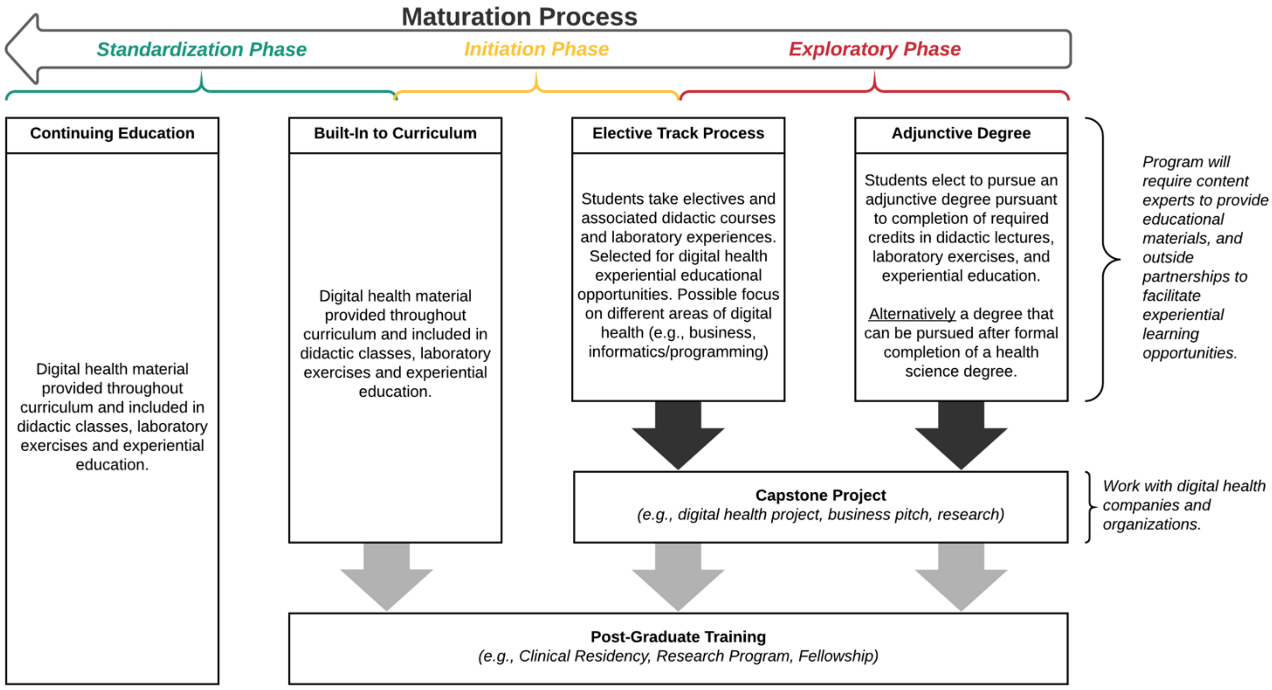

Figure 7: Digital health framework for health education programme adoption[1]

Lastly, the nature of continuing education will be essential to digital health integration. While the above issues target incoming learners to healthcare teaching institutions, it does not solve the intrinsic issue of how to get current and new health professionals up to par. Again, determining what topics to offer and to what extent is up for debate, but likely similar to market-shaping initiatives, it will be necessary to get current healthcare professionals up to date on current digital health topics at hand being discussed and utilised. Afterward, best practices, guidelines, and evidence of technology and solutions may be pushed out to specific therapeutic areas (e.g., endocrinology, cardiovascular, oncology). This will likely involve partnerships or sponsorship of digital health manufacturers and biopharma.

2.2.5 Leadership initiatives for future implementation

One aspect to consider will be how healthcare leadership chooses to engage with digital health within their individual professions. For instance, in the USA, the American Medical Association (AMA) has fostered a digital health-focused initiative internally to disseminate knowledge and innovation with stakeholders. Thus far, it has also crafted two publicly accessible "playbooks" focused on "Remote patient monitoring" and "Telehealth". These playbooks serve as guides for physicians to establish and set up their own services using these technologies, taking into account how to identify vendors, evaluate internal problems these technologies can solve, financial implications, bringing patients onboard, and workflow conduction. In many ways, the AMA is likely demonstrating to other health professions how to integrate digital health within their networks.

Ultimately, without a national focus or professional driven initiative, it is likely the impetus for digital health integration within healthcare professions will be slow to start.[17] With a centralised focus, it is possible to help address current limits and devise a strategy on how to navigate the concerns of healthcare education for upcoming learners and current practitioners.[20,21] Nonetheless, it may come to a point where digital health could lead to a separate entity that other health professional organisations turn towards, as we see such societies or organisations now coming into play, such as those focused on digital therapeutics and digital medicine. An overarching agreement could be reached between different health professions, such as interprofessional education, where digital health becomes a similar initiative.

2.2.6 Future considerations

Digital health in formal healthcare education will be an overarching problem to solve for the next decade. Foremost, as identified, there are multiple instances on what digital health exactly means, and its relevance to different healthcare professions. A lack of resources, brain capital and direct guidelines for best teaching practices needs to be addressed. Until then, exploratory programmes will be the likely means to foster digital health education in a limited fashion for those institutions or professions with the means. Over time, this will improve, but determining the process will have multiple stakeholders to determine a solution. The sooner this happens, the faster we may expect some road map to be devised.

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2.3 Digital health in pharmacy education: Faculty perspective

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Pharmacy academic institutions have a mission of sustaining professional pharmaceutical workforce development through a robust education. Promoting transformation of the profession through research, using advanced technologies, is essential for tomorrow's pharmacy practice. This noble mission is achieved by addressing the inter-connected complex facets of education and research in pharmacy while maintaining a social accountability focus. The integration of social accountability goals in a college's mission, strategy, curriculum, learning experiences, research activities and partnerships sustains the relevance of education and research to meet the needs of society.

2.3.1 Why digital health in pharmacy education matters?

Within the social accountability framework, pharmacy educators have a responsibility to reflect on developments in the healthcare ecosystem. Digitalisation is a significant evolvement which is contributing to opportunities and challenges in the healthcare ecosystem. Digital health, which has picked up momentum very rapidly, is revolutionising the way patient care is delivered. Society is empowered and is in a position to seek on-demand healthcare as a result of accessibility to technologies that generate health data and provide access to health services.

A confident, capable, agile and digitally enabled pharmaceutical workforce is required to make use of the full potential of digital health. Only with education and training can the pharmaceutical workforce keep up with the pace of digital health transformation.

In this context, questions that need to be addressed by academia are:

1. What facilitates preparedness of graduates for the evolving health systems in the light of digital health?
2. Which learning experiences provide skills necessary in this digital age?
3. How can effective learning experiences be organised?

2.3.2 Preparing graduates that are relevant to the evolving health systems

Pharmacy graduates have the opportunity to take up career options in a number of settings including in direct-patient care practice in hospital and community pharmacies providing clinical pharmacy and pharmaceutical care, in patient safety settings such as pharmaceutical regulatory sciences and pharmacovigilance, and in industrial settings such as quality assurance and manufacturing. Key to this state-of-affairs is the contribution by pharmacy graduates in these settings as patient safety advocates. Pharmacists are acting as co-ordinators of care and as an anchoring profession through collaboration with other disciplines. To this effect the patient-centred focus in pharmacy curricula is crucial to prepare graduates as valid players in health systems. All these functions benefit from a sound education in aspects of digital healthcare.

The FIP Nanjing Statements on Pharmacy and Pharmaceutical Sciences Education provide a global vision of the future needs of pharmaceutical education standards.[1] Clusters include a professional skills mix, foundation training and leadership, and experiential education. In Europe, the European Association of Faculties of Pharmacy (EAFP), established a position paper to highlight the four pillars for relevant pharmacy education, namely, a science-practice balance, teaching methods, team players and preparedness.[2]

The Nanjing Statements and the EAFP position paper provide a framework for pharmacy educators to update curricula so that they ensure that graduates are prepared for today's healthcare ecosystems using the context of digital health as a basis (Figure 8). Case examples of challenges and opportunities of digital health, for which graduates need to be prepared, include:

- Personalised care: Digital technologies are enabling society to observe biological markers through medical applications and wearable devices. The big data generated is an opportunity for understanding the totality of the patient's background. A sound science-practice balance is a fundamental requirement for students to acquire the skill to support patients in the interpretation and personalisation of the inferences of such data in the context of the individual's health status.

- Service provision: With the advent of digitalisation, the provision of patient care through telehealth gives the opportunity for patients to access healthcare via telecommunications. Telemedicine and telepharmacy revolutionise the patient-pharmacist-healthcare team interaction. Teaching methods, including experiential education, go beyond communication skills and ought to embrace remote communication as this is applied to provide patient counselling, patient monitoring and to actively interact within the healthcare team.

- Safety and risk: Ensuring patient well-being by regulating the safety, quality and efficacy of delivery systems that feature digital platforms is of essence. Encompassing digitalisation prepares students for the current and future evolvements.

- Leadership: Student competence to reflect on strengths, weaknesses and opportunities takes up a leading role in adopting digital health to transform health systems. Teaching methodologies including exposure to real-life practices strengthen the impact of the exposure.

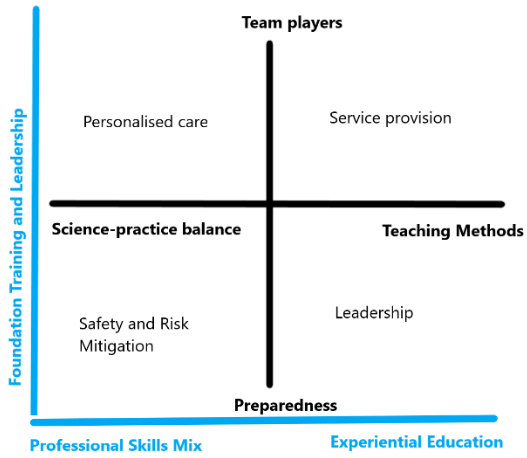

Figure 8: Domains in pharmacy education in the digital age

Figure 8 illustrates how the clusters of experiential education, professional skills mix and foundation training and leadership from the FIP Nanjing Statements[1] and the four pillars of relevant pharmacy education of science-practice balance, teaching methods, team players and preparedness as identified by the EAFP position paper[2] intertwine. Both propositions support domains that promote education which prepares pharmacy graduates for the digital age.

Pharmacy and pharmaceutical sciences education must be needs-based to meet existing and emerging requirements in digital health. These requirements must reflect the needs in all sectors of pharmacy and pharmaceutical sciences, from clinical pharmacy to drug research, of all members of the pharmaceutical workforce as well as patients and the community.

2.3.3 Learning experiences that provide required skills

Learning experiences require an unfragmented education that has a foundation of science as applied to practice. The basis for the didactic experience is guided by a balance between biomedical sciences and clinical sciences. In addition to the knowledge base, the value of students being exposed to longitudinal experiences throughout the curriculum cannot be overstated. The longitudinal practical and placement experiences support the mobilisation of knowledge and application to administrative, social, therapeutic and regulatory interventions. The learning experience reinforces student transition from the "learning how to think" to the "thinking how to learn" mentality. The outcome of this learning experience is to develop active, self-directed lifelong learners who are able to evaluate and update with the dynamic developments in the healthcare ecosystem, including digital health.

The relevance of experiential education becomes accentuated when aiming to provide learning experiences in the perspective of our contemporary digital age. Students are exposed to the realities of communicating with patients through telemedicine: understanding barriers that patients may have to access healthcare through digital health and overcome anxiety. Work ethics that improve on communication techniques need to be addressed in a remote communication environment.

Laboratory sessions require adjustment to secure the facet of digital health. Efforts should be directed to provide a learning experience on embracing digital technologies in healthcare rather than towards exposing students to the technologies available at the time. Laboratory sessions need to boost skills involved in handling and managing digitalisation in healthcare systems and may require a transversal approach in evaluation and use. A transversal approach adopts a comprehensive learning experience of applications of digital health in addition to theoretical areas of study such as formulation, dispensing and analysis. The laboratory mindset within colleges of pharmacy should evolve from classic aspects to include exposing students to technology-driven learning facilities.

Capstone projects which give a comprehensive overview of digital health as it impacts on service development, personalised medicine approach and regulation, expose students to an intellectual experience which nurtures leadership skills in leading innovative applications of digital health. Such capstone projects may be incorporated during undergraduate and post-graduate level programmes.

2.3.4 Organising effective learning experiences

Academic pharmacy has transitioned its science-focused curriculum delivered within a higher education institution, to include a competence-based learning model which includes experiences within relevant health systems.[3] A way how pharmacy education could respond to the needs of society, in the environment of digitalisation, is through a ''Fourth Generation'' paradigm of digitalised pharmacy education (Figure 9).

A people-centric Fourth Generation encapsulates a proactive approach in preventing communicable and non-communicable disease and respond to the needs of society. Embedded within the people-centric curriculum, domains may be identified that sustain development of competences which ensure: efficacy, safety and quality medicinal products (including medical devices) and digitalised drug delivery systems; access to medicines and pharmaceutical services; and patient monitoring and application of information to specific individual needs.

A technology-driven delivery of the learning experience provides for a large proportion of the students, who are now from the Z generation, therefore open and amenable to digital technology. Their avid use of social media, digital communication, cloud computing and mobile apps should not jeopardise the emphasis on personal professional and social interactions. This environment highlights the importance of technology-driven quality education which emphasises the collaborative, people-centric focus. Digitalisation results in bringing down boundaries and expanding networks. Collaborative networks among health professionals that exploit the benefits of interprofessional education are easier to conceptualise within a digitalised education. Benefits of interprofessional education, namely, the development of mutual respect, sharing patient care, connecting with patients and experiencing equitable and effective teamwork, are transferable skills that prepare students for a collaborative practice approach.[4]

Figure 9 illustrates the Fourth Generation of digitalised pharmacy education — a people-centric education within a collaborative instructional approach that is technology-driven and with the objective of covering the domains essential for safe, effective and quality pharmaceutical contributions.

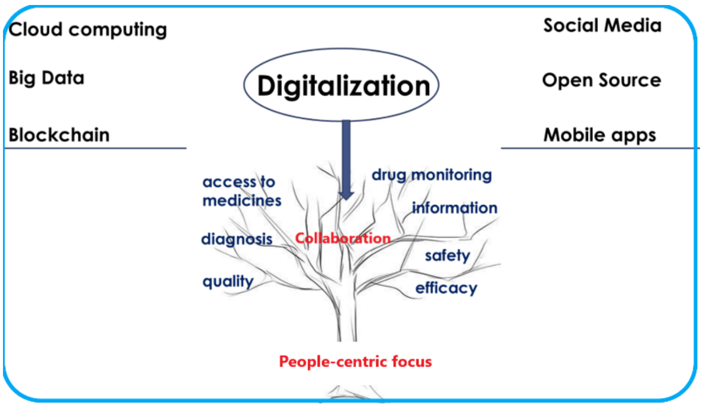

Figure 9: Fourth Generation of digitalised pharmacy education

2.3.5 How to assess competences in providing care and ensuring patient safety in the digital age

Pharmacy education prepares pharmacists who in turn are life-long learners and educators entrusted with promoting good practice in pharmaceutical processes and advising on rational and safe use of medicinal products. In a learner-centred model, assessment is not only a measure of evaluating learner success but is also an indicator of success of the educator model. Having set the faculty perspective of embracing curriculum developments and teaching modalities that support student competences in performing in the digital health age, identifying appropriate assessment processes that measure the outcome is commensurate. Electronic examination platforms allowing different written examination structures, including short-answer and

multiple-choice questions, are an option. Carefully designed digital formats for assessment serve as a technique of assessing digital skills within a specific environment such as that created during an exam session. A trend in adopting digital assessments in medical education has been witnessed.[5]
The application of Objective Structured Clinical Examination (OSCE) gained momentum in pharmacy entry-to-practice licensing examinations and final examinations over the past 15 years.[6] OSCEs are useful learner-centred assessment model adopted in some regions of the world in pharmacy education to evaluate students' ability to counsel and educate patients, to optimise drug therapy and to evaluate and provide drug information.[7, 8] The implementation of OSCEs in pharmacy education serves as a student performance-based summative assessment for clinical and patient skills.[9] OSCEs may be adjusted to reflect realities in health systems that incorporate digital health for example ability of the student to counsel patients remotely.

Considering that digital health requires the development of discreet competencies which provide a comprehensive proficiency, the application of the more recent concept of "entrustable professional activities" (EPAs) may be also pertinent. EPAs sustain continuous assessment modalities that provide feedback to the learner and the faculty.[10] EPAs for pharmacy practice capture domains that are relevant to pharmacy education in the digital age. Updating EPAs to reflect tasks specific to digitalised healthcare systems puts forward an assessment process which may be triangulated along other conventional assessment procedures. Research in the application of EPAs to pharmacy student assessment would inform better on the advantages and disadvantages of adapting these structures in the context of digitalisation.

2.3.6 Conclusion

Pharmacy educators are key players in preparedness for digital healthcare.[11] A Fourth Generation of digitalised pharmacy education is proposed to achieve effective teaching and student learning models that meet this evolvement.

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2.4 Digital health in pharmacy education: Students' perspective

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2.4.1 Introduction

Pharmacy and pharmaceutical sciences students, in addition to recent graduates, are largely using the internet to seek health information while studying, doing scientific research and in practice. However, they are using mobile health apps and wearable devices to a lesser extent. Students are using online platforms to be able to take courses related to digital health that are not usually provided as a part of the academic curricula.

Nonetheless, the development of a framework that supports the development of digital health education will be a topic of debate in the coming years,[1] especially in the field of pharmacy, where integrated telemedicine with the use of information and communication technologies enables remote medical services. It can reach citizens in remote and rural areas by providing access to medical services that may not otherwise be available or affordable. Digital health systems can also make quality health information more accessible, promote health literacy and healthy behaviours, and provide patients with access to support networks.

With the increasing complexity of smartphone apps, app-connected sensors and other technological advancements, the competencies of the health workforce must be developed accordingly.[2] Additionally, despite being around for over a decade, digital health has not been fully integrated into pharmacy education.

2.4.2 Reasons for the integration of digital health in the curricula

The rise of digital health technologies and access to online health information by patients requires pharmacy students to be prepared to address future patients' needs.[3] According to the WHO Regional Office for the European region,[4] digital health technologies enable patients to receive care without physically going to a hospital or clinic. This means that healthcare professionals will need to have the skills to use digital health tools and to guide patients in understanding and using digital solutions to improve their health.

Building digital health into a curriculum would allow learners to have a better grasp of digital health at large and understand implications in pharmacy practice after graduation, instead of a snapshot approach which is limited in learning.[5] The integration of digital health into education fosters the implementation of technological solutions that offer great potential in ensuring equity in access to health. These connect rural and remote areas to quality care that usually is more frequent in urban areas.[2]

Pharmacy students must be educated in digital health to be able to leverage existing and future tools to support medication-associated care. Furthermore, this allows pharmacists to fulfil their duties and responsibilities beyond the direct-to-patient applications of digital health, into early sets of clinical trials, and health research overall.

An elective can be part of the curriculum at universities, implying that pharmacy students receive credits for it and have to pass an exam at the end. On the other hand, an elective can also be a voluntary module, students choose to take in addition to regular lessons and courses.

At most universities, having and organising an official elective is not applicable without engaging professors and educators while planning and executing it. Therefore, pursuing an elective track concurrently with the health programme curriculum would offer students with an interest in digital health a consistent approach to learning and understanding the concepts.

2.4.3 Tools for the integration of digital health in education

Digital health components should be included at all levels in the formal and informal education and training curricula of all health and allied professionals; workshops focused on digital health technologies would be a great way to increase knowledge and experience in an increasingly technology-reliant healthcare space.

Digital education based in problem-solving learning and design thinking relates to many health-focused hackathons being implemented by FIP and the IPSF, their members and other pharmacy organisations.[4,5]

Healthcare, evolving through the disruptive changes brought about by digitalisation, engages numerous different professions, now more than ever. Thus, interprofessional collaboration is a substantial part of a future-proof health curriculum. Areas such as engineering, computer science and entrepreneurship have become increasingly important for healthcare graduates and therefore should be part of undergraduate healthcare education.

Students across multiple professions should learn and work together to engage in digital health discussion that aims to tackle public health problems by focusing on technological solutions while bringing multiple perspectives together. Interprofessional and interdisciplinary workshop activities allow students to focus on what they know, based on their educational background and preparation, to apply it in a different context, and to share their findings with others.

2.4.4 How digital health should be taught?

Among some of the major barriers for successful implementation of digital health technologies are lack of coordinated, formal and informal education, which leaves recent graduates and young pharmacists struggling to master the technologies, and resistance to change and scepticism about digital technologies. Addressing this would require a coordinated response targeting different perspectives, populations and different stages of education. It would be overwhelming to squeeze everything into the four to six years of a typical curriculum for pharmacists, or other specialties.

Ensuring the competence of pharmacy educators and trainers is crucial when delivering courses or training on digital health and its impact on health transformation. All pharmacists, including practitioners, are educators, responsible for teaching pharmacy students in clinical rotations, giving lectures and lessons; therefore, their proficiency in digital health has a direct impact on the learning outcomes of students. The teaching of digital health literacy and skills must follow a holistic approach and be integrated equally into undergraduate and continuing education. Figure 6 in Chapter 2.2.3 shows teaching options for digital health.

2.4.5 Expectations towards digital health in pharmaceutical education

Pharmacy education and effective culture of learning have the potential to drive meaningful digitisation of healthcare. Several medical schools are already housing centres for digital health, and it comes as no surprise that they may seek to expand these to formal educational outputs.

Some centres and institutions — such as Brown Alpert Medical School, University of Massachusetts Amherst Centre for Digital Health (CDH), Stanford Medicine CDH, and Thomas Jefferson University CDH and Data Science — are among those leading the way involving academia to help study, inform and evolve the medical field in a critical and evidence-based way and providing digital courses integrated into the curriculum or not.

These centres: provide expertise in data science, software development, product and project management, digital health policy development; support digital health projects and research; host events and educational seminars; engage in research and education; and also work with industry with a digital health focus.[2]

It is expected that medical and health science programmes will build into their curricula digital health topics such as didactic courses, laboratory exercises to foster new opportunities in postgraduate education, like residency, research programmes or fellowship positions which pharmacy students can pursue.[5]

When adopting digital health in education several pathways could be pursued, and pharmacy students need to be provided with enough educational contexts not just to understand the medicines use process but also to participate in its continuous improvement. This includes a scientific approach to understanding the safety and effectiveness of digital health for the medicines use process.

Pharmacy students also must learn how digital health is impacting the global healthcare delivery system. For example, digital solutions that automatically capture and analyse data can ease professionals' workload, giving them more time with patients and enabling them to achieve better treatment outcomes. Digital devices that help people follow their medication regimen or post-operative protocols allow health workers to spend more time with patients individually when this is needed. Digital health systems can also help address the current and projected shortages of healthcare professionals.[2]

Other than digital health components, the current ongoing challenge of data overabundance is a further dilemma facing future clinicians, not to mention advanced data analysis methods. Current practitioners and educators do not always realise the full picture of this current challenge. Many conversations and talks were centred around the use of artificial intelligence (AI) in most of the current software being developed. Whether these current technologies qualify to be called true AI is arguable, but machine learning and relevant applications in the health sector are indeed making steps towards integration in healthcare management.

With the AI-generated suggestions or analyses of patients' health situations, how should future practitioners take action upon the data that are provided, given that currently limited or no basic understanding of data analysis or IT topics are adopted by most institutions? It is clear that the integration of AI in practice is an inevitable part of healthcare adapting to future needs. Healthcare students, in general, should be equipped with the appropriate tools and learning opportunities to manage and address those changes introduced to the practices.

2.4.6 What can students do about digital health education?

The IPSF's mission is to respond to global challenges in health education as the global, collective voice of students and recent graduates in pharmacy and pharmaceutical sciences. It aims to disseminate scientific and professional knowledge; to advocate for improvements to pharmaceutical education; and to serve as a platform for members to exchange knowledge, experience and ideas.

With these challenges coming to light and these future endeavours being disseminated, many students and young professionals around the world are putting efforts into becoming the pharmacist they will need to be and have the potential to become in response to digital health implications that might arise.

Unfortunately, such individual initiatives are not sustainable and would not in best-case scenarios be sufficient to supply the resources needed to manage and provide adequate and fully functioning services that match digital health capabilities and possible applications. Therefore, there is a need for student bodies and organisations to get involved in policy, advocacy and strategies work in collaboration with all stakeholders.

Not only that, but with the virtual platform the IPSF offers, all different experiences are shared and reported to all students and student bodies to be informed about what has been done and what is currently being implemented in countries that are under the federation. This culture of multilateral exchanges fosters an environment where the transfer of knowledge is enabled and opportunities for advancement, reflection and personalisation are within reach.

Member organisations are encouraged to share their knowledge for others to develop and learn from. When it comes to digital health, despite all the obstacles highlighted above, a collective commitment to promote and report would help in introducing a region- and country-specific framework that the IPSF and member organisations can independently advocate.

2.4.7 Conclusion

Young pharmacists and pharmaceutical scientists and students have a responsibility to lead the adaptation and promotion of new information technologies in community pharmacies, hospitals, industries and other areas where they work, especially since they, as members of generations Y and Z, are most associated with living through the digital transformation era. Pharmacists are one of the most accessible healthcare providers and through their frequent interactions with patients can guide them during this digital transformation.

Pharmacists can and should be an asset that governments, non-governmental or intergovernmental organisations, in addition to the private sector, could invest in and count on to deliver early, representative and specific data that would help customise digital health developments while expanding these to all other healthcare practices and management.

Overall, digital technology has transformed healthcare and pharmacy, and this transformation is expected to continue in future. Artificial intelligence, machine learning, healthcare mobile apps, wearables and many other advancements will change the future of healthcare. As long as universities, healthcare organisations, healthcare professionals and students keep updated, deliver and take necessary training and courses related to digital health, digital technology can be incorporated into healthcare.

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2.5 Overview of existing digital health in pharmacy education initiatives

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A literature review has been conducted on existing digital health in pharmacy education initiatives. Limited literature is available on the design and implementation of digital health training curricula with special emphasis on the pharmacist's role promoting digital health use.[1,2]

Findings from a study conducted in United Kingdom found that pharmacists and pharmacy technicians were trained without explicit reference to digital health and pharmacy technologies in their curricula. The self-reported lack of digital literacy and often mentioned lack of confidence in using information technology (IT) suggested pharmacy staff needed training. There was overwhelming evidence from pharmacy staff at all levels, ages and stages that they could not recollect IT training as part of their pharmacy education and yet said that it was central to their everyday practice. There was a clear need for a workforce fit for future needs and pharmacy education to ensure a basic standard of IT literacy.[3]

Furthermore, a study conducted in Italy found that basic knowledge of community pharmacists on technological infrastructure was quite low. Although pharmacists played an essential role in health services, they had limited computer skills. This suggested the need of educational and training efforts for enlarging the competent use of computer and technological resources in daily pharmacy practice.[4]

A study conducted in Turkey among pharmacy students showed that mobile health apps users and male pharmacy students had statistically higher eHEALS (eHealth Literacy Scale) scores compared with non-users and female pharmacy students. Fifth-grade pharmacy students had statistically higher scores when compared with the third-grade pharmacy students. It was found that 83% of pharmacy students said that mobile health apps improved patients' quality of life whereas 30% thought that pharmacists do not have sufficient knowledge of using mobile health apps. It was concluded that pharmacy students' knowledge and behaviours towards mobile health apps could be increased by improving their e-health literacy levels.[5]

In a study conducted in United States, students used the online pharmacy informatics modules as part of their readiness assurance process. Participants' knowledge of electronic health records, computerised physician order entry, pharmacy information systems, and clinical decision support was significantly improved. Additionally, their confidence significantly improved in terms of describing health informatics terminology, describing the benefits and barriers of using health information technology, and understanding reasons for systematically processing health information.[6] Previous studies conducted in the USA showed that pharmacy informatics education and informatics courses have been delivered in only 33% and 36% of pharmacy schools, respectively. Pharmacy schools in the USA are striving to meet the standards.[7]

Specific to pharmacy, a study conducted to examine pharmacy staff members' (e.g., pharmacists, pharmacy graduates, pharmacy assistants) self-reported levels of eHealth literacy in Scotland found that although the use of technology was essential in their everyday practice, they did not recall receiving IT training as part of their pharmacy education. They expressed low confidence in their use of technology and low self-reported eHealth literacy.[3]

Similarly, another study conducted in the United Kingdom showed specific mention of the digital literacies required to facilitate pharmacy staff's collaborative healthcare role. Digital health was not evident in the UK curricula for initial training or for continuing professional development (CPD).[8]

Pharmacy programme accreditation in Australia and New Zealand makes explicit mention of the need to prepare students to make best "use of information technology in pharmacy and more widely in healthcare". While digital literacy may be covered to an extent in some initial training programmes, there was limited evidence that it features in CPD for existing members of pharmacy staff.[9]

The Australian Digital Health Agency (ADHA) published its "National digital health workforce and education roadmap" in September 2020. The roadmap set three horizons which are "digital health foundations", "new technologies and ways of working" and "system transformation". To achieve the "digital health foundations" horizon, the Pharmaceutical Society of Australia and the ADHA have committed to integrate digital health foundations into undergraduate and postgraduate curricula over January 2021, 2023 and 2026.[10]

A study conducted in Canada found that, overall, pharmacy students were aware of the health information available online and had the knowledge of where and how to find it. However, they felt less confident evaluating the health resources that they found on the internet and using that information to make health decisions. Furthermore, in Canada, currently a limited offering of healthcare informatics courses is available for pharmacy students. For pharmacy programmes that do not offer a course in health informatics, other national resources are available, such as the online educational, peer reviewed, open-access resource called "Informatics for pharmacy students" developed by the Association of Faculties of Pharmacy of Canada and Canada Health Infoway.[11]

A study conducted in North America noted that informatics was not a formal component of the core undergraduate or graduate programmes at their local university and "remained an uncommon component of most pharmacy and medical school curricula" in North America. It also found that 79% of pharmacists who responded to the survey "had received no formal computer training" and 77% were in need of "general computer skills upgrading", ranking medical database and internet searching as priority areas.[12]

Findings from Bearman *et al*'s literature review showed that many pharmacists had not been educated in internet use for professional practice. Following their educational intervention, they received positive feedback from participants about improved searching skills and more effective searching while "almost half of the respondents reported a change in practice".[13]

The findings from Fuji and Galt's study described the results of an online elective course in pharmacy. The study concluded having access to e-prescribing and EHR (electronic health record) software demonstrations or educational licences might facilitate the development of application exercises and provide students with better opportunities to understand the basic functionalities of such technologies.[14]

Various studies have concluded that pharmacy has embraced technology without recognised occupational standards, definition of baseline skills or related personal development plans. There is little evidence that digital health has been integrated into pharmacy education and training and remains an under-researched area. Previous studies have also shown that students believed the course helped them to improve their knowledge regarding key aspects of digital health. It is important to design a digital health curriculum targeting competencies to provide necessary knowledge and skills to help students practise digital health in their professional careers.[3,11]

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3 Findings from the FIP digital health in pharmacy education survey

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Key findings on readiness and responsiveness of pharmacy education and training

- 57% of surveyed pharmacy schools do not offer digital health education. 9.9% of surveyed students and 25% of surveyed practitioners have received digital health education or training as part of their continuous education.
- Digital health education terminology was sometimes perceived as interchangeable with online education by surveyed students and academics.
- Around half of academics agreed that their students were equipped with the competencies to deliver digital health services after graduation and their schools were able to readily identify and include new digital health skills/competencies in the curriculum as they emerge in practice. Thus, half of pharmacy schools were ready and responsive to train and prepare their students on digital health education.
- The most common digital health tools and services covered in pharmacy education were mobile applications, according to all surveyed groups. These were also the most utilised tools, according to practitioners.
- Practitioners indicated a lack of familiarity with emerging digital health technologies such as blockchain technology, bots, digital medicines and artificial intelligence (see Annex 3 for definitions). Likewise, the least common tools covered in pharmacy education were bots and blockchain technology. Students confirmed that their educational needs were highest for these two tools.
- Digital health concepts related to implementing digital health tools in clinical care were among the least likely to be included in pharmacy education (clinical reasoning and decision-making and evidence-based digital medicine). This finding may contribute to the low percentage of clinical or health outcomes-related expectations from the use of digital health tools in practice highlighted by practitioners.

Key findings on knowledge and skill gaps of the pharmaceutical workforce

- The most common competencies that were perceived as essential by academics were patient-centred digital health provision and knowledge of digital health tools. This finding was also highlighted as the highest skillset needed from the students' perspectives.
- Around half of the academics agreed that their students were equipped with the competencies to deliver digital health services after graduation and their school was able to readily identify and include new digital health skills/competencies in the curriculum as they emerge in practice. They believed that their pharmacy schools were ready and responsive to train and prepare their students on digital health education.
- In general, students who took a digital health course were confident to have better knowledge than students who did not take such a course.
- A key gap in digital health education is the skillset and knowledge of how to apply technology to solve existing clinical problems and improve care. Guidance on how to implement digital health tools was a key need cited by students and practitioners.
- Integrating digital health in undergraduate pharmacy education is a critical strategy to increase digital health competencies overall as it is likely to promote greater awareness and life-long learning; there was a greater likelihood of receiving digital health education as part of continuous professional development if one previously had received digital health education in pharmacy school.
- Moreover, taking a course in digital health might influence a student's plan in having a career in digital health after graduation.

Key findings on challenges and enablers for robust digital health education and skills development

- The most common challenges related to implementing digital health education reported by schools were the lack of experts followed by lack of resources. Most of the pharmacy schools indicated a need for support, such as guidance, training and resources.
- Most students did not receive any support from their school on employment opportunities in digital health. Student associations might play an important role in filling this gap.
- Lack of enabling policies and guidance, as well as lack of technical limitations and lack of access to data were reported as the biggest challenges in using digital health in practice. Practitioners expressed the need for greater support, including access to digital health tools, increased digital health education, and guidance on how to apply digital health technologies in practice.

3.1 Method

The delivery of relevant course content in the curriculum and training on digital health is important to support the pharmaceutical workforce with appropriate competencies on leveraging digital health in their practice. However, there is not much evidence in the literature on the availability of digital health courses and the current states of skills and knowledge that pharmacists and pharmaceutical scientists have in responding to current and future challenges on digital healthcare.

The research question which our survey addressed was "how should the current and future pharmaceutical workforce be educated and trained to embrace the impact of the technological revolution?". To answer the research question, two aims were set: (1) to investigate and describe the readiness and responsiveness of education programmes to train the current and future pharmaceutical workforce on digital pharmaceutical care; and (2) to identify knowledge and skill gaps in the pharmaceutical workforce on digital health. The first aim was achieved by collecting the responses of academic institutions and faculty members; the second aim was achieved through surveying students and practising pharmacists and pharmaceutical scientists.

To gather a large number of responses in a short period, an online questionnaire was chosen as a way of collecting data using the QuestionPro platform. The questionnaire consists of four sets of questions which were prepared based on the target audiences: (1) academic institutions, (2) faculty members, (3) students, and (4) practitioners. The questionnaire combined open-ended questions and multiple-choice questions. Some questions asked were similar but were rephrased according to the target groups. The list of questions can be seen in Annex 2.

There is limited evidence that a previously validated questionnaire was usable. Therefore, the survey was developed by survey project team, who have various skills and expertise in digital health (see the Acknowledgements for the composition of the team). A scoping literature review was conducted to identify survey themes for the questionnaire and presented to the core project team.

Various studies related to digital health conducted in healthcare areas were reviewed. Surveys conducted to assess the digital skills, literacy and knowledge of paramedical students, nursing students, medical students and pharmacy students were also reviewed. Different topics such as commonly used digital technology in pharmacy, frequency of use and perception of pharmacists towards digital health were also covered.

The questionnaire draft was piloted to the core, extended team and the FIP Technology Forum for feedback. All feedback from the pilot stage was incorporated. The final survey draft was agreed and translated into eight languages by volunteers (see acknowledgement): Arabic, Brazilian Portuguese, Chinese, English, French, Russian, Spanish and Turkish. Considering the topic was new, a glossary was developed to help participants in understanding some terminologies in the survey. The glossary can be seen in Annex 3 The survey was distributed from 17 August 2020 to 1 October 2020 to the FIP network and collaborators including the FIP Academic Institutional Membership members, the FIP Academic Pharmacy Section members, the International Pharmaceutical Students' Federation members, individual members of FIP and through extended team member to their networks. The distribution was through social media and electronic mailing lists.

The analysis of survey data in this report was conducted only for the respondents who completed the full survey, which was defined as respondents who progressed through to the end of the survey and clicked to submit their responses. It was not required to answer all questions before submitting. Therefore, a completed survey response could have missing answers to some questions. The data captured were translated into English where necessary and compiled before the analysis. A survey analysis plan was developed to guide the analysis process based on the questionnaire. The analysis was conducted independently by the authors of this section for the three categories of respondents: academia, students and practitioners. The survey results were analysed descriptively using Microsoft Excel and other statistical software as necessary (e.g., SPSS and SAS).

3.2 Findings from the FIP Digital health in pharmacy education survey

In total, 1,060 respondents from 91 countries completed this survey (see Annex 4 for country distribution). The breakdown of respondents' distribution and country coverage based on the WHO regions can be seen in Table 3. The highest percentages of response rate of academic, student and practitioner groups were from the European region, 32%, 54% and 49%, respectively. The lowest percentages of response rate of academic and student groups were from the Eastern Mediterranean (10% and 4%, respectively). In contrast, the lowest percentage of practitioner groups were from Eastern Mediterranean and Southeast Asia (4%). The country coverage of the data sample mapped to the WHO regions shows the highest relative country coverage distribution of the academic group to be from the European region (35%), with lower country coverage distribution reported from the African region (13%). In the student part, the country coverage of the data sample mapped to the WHO regions shows the highest relative country coverage distribution to be from Southeast Asia region (10% vs 6%), with lower country coverage distribution reported from America (15% vs 18%) and the Eastern Mediterranean region (8% vs 11%). A comparison of country coverage of practitioners showed a similar representative spread to the WHO member states distribution.

Table 3. Respondents' distribution and country coverage based on WHO regions

WHO region	Academic		Students		Practitioners		WHO member states (n; %)
	Sampled respondents (n; %)	Country coverage (n; %)	Sampled respondents (n; %)	Country coverage (n; %)	Sampled respondents (n; %)	Country coverage (n; %)	
Africa region (AFRO)	31; 12%	8; 13%	40; 15%	10; 26%	98; 18%	14; 20%	47; 24%
America region (PARO)	41; 16%	10; 17%	28; 10%	6; 15%	88; 17%	15; 21%	35; 18%

WHO region	Academic		Students		Practitioners		WHO member states (n; %)
	Sampled respondents (n; %)	Country coverage (n; %)	Sampled respondents (n; %)	Country coverage (n; %)	Sampled respondents (n; %)	Country coverage (n; %)	
Eastern Mediterranean region (EMRO)	26; 10%	8; 13%	11; 4%	3; 8%	22; 4%	7; 10%	21; 11%
Europe region (EURO)	84; 32%	21; 35%	149; 54%	11; 28%	256; 49%	20; 29%	53; 27%
Southeast Asia region (SEARO)	43; 17%	6; 10%	28; 10%	4; 10%	20; 4%	4; 6%	11; 6%
Western Pacific region (WPRO)	35; 13%	7; 12%	18; 7%	5; 13%	42; 8%	10; 14%	27; 14%
Total	**260; 100%**	**60; 100%**	**274; 100%**	**39; 100%**	**526; 100%**	**70; 100%**	**194; 100%**

The country coverage based on World Bank Income Level can be seen in Table 4. In general, there was a low representation of respondents coming from low-income countries; the highest representation across all respondents' categories was from the high-income countries.

Table 4. Respondents' distribution and country coverage based on World Bank Income Level

World Bank income category	Academic		Students		Practitioners		World Bank income category (%)
	Sampled respondents (n; %)	Country coverage (n; %)	Sampled respondents (n; %)	Country coverage (n; %)	Sampled respondents (n; %)	Country coverage (n; %)	
Low income	2; 1%	2; 1%	10; 4%	2; 5%	5; 1%	5; 7%	29; 13%
Lower-middle income	81; 31%	14; 22%	62; 23%	12; 31%	125; 24%	14; 20%	50; 23%
Upper-middle income	83; 32%	20; 33%	51; 19%	13; 33%	113; 21%	21; 30%	56; 26%
High income	94; 36%	24; 40%	151; 55%	12; 31%	283; 54%	30; 43%	83; 38%
Total	**260; 100%**	**60; 100%**	**274; 100%**	**39; 100%**	**526; 100%**	**70; 100%**	**218; 100%**

The findings of this survey will be presented separately based on target respondents.

3.2.1 Findings from academic perspectives

Analysis team

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Key findings

- A significant number of pharmacy schools do not offer digital health education in their curricula.
- Most of the schools which provide digital health education integrated digital health into already existing courses. Only a few schools offered digital health education as a standalone course.
- In minority of institutions, digital health education was delivered by experts from the digital health industry.

- More than two-thirds of the schools that provided digital health education did so only to pharmacy students, whereas few schools provided interdisciplinary such as with nursing students.
- The most common digital health tool/service covered in pharmacy schools was mobile applications, while the least common tool was bots. Ethics and compliance, followed by data privacy and security, were the most common digital health concepts covered in the schools.
- Half of the respondents agreed their students were equipped with the competencies to deliver digital health services after graduation and more than half of the respondents agreed their school was able to readily identify and include new digital health skills/competencies in the curriculum as they emerge in practice.
- Patient-centred digital health provision and knowledge of digital health tools are amongst the competencies that need most strengthening and further development through pharmacy education.
- Most of the pharmacy schools indicated a need for support, such as guidance, training, and resources on digital health.

Surveyed academics' demographics

Out of the total 260 responses received from academic institutions, most were received from public universities (n=168, 65%), followed by private universities (n= 82, 32%) and other types of universities such as autonomous universities (n=10, 4%). Few of the respondents (n= 45, 17%) were from leadership positions such as dean, head of the department, or head of the institution. The majority of the participants (n= 156, 60%) were faculty members (associate professor- assistant professor). Several participants (n= 56, 22%) were research assistants and students. Very few respondents (n=3, 1%) did not declare their position.

Processes of teaching digital health in pharmacy & pharmaceutical sciences education and training

Nearly half of the participants (n=148, 57%) responded that digital health was not taught in their university. Where digital health was included in the curriculum, it was either integrated into other courses (n=89, 34%) or offered as a standalone course (n=13, 5%). Some participants (n=10, 3%) stated that they did not know about the inclusion of digital health at their institution. It may be preferred to have digital health education integrated throughout the curriculum, as technology is now a relevant and important aspect to consider for almost every topic and it is important not to think of it as in isolation or a separate curriculum.

Some of the respondents (n=37/106, 35%) who answered the question related to the duration of the digital health course reported that the digital health concept was taught in their pharmacy school for around one to two lectures over an academic year. Twenty-nine (27%) mentioned it was taught for more than three lectures over an academic year, and 24 (23%) did not know the number of lectures being offered per year.

In the majority of the pharmacy schools, digital health was offered in a classroom setting (63%), while in some it was offered in a virtual setting (43%). In most of the pharmacy schools, digital health was taught by lecturers from the pharmacy department while in a few of the schools it was taught by guest speakers from the digital health industry (24%) and visiting lecturer (13%). Digital health was taught to pharmacy students as a single group (79%) in the majority of the schools that provided education on digital health. In contrast, some of the schools provided digital health in liaison with other healthcare students (e.g., medicine, nursing). Table 5 summarises the details of digital health courses offered in pharmacy schools.

Table 5. Details of digital health courses offered in pharmacy schools

Digital health course details	Categories	Frequencies (%)
Availability of digital health course	Yes, it is a standalone course	13 (5%)
	Yes, it is integrated into already existing courses	89 (34%)
	No	148 (57%)
	I don't know	10 (4%)
	Total respondents	**260 (100%)**

Digital health course details	Categories	Frequencies (%)
Ways of digital health being offered in university*	Mandatory	61 (54%)
	Elective	28 (25%)
	Through an optional certificate programme	6 (5%)
	I don't know	23 (21%)
	Total respondents**	**112 (100%)**
Academic degree of digital health course being offered*	BPharm	57 (54%)
	MPharm	30 (29%)
	PharmD	31 (30%)
	Total respondents**	**105 (100%)**
Academic year of digital health course being offered*	First-year	22 (21%)
	Second-year	25 (24%)
	Third-year	35 (33%)
	Fourth-year	47 (45%)
	Fifth-year	28 (27%)
	Sixth-year	3 (3%)
	Total respondents**	**105 (100%)**
Frequency of digital health course	1–2 lectures over an academic year	37 (35%)
	3 or more lectures over an academic year	29 (27%)
	An entire module or course within the curriculum	16 (15%)
	I don't know	24 (23%)
	Total respondents	**106 (100%)**
Ways of digital health being delivered in university*	In a classroom setting	71 (63%)
	In a practice setting, e.g., hospital	29 (26%)
	In a virtual setting	28 (43%)
	I don't know	11 (10%)
	Total respondents**	**112 (100%)**
Groups who deliver digital health course in pharmacy school*	Lecturer(s) from pharmacy department	80 (71%)
	Lecturer(s) from other departments	21 (19%)
	Guest speaker(s) from digital health industry	27 (24%)
	Visiting faculty	15 (13%)
	I don't know	13 (12%)
	Total respondents**	**112 (100%)**
Digital health as part of interprofessional education together with other students*	Only to pharmacy students	79 (71%)
	With other healthcare students (e.g, medicine, nursing, etc)	27 (24%)
	With other disciplines (e.g., engineering, etc)	7 (6%)
	I don't know	13 (12%)
	Total respondents**	**112 (100%)**

*Participants can choose more than one response.

**The total respondents were the respondents who chose at least one response. The respondents could select more than one option; therefore, the total sum of responses can be more than total respondents.

Digital health in pharmacy and pharmaceutical sciences curricula

The academics were asked about their perception on the readiness of their school through their response to the statement: “My students are equipped with the competencies to deliver digital health services after graduation”. They were also asked about their perception on the responsiveness of their school through their response to the statement: “In the ever-changing landscape of digital health, my school is able to readily identify and include new digital health skills/competencies in the curriculum as they emerge in practice”. Nearly half of the respondents (48%) agreed their students were equipped with the competencies to deliver digital health services after graduation and more than half of the respondents (52%) agreed their school was able to readily identify and include new digital health skills/competencies in the curriculum as they emerge in practice. Both readiness and responsiveness findings can be seen in Figure 10.

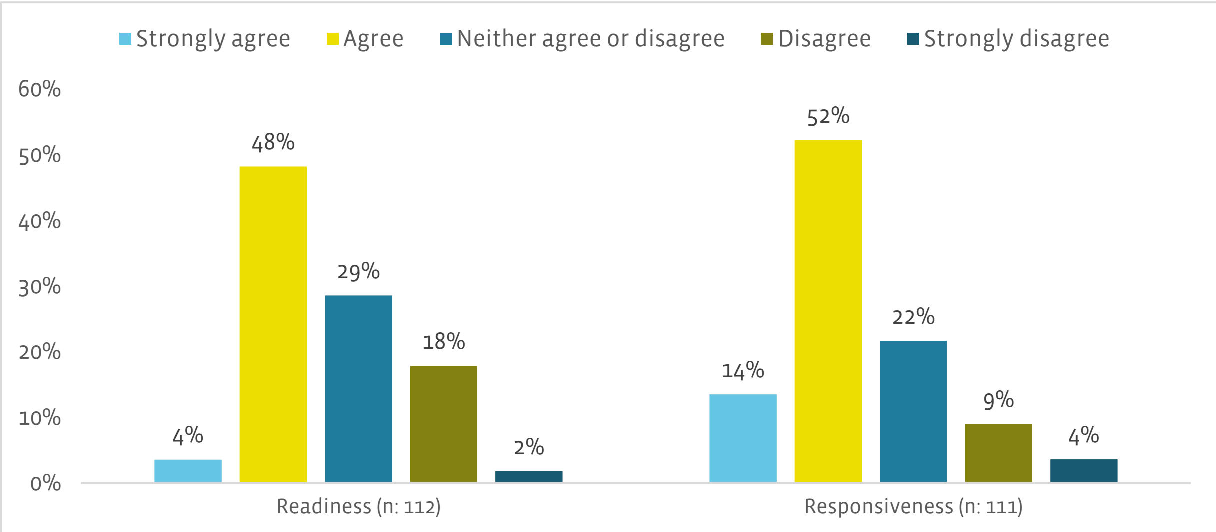

Figure 10. Readiness and responsiveness of pharmacy school with respect to digital health

An overview of the tools/services covered in digital health education in pharmacy schools is represented in Figure 11. The most common tool/service covered in pharmacy schools stated by respondents was mobile applications (63%) while the least common tool was bots (7%). Some of the other tools covered in pharmacy schools included electronic health record (53%), online/remote (patient) counselling (52%). The majority of the respondents who were from the school that did not offer digital health course were interested in teaching about online (remote) patient counselling (39%) followed by mobile applications (37%).

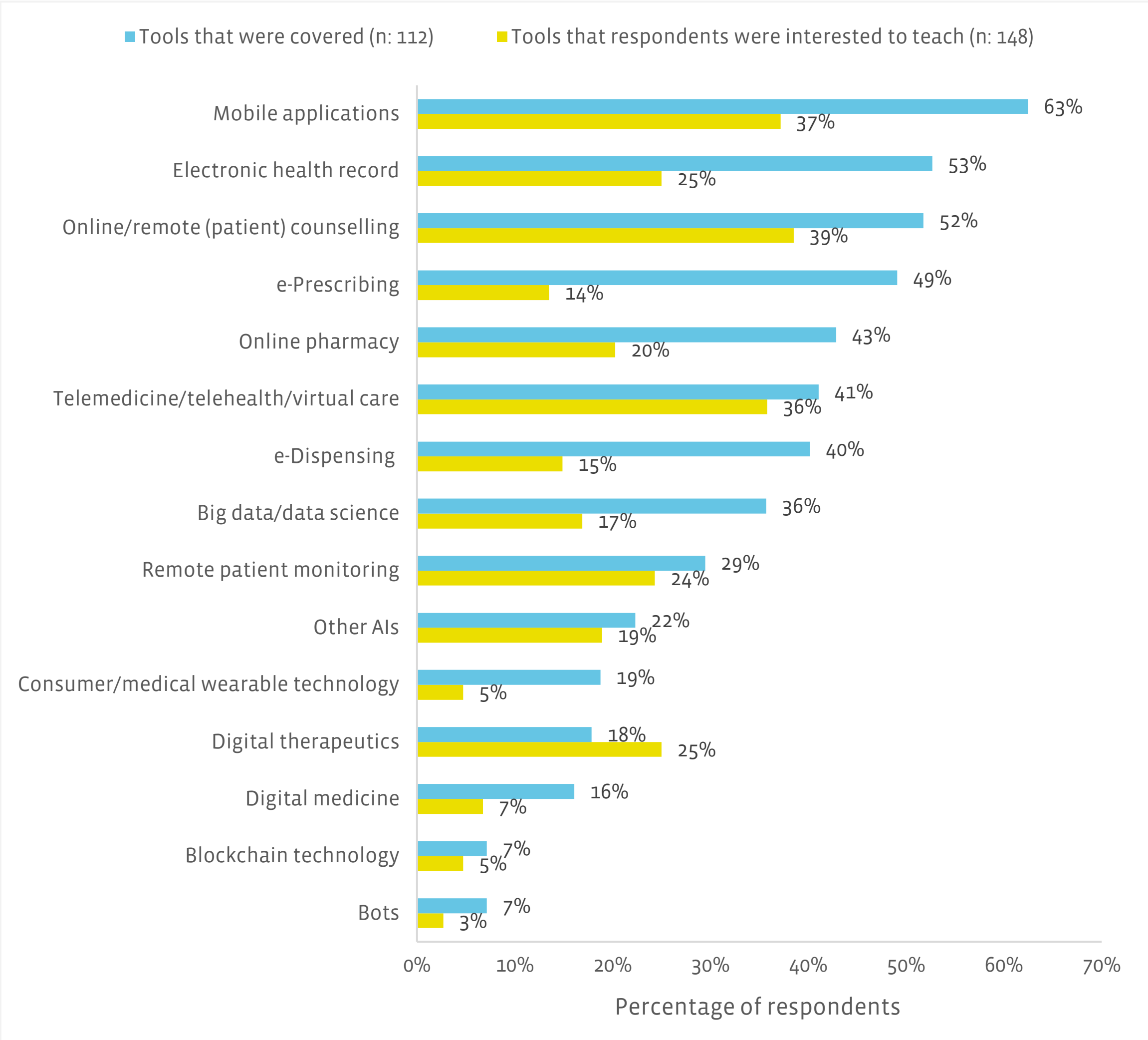

Figure 11. Overview of tools/services related to digital health covered in pharmacy school

Concepts covered in digital health education in the pharmacy school included ethics and compliance, innovation and creativity, and data privacy and security (Figure 12). It was found that the most common concepts included ethics and compliance (63%), followed by data privacy and security (53%). The least common concept included cybersecurity (12%). Nearly half of the respondents from schools which did not provide digital health course were interested in teaching concepts such as innovation and creativity (49%) followed by evidence-based digital medicine (41%).

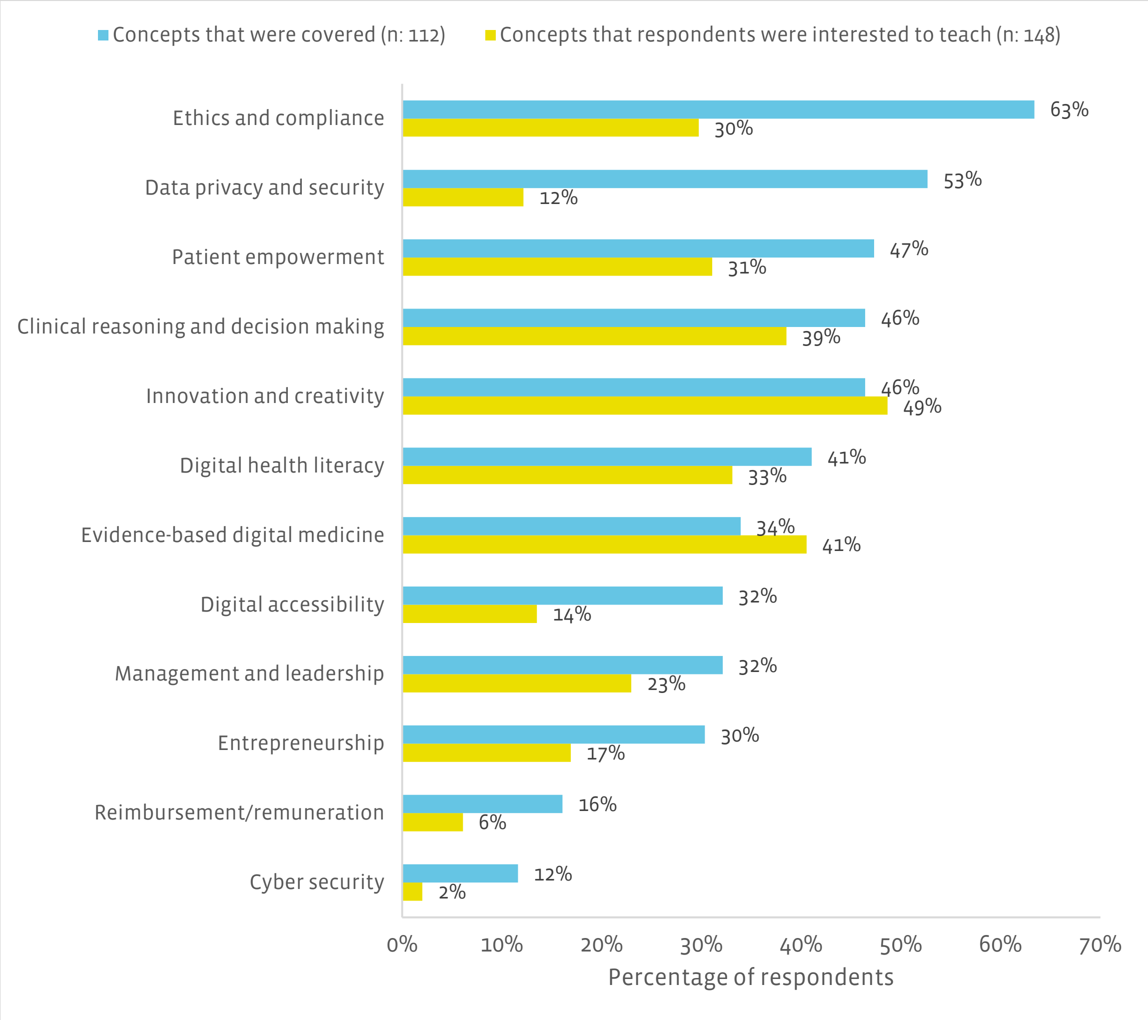

Figure 12. Overview of concepts related to digital health covered in pharmacy school

According to the respondents, infrastructures most commonly linked to digital health included e-learning (60%), active learning sessions (54%), while infrastructure such as living lab (6%) and hackathon (6%) were the least common infrastructures (see Figure 13). Among the respondents from schools which did not provide digital health course, access to clinical care digital platforms (67%) was the most common infrastructure that was thought to be linked with digital health.

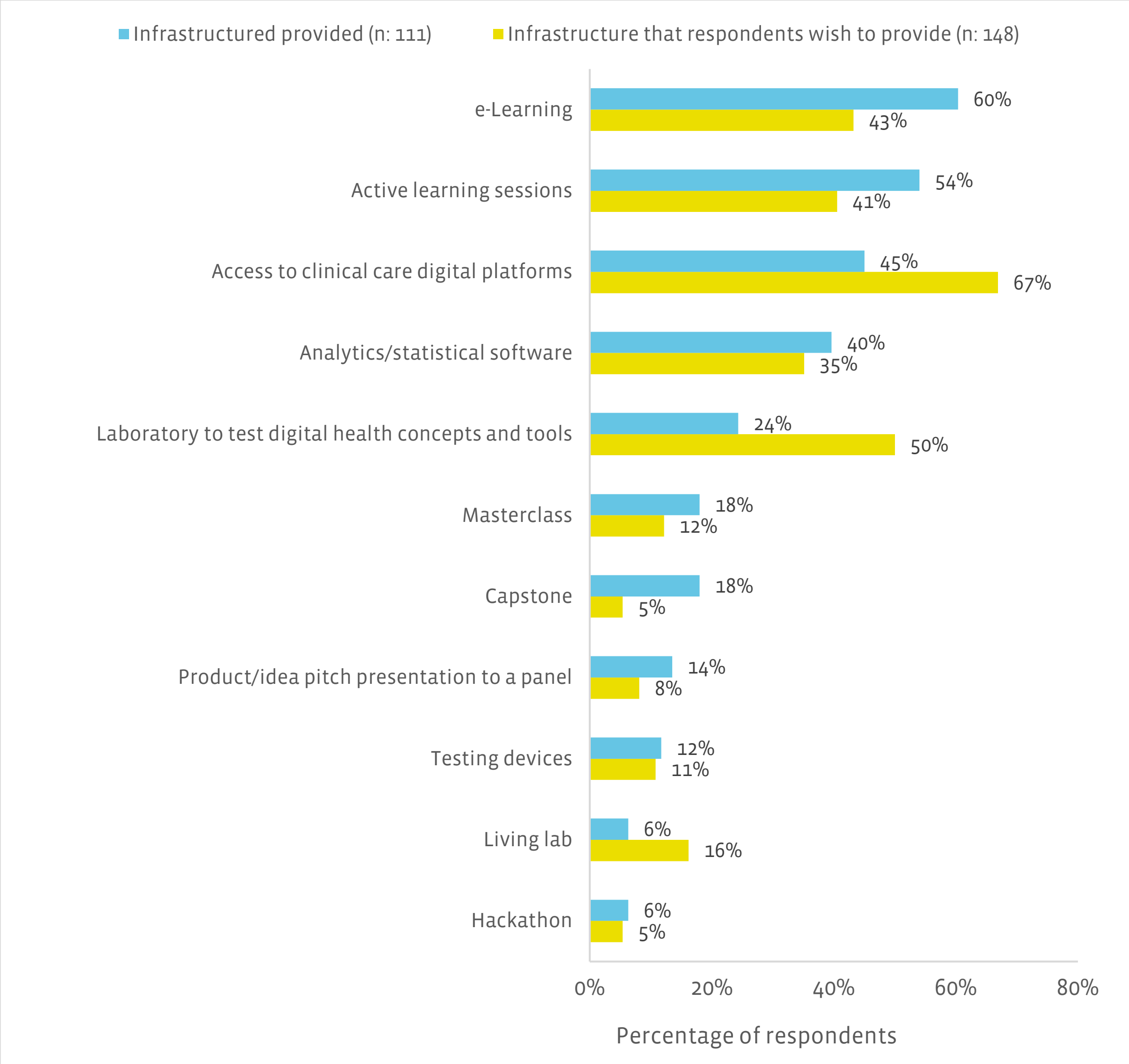

Figure 13. Overview of infrastructures provided to support digital health education

More than half of respondents mentioned that competency such as patient-centred digital health (58%) followed by knowledge of digital health tools (55%) were the most common competencies related to digital health whereas competency such as service design (19%) and design thinking (19%) were the least common ones. Patient-centred digital health (49%) and knowledge of digital health tools (46%) were the most common competencies the respondents from schools which did not provide digital health course were interested in teaching (Figure 14).

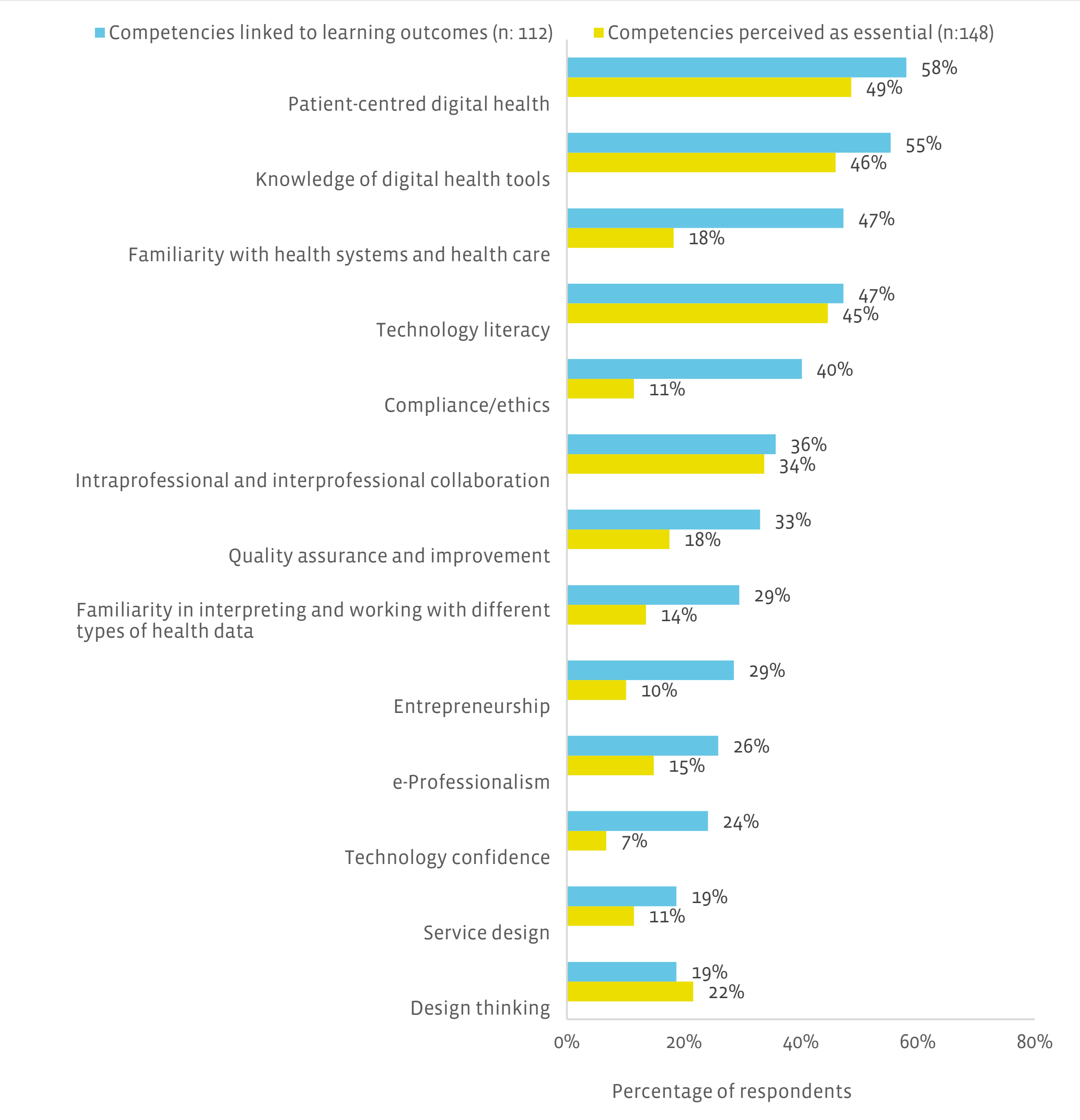

Figure 14. Overview of competencies related to digital health courses

Most pharmacy schools (79%) did not provide postgraduate courses on digital health. Very few (9%) provided certificate programmes on digital health to practising pharmacists as part of continuous education or continuous professional development.

Digital health was included in the general strategic plan in some of the schools (30%). Only 15% of the pharmacy schools which did not provide digital health education had decided to incorporate digital health education/training into the curriculum (see Table 6).

Table 6. Other details of digital health

Description	Categories	Frequencies (%)
Any postgraduate courses on digital health in pharmacy education	Yes	10 (9%)
	No	88 (79%)
	I don't know	14 (13%)
	Total respondents	**112 (100%)**

Description	Categories	Frequencies (%)
Any certificate programmes on digital health to practising pharmacists as part of continuous education or continuous professional development	Yes	10 (9%)
	No	86 (78%)
	I don't know	14 (13%)
	Total respondents	**110 (100%)**
Digital health is included in the general strategic plan for pharmacy school	Yes	77 (30%)
	No	124 (48%)
	I don't know	57 (22%)
	Total respondents	**258 (100%)**
The pharmacy school has made a decision to incorporate digital health education/ training into the curriculum	Yes	22 (15%)
	No	69 (47%)
	I don't know	56 (38%)
	Total respondents	**147 (100%)**

Half of the respondents mentioned that the lack of experts (50%) followed by lack of resources (40%) were the most common challenges related to digital health. These were also the most common challenges the respondents from schools which did not provide digital health course cited (Figure 15). Lack of experts was more commonly reported in low to upper middle-income countries (38/63; 60.3%) compared with high income countries (18/49; 37%).

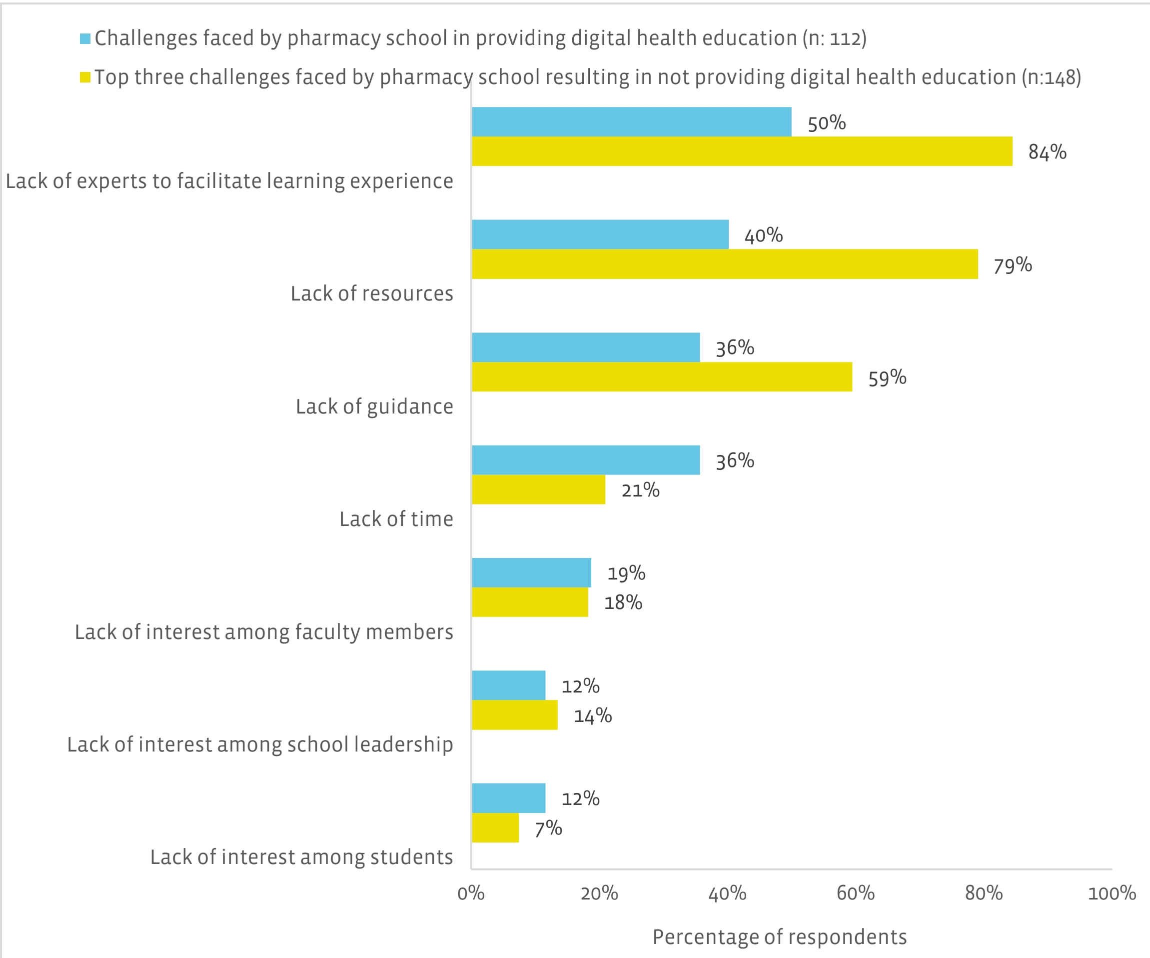

Figure 15. Overview of challenges related to digital health

Most respondents mentioned that advancing pharmacy outcome (86%) followed by digital health applied in practice settings (71%) were the most common desired outcome of including digital health in the curriculum of pharmacy schools. These were also the desired outcomes most of the respondents of the schools which did not provide digital health education preferred (Figure 16).

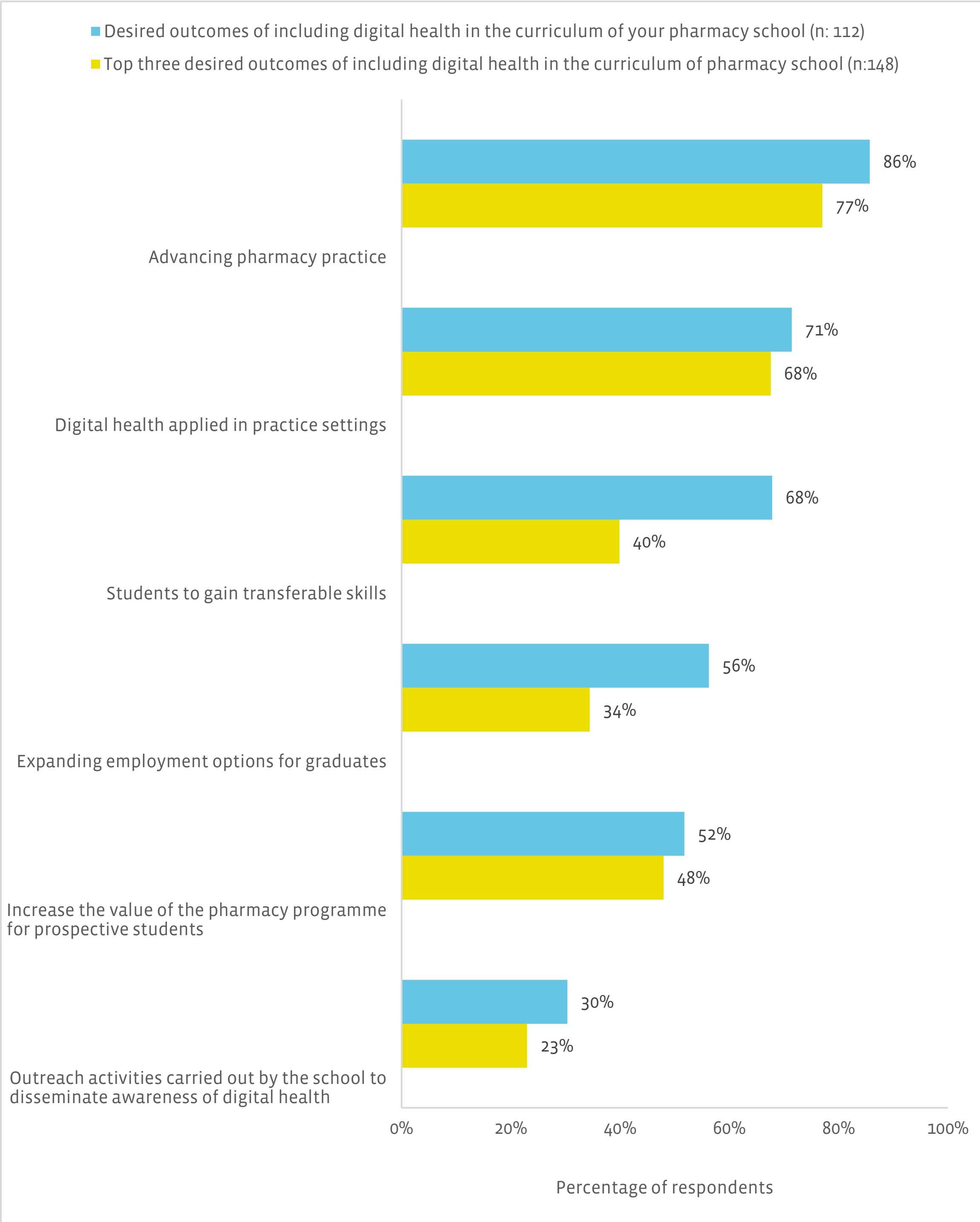

Figure 16. Desired learning outcomes related to digital health

Policy and support for learning digital health

All the 148 respondents (100%) who indicated their pharmacy schools did not provide digital health education were interested in providing digital health education in future.

When respondents were asked about the infrastructure that they would like to have in their pharmacy schools, some themes arose including: access to digital platform/software which include analytical software; laboratory to test digital health concepts and tools; and e-learning infrastructure.

Most of the respondents would like to teach more on: online/remote (patient) counselling; mobile applications and telemedicine/telehealth/virtual care.

Only 10 (7%) out of 147 respondents to the question on whether any support is received said they have received support or guidance from their national/regional pharmacy students association for digital health education/skills. Only a few (23%) mentioned support received from national/regional pharmacy organisations for the development of digital health courses or lectures in pharmacy school (Table 7).

Table 7. Support/guidance from pharmacy organisations related to digital health

Category		Have they received any support (n: 111)?	Is there any support available (n: 147)?
Support, policy or guidance from national/regional pharmacy organisations for the development of digital health courses or lectures in pharmacy school	Yes	25 (23%)	10 (7%)
	No	66 (59%)	92 (63%)
	I don't know	20 (18%)	45 (31%)

One hundred and fifteen (77%) respondents expressed that support was needed from FIP. The major support needed was guidance, training, resources, etc.

3.2.2 Findings from students' perspectives

Analysis team

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Hamsa Hassan, International Pharmaceutical Students' Federation (IPSF).

Key findings

- A small fraction of surveyed students has received digital health education in their schools and/or outside their schools. The percentage of students who have taken a digital health course progressively increases moving from Bachelor of Pharmacy to Doctor of Pharmacy.
- Digital health seemed to play an increasing role during the COVID-19 pandemic. There might be a misperception among students on the definition of digital health where they think digital health is similar to online education.
- The top digital health tools covered in pharmacy education stated by respondents were online pharmacy, mobile applications and telemedicine. While students expect to learn more on artificial intelligence technologies, bots and blockchain technology, these tools were not covered in their courses. Two concepts that were not covered in pharmacy schools according to respondents were reimbursement/remuneration for providing digital health services and cybersecurity.
- e-Learning, active learning session and access to digital care clinical platforms were the top three ways used to provide digital health education. The surveyed students highlighted that they need infrastructure such as assets, software and curriculum, events and activities, and well-trained and qualified personnel on digital health to support them in getting a better learning experience related to digital health.
- The top three skills that students gained through digital health education were interprofessional collaboration, compliance and knowledge of digital health tools. Interestingly, the top digital health skills need of the students were patient-centred digital health, knowledge in digital health tools, familiarity with the health system and entrepreneurship.

- In general, students who took a digital health course were confident to have better knowledge than students who did not take a digital health course.
- The history of taking the course in digital health might influence a student's plan in having a career in digital health. Nearly half of respondents who have taken digital health courses have career plans to focus on digital health after they graduate. The distribution of students' career plans in digital health across the region suggests that especially students in the Eastern Mediterranean, Southeast Asia, and Africa regions see employment opportunities in this field.
- Most students did not receive any support from their school on employment opportunities in digital health. A minority of respondents received support from the national/regional students association. This finding highlights a potential role for student associations.
- Among students, common themes arose for the support needed from FIP related to education and training, research project and events. This support can be done in collaboration with the International Pharmaceutical Students' Federation.

Surveyed students' demographics

Table 8 summarises the demographics of students who participated in this survey. From 274 students, 63% of respondents were female; 75% of respondents were in BPharm, and 30% of respondents were currently in their fifth year. A variety of respondents completed the survey from different academic years.

Table 8. Sample demographics (students) (n: 274)

Demographic	Categories	Frequencies (%)
Gender	Male	98 (36%)
	Female	174 (63%)
	Prefer not to say	2 (1%)
Academic degree	BPharm	206 (75%)
	MPharm	35 (13%)
	PharmD	33 (12%)
Academic year	First year	25 (9%)
	Second year	39 (14%)
	Third year	64 (23%)
	Fourth year	52 (19%)
	Fifth year	81 (30%)
	Sixth year	13 (5%)

Processes of learning digital health in pharmacy & pharmaceutical sciences education and training

Students were asked if they have taken any courses on digital health in their school or other places. Only one-tenth of respondents (n:27; 9.9%) have received digital health in their schools. (See Table 9 for a list of institutions providing the course.)

Table 9. List of institutions providing digital health courses

Country	Name of institutions
Bangladesh	Southeast University
Brazil	Universidade Federal da Bahia
	Universidade Federal de Sergipe
	Universidade Paulista
France	Poitiers
India	Jss College of Pharmacy

Country	Name of institutions
Indonesia	Ahmad Dahlan University
	University Bengkulu
Nepal	Kathmandu University
Nigeria	University of Benin
	Usmanu Danfodiyo University Sokoto
Pakistan	University of Sindh Jamshoro
Philippines	Manila Adventist College Pharmacy Department
Portugal	Faculty of Pharmacy, University of Porto
Rwanda	University of Rwanda
Spain	Facultad de Farmacia — Universidad de Sevilla
	Universidad Complutense de Madrid — Facultad de Farmacia
	Universidad de Salamanca
Zambia	School of Health Sciences

Similarly, only one-10th of respondents (n:28; 10.2%) have taken a digital health course in other places. They have taken online courses/webinars offered on some websites, such as Coursera, Alison or Futurelearn.com. They also stated that they participated in courses given by the IPSF, FIP and the Ministry of Health in their countries. Some participants also highlighted some topics that they took and, interestingly, some topics they mentioned were not related to digital and health innovative technology, such as phytotherapy and pharmacology. This may suggest that there was a misperception from students on the definition of digital health. They may think digital health is similar to online education.

Combining the results, nearly one-fifth of students (n:50; 18.2%) have taken a digital health course in either schools or outside schools. The difference in gender distribution between students who have taken the digital health course or who have not taken the digital health course can be seen in Figure 17. Most respondents, whether male or female, have not taken digital health courses (n: 82%). Based on this sample, gender does not influence whether students have taken digital health courses or not.

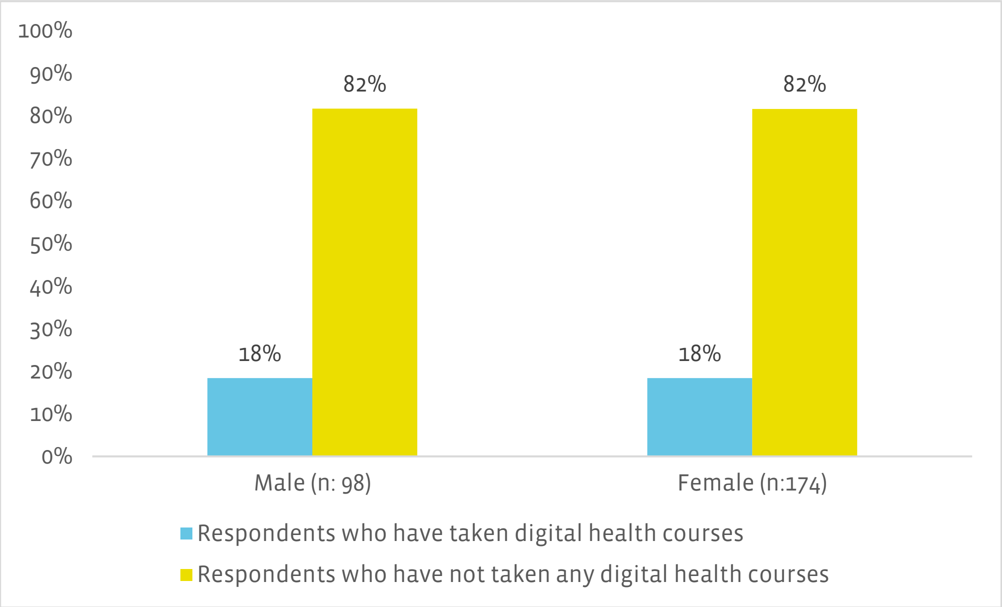

Figure 17. Gender distribution of respondents by digital health course

The difference in academic degree distribution between students who have taken a digital health course or who have not taken a digital health course can be seen in Figure 18. The percentage of students who have taken a digital health course progressively increase moving from BPharm to PharmD [X^2 (2, n = 274) = 23.95, p <

0.0001]. It is interesting to note that there was not much difference on those who have taken or who have not taken digital health courses for students who were currently in PharmD.

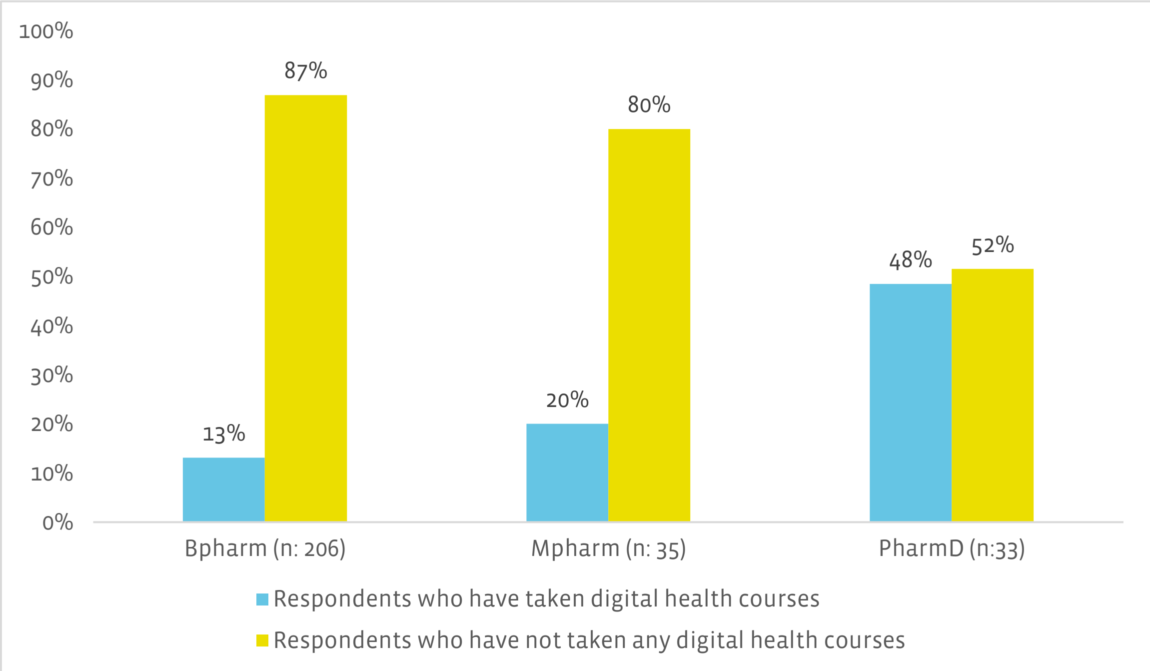

Figure 18. Academic degree distribution of respondents by digital health course

The difference in academic year distribution between students who have taken a digital health course or who have not taken a digital health course can be seen in Figure 19. It seems that the highest percentage of students who have taken a digital health course was currently in the sixth year (38%); however, it had the lowest number of respondents (n: 13). The highest number of respondents who have taken a digital health course was currently on their fifth year (n: 15; 19%), followed by fourth year (n: 13; 25%), and third year (n: 10; 16%).

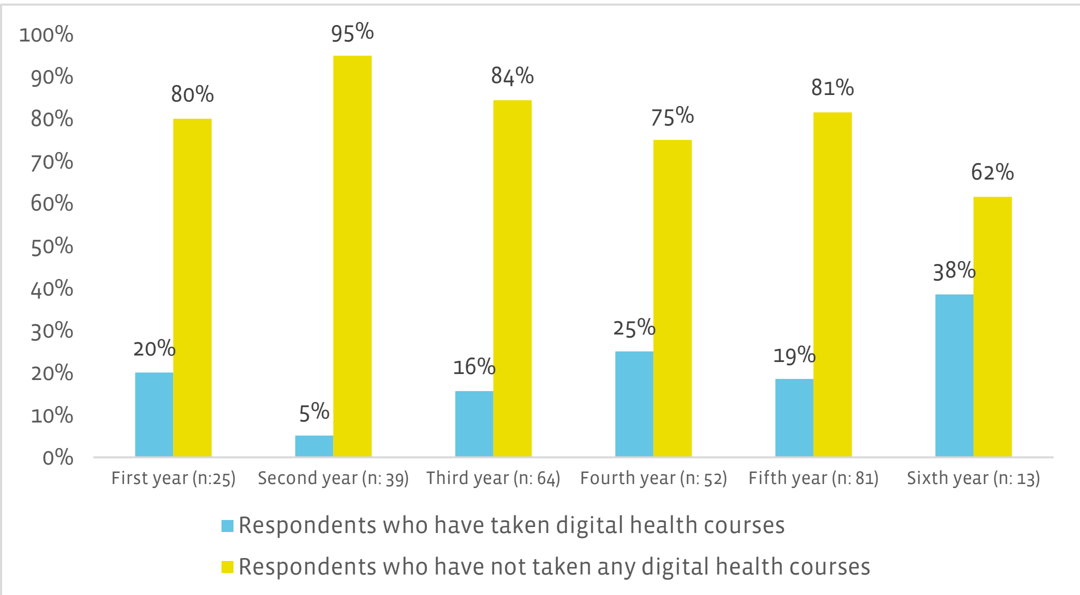

Figure 19. Academic year distribution of respondents by digital health course

When broken down across regions, Eastern Mediterranean had the highest percentage of students who have taken digital health courses (n: 4; 36%), while Western Pacific had the lowest (n: 2; 11%). However, it needs to be noted that Europe has the highest number of respondents compared with other regions (n: 149) (see Figure 20).

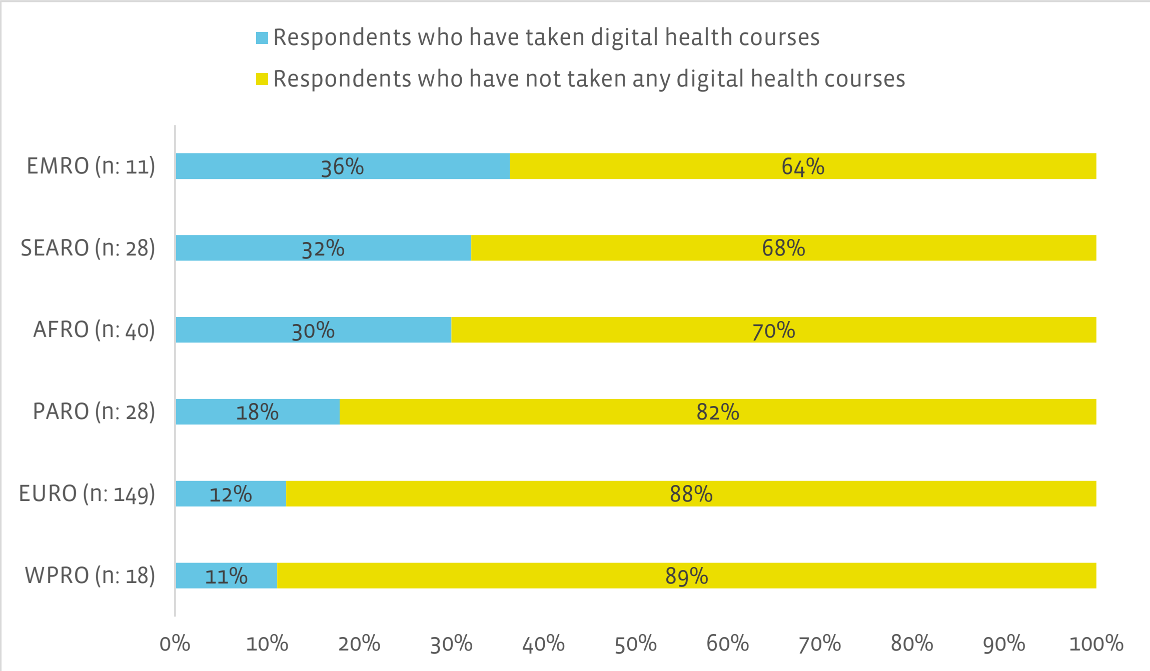

Figure 20. WHO region distribution of respondents by whether they have taken a digital health course

Most students who have taken digital health courses (n: 21, 81%) reported that they had learned the concepts related to digital health in around one or two lectures over an academic year. Only five respondents (19%) indicated they had learned digital health in more than three lectures over an academic year.

Students were asked about how their pharmacy school provides digital health course. There were only four respondents who completed this question, and three of them (75%) indicated that they had received digital health courses in a virtual setting followed by one (25%) who received it in the classroom setting. Students who have learned digital health outside the school also responded to this question. Interestingly, the majority of them (n: 11; 61%) received digital health courses in the classroom setting. The result was followed by 33% (n: 6) in a virtual setting and 18% (n: 3) in the practice setting.

Most students defined digital health as applying the tools or technology to advance healthcare. The technology used has to relate to the health of individuals and community to advance healthcare and save lives through prevention, mitigation, diagnosis and treatment of diseases. Some students stated that it also includes the use of technology to facilitate healthcare processes, interprofessional communication, diagnostic tests and management of administrative matters such as online medical records. Digital health seemed to show an increasing role during the COVID-19 crisis, whether providing digitalised awareness campaigns or enabling healthcare practitioners to monitor their patients during quarantine. Also, it provides platforms for sharing new updates, evidence-based medicines, case scenarios, and education during COVID-19.

"Technology applied in the health field to improve the prevention, diagnosis and monitoring of the health of a specific person or population." (Female, Spain, has taken course on digital health in school)

"It is a form of health service delivery to the clients or patients which requires the use of technology, e.g, smartphones, internet and many others." (Male, B.Pharm, fourth-year, Zambia, has not taken course on digital health)

Digital health in pharmacy and pharmaceutical sciences curriculum

Two hundred and forty-four (99%) out of 246 students who have not taken digital health courses apart from at their pharmacy school were asked about the top three tools/services that they would like to learn more about in their pharmacy school. This is described as "tools/services expectation". Twenty-two (79%) out of 28 students, who have taken digital health courses away from their pharmacy school were asked about the tools/services that were covered in digital health education in their pharmacy school. This is described as "tools/services that were covered". The results are described together to show the difference between the tools that were covered and the tools/services expectations from the students. For tools/services that were covered, students could select as many as they wanted and for tools/services expectation, students could only select a maximum of three (see Figure 21). The top six tools covered in digital health stated by respondents were electronic health records (50%), mobile applications (45%), online counselling (36%), e-prescribing (36%), online pharmacy (27%), and e-dispensing (27%). Interestingly, students had an interest to learn more on online pharmacy (42%), mobile applications (35%) and telemedicine (29%). While students expect to learn more on other artificial intelligence (14%), bots (10%) and blockchain technology (1%), these tools were not covered in their courses.

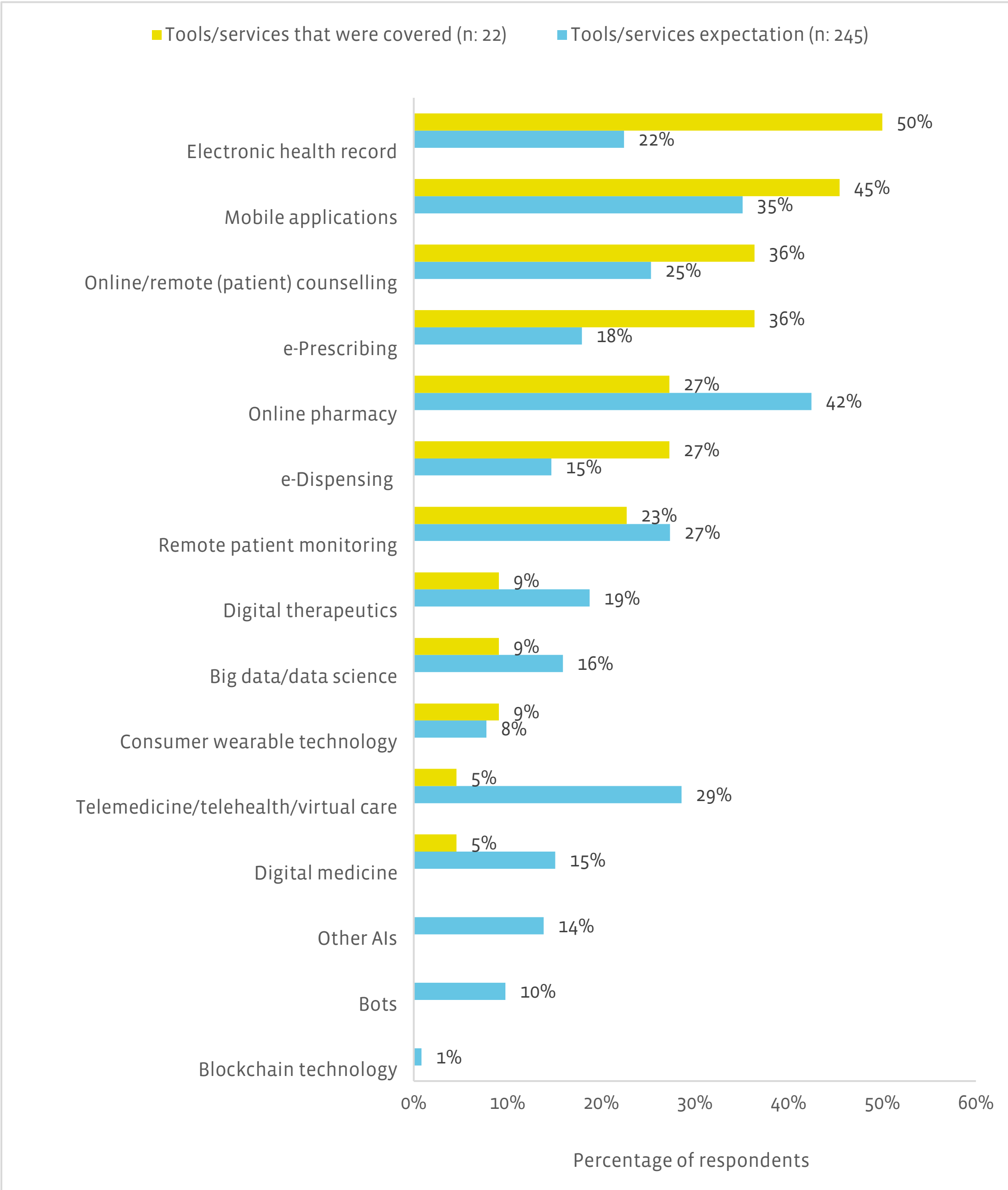

Figure 21. Tools/services in digital health

Twenty (71%) out of 28 students who have taken digital health courses away from their pharmacy school were asked about the concepts that were covered in digital health education in their pharmacy school (see Figure 22). Two concepts that were not covered based on respondents' answers were reimbursement/remuneration for providing digital health services and cybersecurity.

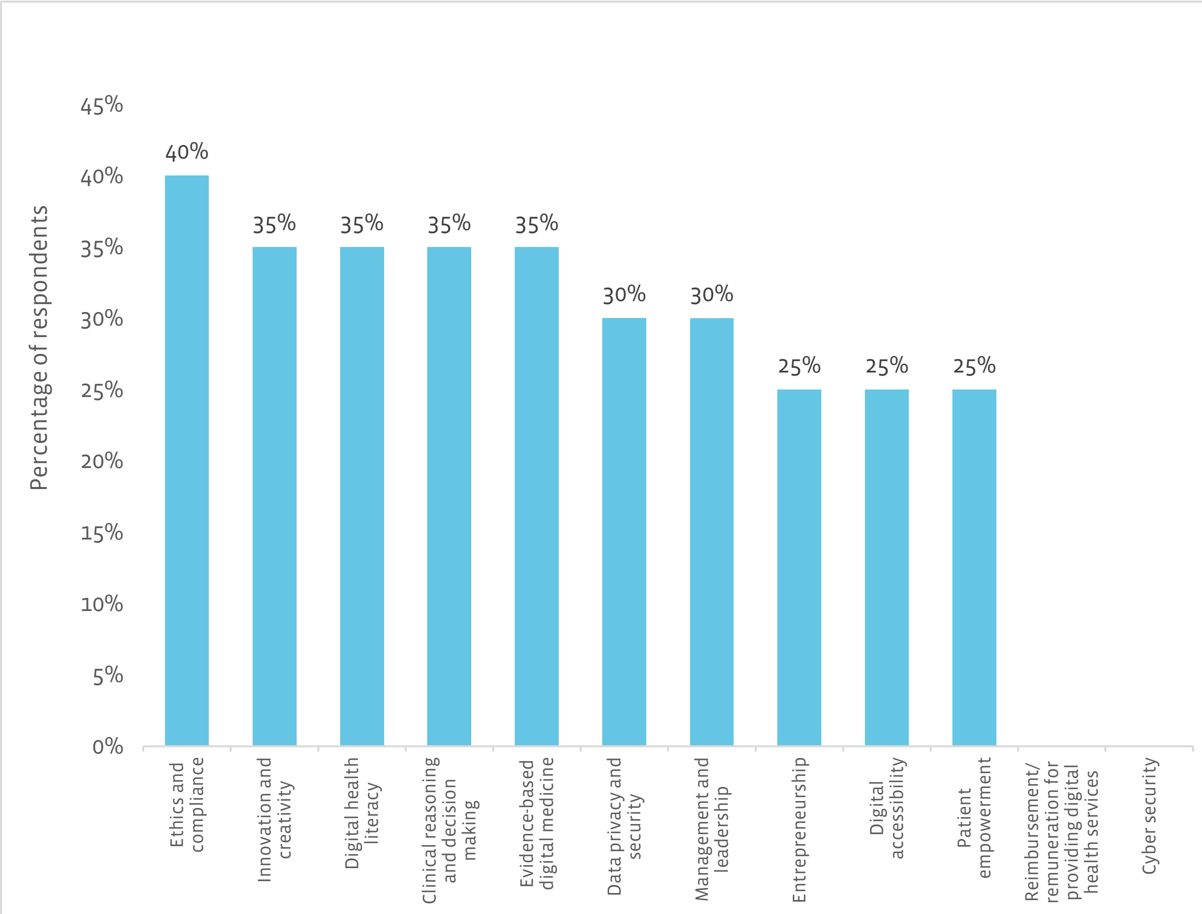

Figure 22. Overview of concepts covered

Similar to the tools/services, the students were also asked about the infrastructure that was provided to support digital health education in their pharmacy school. Twenty-two (79%) out of 28 students who have taken digital health courses away from their pharmacy school responded to this question. All students (n: 246), who have not taken digital health courses away from their pharmacy school were asked about the top three infrastructures that they wished to have in their pharmacy school. The results are described together (see Figure 23). The top three infrastructures provided based on students' responses were e-learning (50%), active learning sessions (36%) and access to digital care clinical platforms (27%). Similarly, the top three needs from students on the infrastructures were access to digital care clinical platforms (60%), a laboratory to test digital health (59%) and active learning sessions (43%). Sixteen per cent of students wished to have a living lab, but the pharmacy school did not provide this infrastructure.

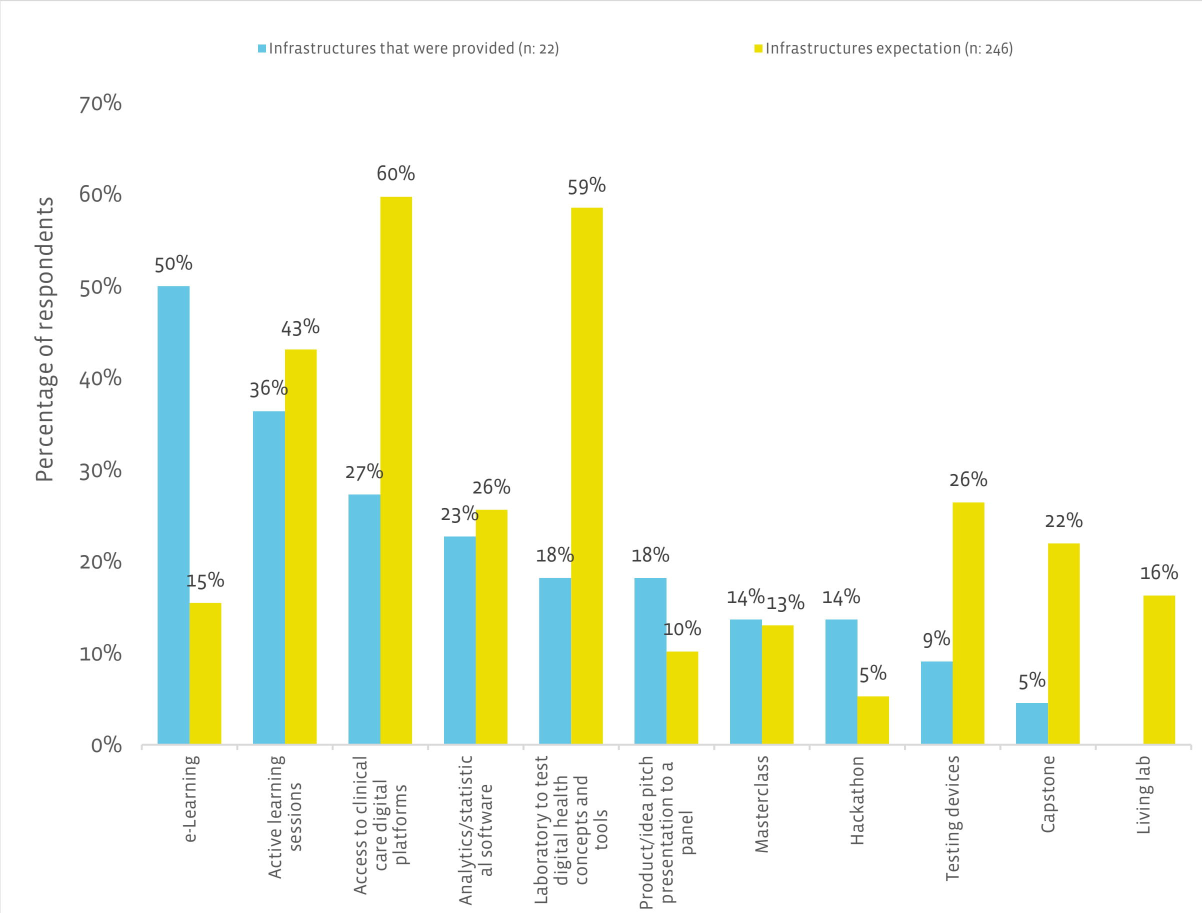

Figure 23. Infrastructures in digital health

Students were also asked about the skills related to digital health that they gain in their pharmacy school. Twenty-two (79%) out of 28 students who have taken digital health courses away from their pharmacy school responded to this question. All students (n: 246) who have not taken digital health courses away from their pharmacy school were asked about the top three skills that they would like to gain in digital health. The results are described together (see Figure 24). The top five skills that students gained were interprofessional collaboration (45%), compliance (36%), knowledge of digital health tools (32%), technology literacy (32%) and patient-centred digital health (27%). Interestingly, the highest skills perceived as required by students were patient-centred digital health (59%) followed by knowledge in digital health tools (39%), familiarity with the health system (30%) and entrepreneurship (24%).

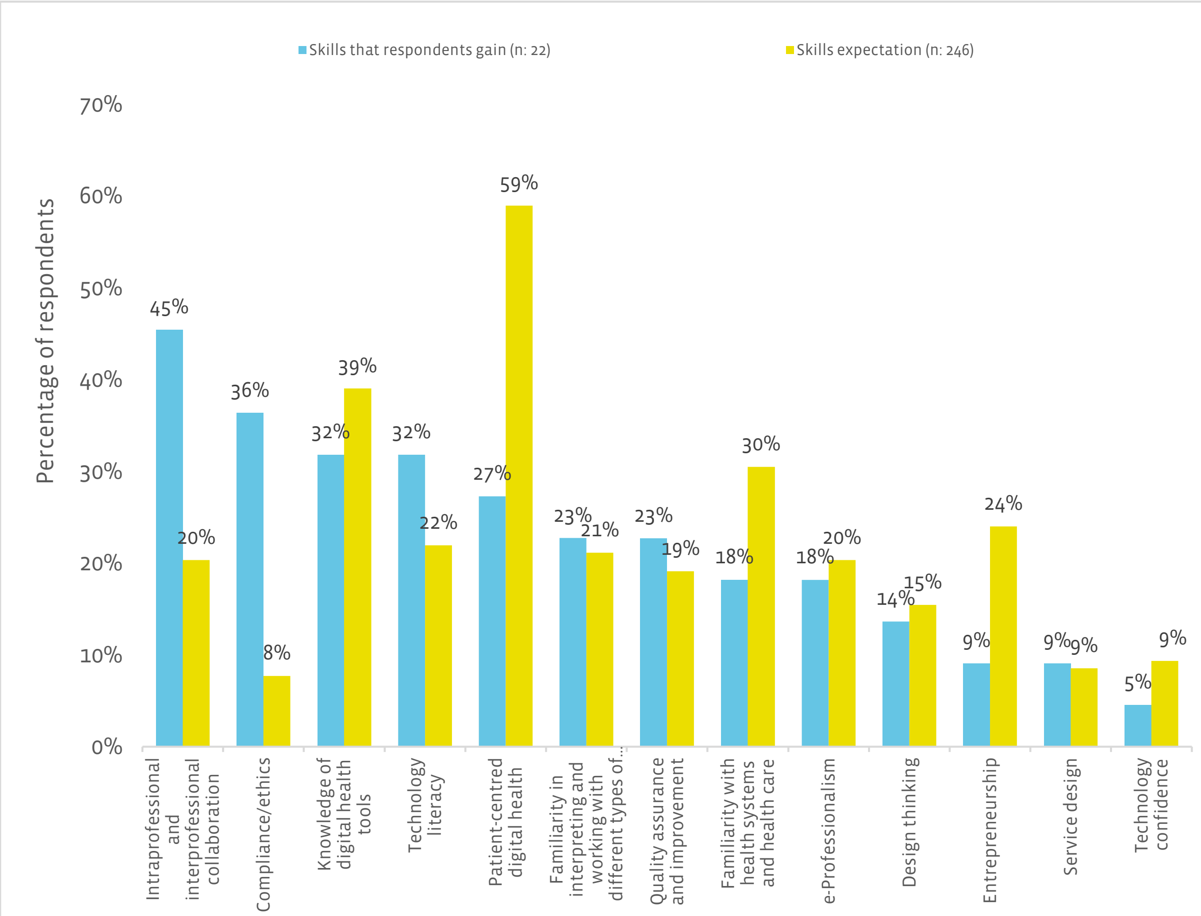

Figure 24. Skills in digital health

Perceived knowledge and skills of the students

The extent of knowledge on the use of digital health tools/services by students is shown in Figure 25. It can be seen that, in general, students who took a digital health course have better knowledge than students who did not take a digital health course (Fisher's Exact Test, n: 272, p = 0.001).

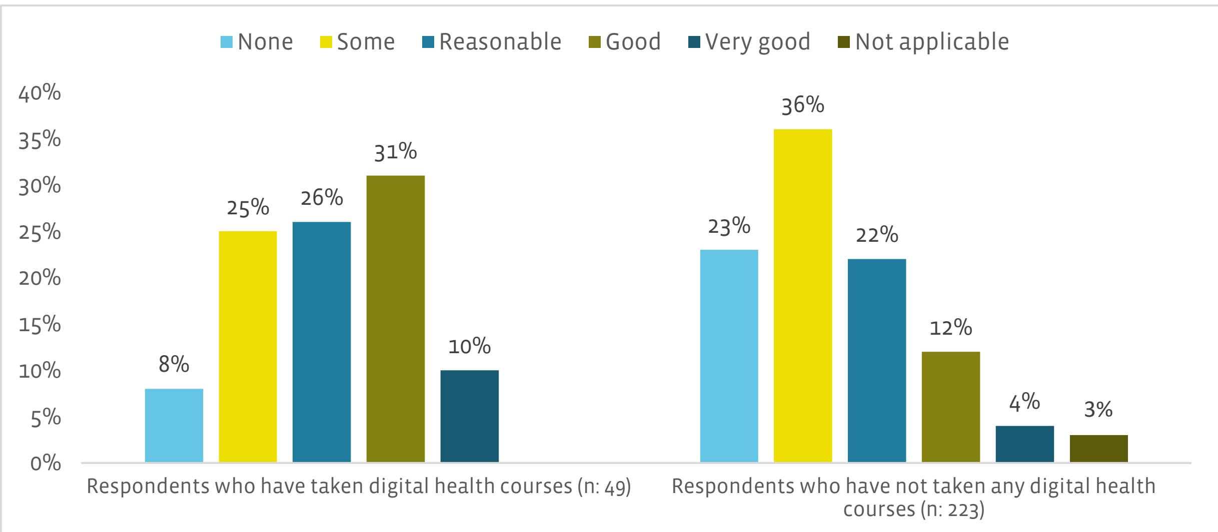

Figure 25. Knowledge level of students

Students who have received digital health courses outside the school were asked about how confident they felt about their skills to deliver digital health services after graduation. The confidence to deliver digital health services after graduation across the WHO region is shown in Figure 26 (n: 28).

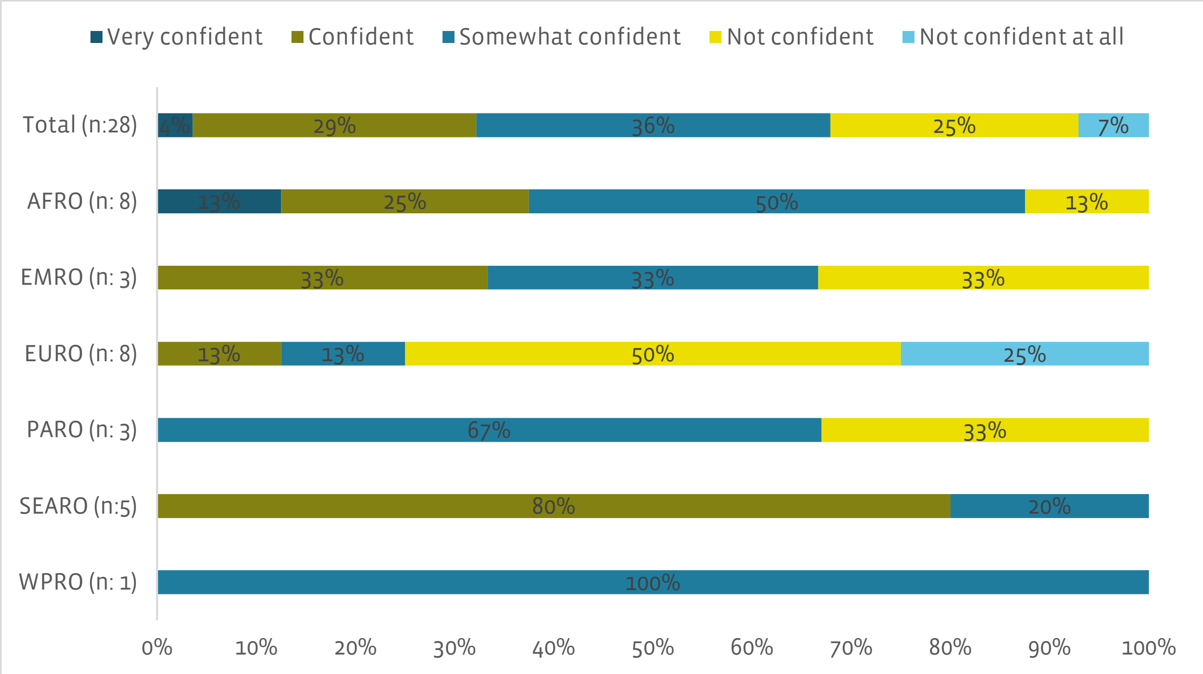

Figure 26. WHO region distribution of confidence rate of respondents who have taken digital health course

Digital health infrastructure gaps in education and training

Students were asked about infrastructure that they would like to have in their pharmacy school for a better learning experience related to digital health. Some broad themes which arose were related to events/ activities, assets, software, curriculum and well-trained and qualified personnel (see Figure 27).

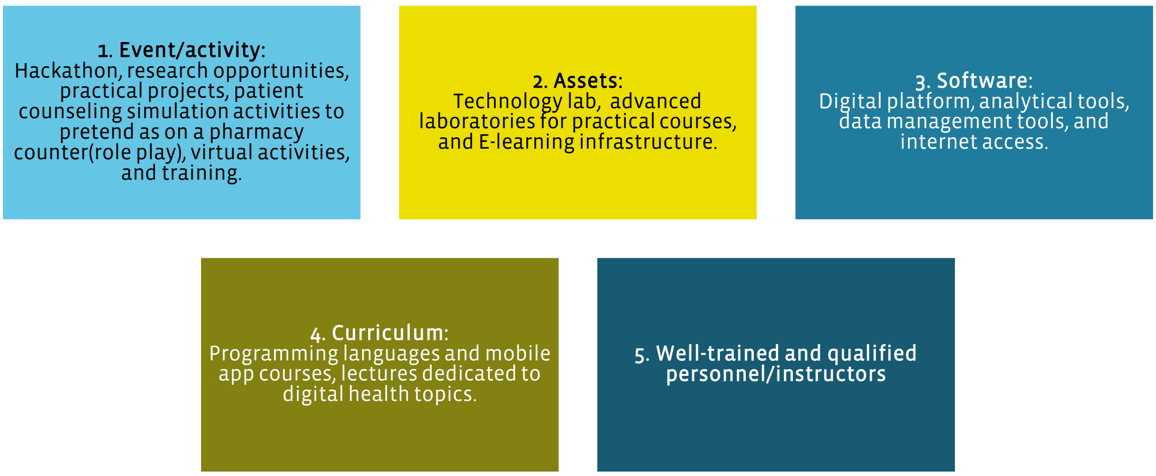

Figure 27. Themes arising from infrastructure gaps

Students were asked what they would like to learn more about digital health in their pharmacy school. Three broad themes arose from the respondents related to knowledge, skills and applications. In terms of knowledge that they would like to gain, some examples were on digital biomarkers, fields/applications of digital health and patient information security. In terms of skills, some highlighted a need to have skills on data analysis and data interpretation, the skills of using different technologies, skills on utilising digital health in pharmacy management and online pharmacy, and in patient monitoring. Some mentioned the application on the use of artificial intelligence and digital health in other pharmaceutical care, such as the pharmaceutical industry and community pharmacy practice. Some responded that it is important to highlight how digital systems have been established or developed in different countries around the world.

Career plans in digital health

Students were asked if, after they graduate, they would have any career plans to focus on digital health in pharmacy practice (see Figure 28). Nearly half of respondents who have taken digital health courses (n: 24; 48%) have career plans to focus on digital health after they graduate. It seems that the history of taking the course in digital health might influence students' plan in having a career in digital health [X^2 (2, n = 273) = 28.19, $p < 0.0001$]

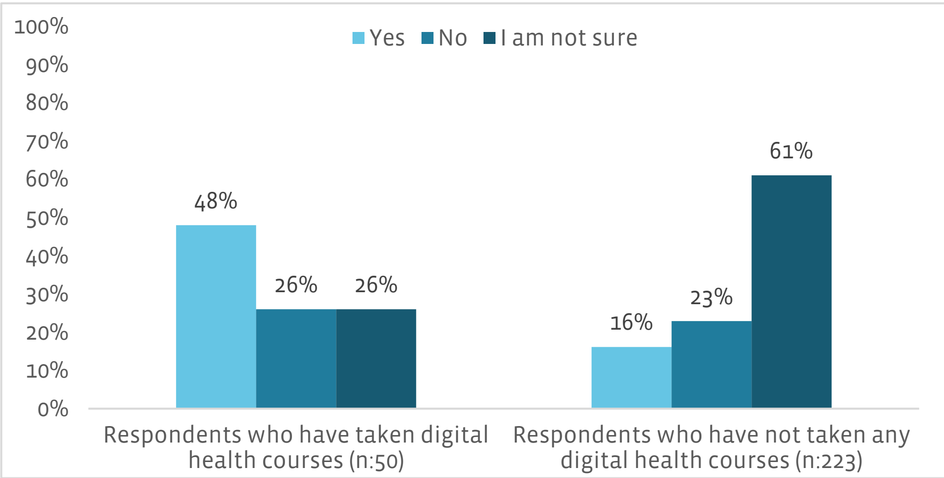

Figure 28. Career plans in digital health

The distribution of students' career plans in digital health across WHO regions is shown in Figure 29. The findings suggest that there are employment opportunities in the EMRO (54%), SEARO (52%) and AFRO (48%). Although the EURO has the lowest percentage, it needs to be noted that the EURO has the highest number of respondents (n: 149).

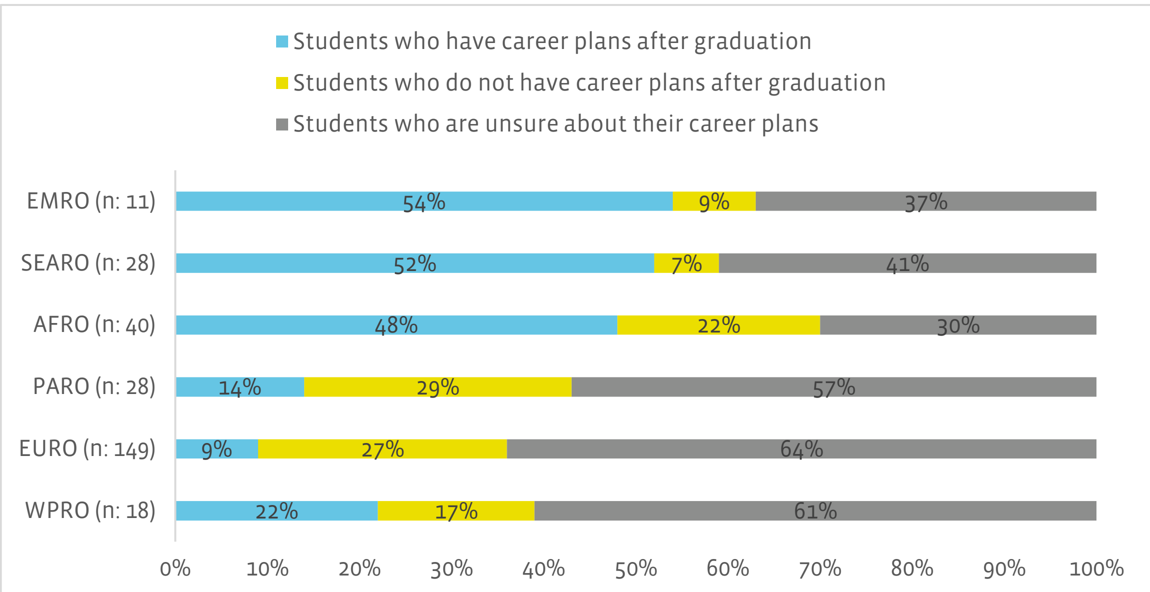

Figure 29. WHO region distribution of respondents by career plans

Most respondents (n: 17; 61%) who had career plans to focus on digital health in pharmacy practice described their plans further in open text questions, as follows:

- **Community and clinical pharmacy setting:** Respondents described this as the use of technology in providing online consultation service, virtual retail, dispensing medication, patient education, checking updates and guidelines in treatment, patient care programmes and patient monitoring.
- **Research setting:** Respondents described this as carrying out research projects about digital health and publishing the findings.
- **Data management system and mobile apps development:** Respondents described this as data analytics in health or health informatics and use the health data from the population to make models with quantum computing for drug development.

Support for learning digital health

For those who have taken digital health courses away from their pharmacy school (n: 28), two questions on whether they have received any support or guidance from their school-related to employment and support or guidance from national/regional pharmacy students association were asked. For those who have not taken digital health courses away from their pharmacy school (n: 246), two questions on whether they knew if there was any support or guidance from national/regional pharmacy students association and from their school-related to employment. The summary of the findings can be seen in Table 10.

Table 10. Support or guidance on digital health

Category		Have they received any support (n: 28)?	Is there any support available (n: 246)?
Support from school about employment opportunities in digital health	Yes	2 (7%)	8 (3%)
	No	26 (93%)	124 (51%)
	I don't know	0 (0%)	112 (46%)
Support from national/regional pharmacy students association for digital health education/skills	Yes	11 (39%)	13 (5%)
	No	17 (61%)	138 (56%)
	I don't know	0 (0%)	95 (39%)

Most students (n: 26; 93%) did not receive any support from their school on employment opportunities in digital health. Similarly, more than half of respondents (n:124, 51%) said that there was no support available at the school on digital health, followed by 46% who did not know if there was any support. A minority of respondents (n: 11; 39%) received support from the national/regional students association, and only 5% (n:13) knew that there was any support available from national or regional students' associations. This finding highlights opportunities for students' associations to develop support in digital health and to promote the support available to students.

Students who indicated that they received any support from local or national associations were asked to provide more information. Most mentioned that they received support from the IPSF and some companies that worked with the Ministry of Health. The support was given through some events or forum or activities dedicated to discussing digital health, digital health training, symposia and congresses.

Support from FIP

Among students, common themes arose for the support needed from FIP related to education and training, finance, research projects and events. This support can be delivered in collaboration with the IPSF. Respondents requested support for:

- **Online education:** Through webinars, training, e-books, journals, practicals (interactive and applicative on the webinars, patient-centred), articles, newsletters and manuals.
- **Offline opportunities:** Through an internship in a place where advanced digital health services are established.

- **Activities/events:** Through hackathons, research projects and establishing platforms to enable pharmacists to meet with patients remotely.
- **Research project and advocate with decision-makers (universities and associations):** Advocacy can be in the form of dedicated courses about digital health in the curriculum.
- **Financial support:** To provide help in establishing digital services.

3.2.3 Findings from practitioners

Analysis team

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Key findings

- A small fraction of practitioners has received digital health education or training, including continuous education.
- Among those that use digital health tools, the most commonly utilised are mobile applications, e-prescribing, and e-dispensing. Other than the top three utilised tools, there is a low prevalence of digital health technology utilisation among practitioners. Survey responses suggest a lack of familiarity with emerging digital health technologies such as artificial intelligence and digital therapeutics.
- Respondents more frequently recognised the ability of digital health tools to save time compared with other benefits such as improved outcomes of medicines use.
- A key gap in digital health education is the skillset and knowledge of how to apply technology to solve existing clinical problems and improve care. Guidance on how to implement digital health tools was a key need cited by practitioners.
- Greater work is needed to show how digital health can be leveraged by pharmacists in community pharmacy and tools/support on integrating/implementing tools and access to tools.
- Early education/awareness could be important to increase the desire to seek additional education later, as there was a greater likelihood of receiving digital health education as continuous professional development training among those who previously received digital health education in school.
- Digital health education appears tailored to the more administrative and functional role of digital health technologies in facilitating business processes and improving operational efficiency. Concepts related to the application of digital health tools in clinical care (e.g., clinical reasoning and decision making and evidence-based digital medicine) were among the least likely to be included in education, according to practitioners surveyed.
- There seems to be minimal support and guidance from pharmacy associations in the use of digital health. Practitioners expressed the need for greater support, including access to digital health tools, increased digital health education and guidance on how to apply digital health technologies in practice.
- Lack of enabling policies and guidance, as well as lack of technical limitations and lack of access to data were reported as the biggest challenges in using digital health in practice.

Surveyed practitioners' demographics

Table 11 summarises the demographics of the 526 surveyed practitioners. Sixty-two per cent of them were female. The median years of professional experience among respondents were 15 (IQR: 6-26) years, with 24% (124/526) indicating they had been practising in the pharmacy profession for five years or less (Figure 30). Slightly over half of the practitioners' reported working in community pharmacy. Clinical biology and military and emergency pharmacy were the least represented fields among respondents.

Table 11. Sample demographics (practitioners) (n: 526)

Demographic	Categories	Frequencies (%)
Gender	Male	196 (37%)
	Female	327 (62%)
	Prefer not to say	3 (1%)
Age	18–24	25 (3%)
	25–34	39 (28%)
	35–44	64 (30%)
	45≠54	52 (21%)
	55–64	81 (15%)
	65 and over	13 (3%)
Years of experience	Median (IQR): 15 (6–26) years	
Professional background	Community pharmacy	298 (57%)
	Hospital pharmacy	85 (16%)
	Other	44 (8%)
	Social and administrative pharmacy	34 (6%)
	Industrial pharmacy	27 (5%)
	Research and development	16 (3%)
	Digital health	16 (3%)
	Clinical biology	3 (1%)
	Military and emergency pharmacy	3 (1%)

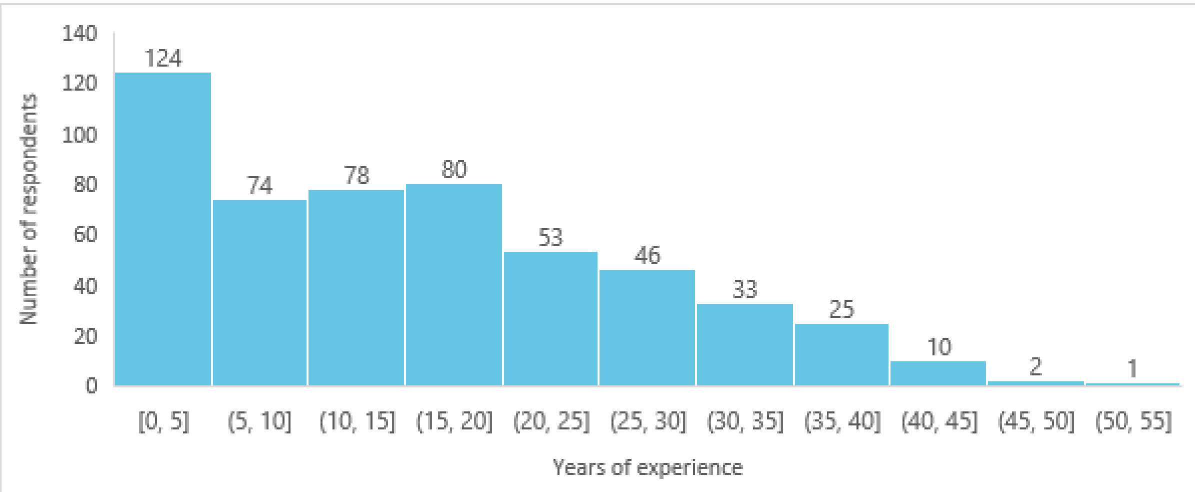

Figure 30. Respondents' years of professional experience

Processes for learning digital health in pharmacy and pharmaceutical sciences education

Practitioners were asked if they received or did not receive digital health education in pharmacy school, followed by a question on whether they received such education as a training/certificate programme or as continuing professional development in their practice. The difference in gender distribution between practitioners who did or did not receive digital health education is shown in Figure 31. A slightly higher percentage of male respondents received digital health education compared with female respondents; this included voluntary or elective digital health courses. This difference, however, was not reflected among student respondents, suggesting any potential trend that may exist has been changing over time.

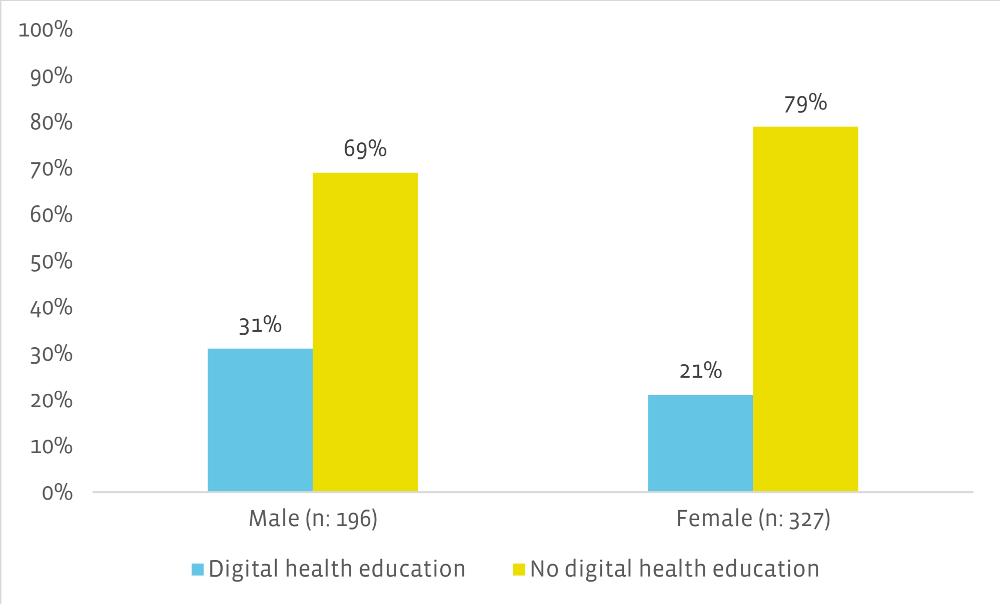

Figure 31. Digital health education by gender

Previously received digital health education in or outside of pharmacy school.

Among practitioner respondents, 130 (25%) reported they received some form of education related to digital health, either within pharmacy school or after pharmacy school as continuous education (see Table 12). When broken down across regions, Western Pacific had the highest percentage of practitioners with prior digital health education. In contrast, Europe had the lowest percentage (see Figure 32), although it had the highest number of respondents.

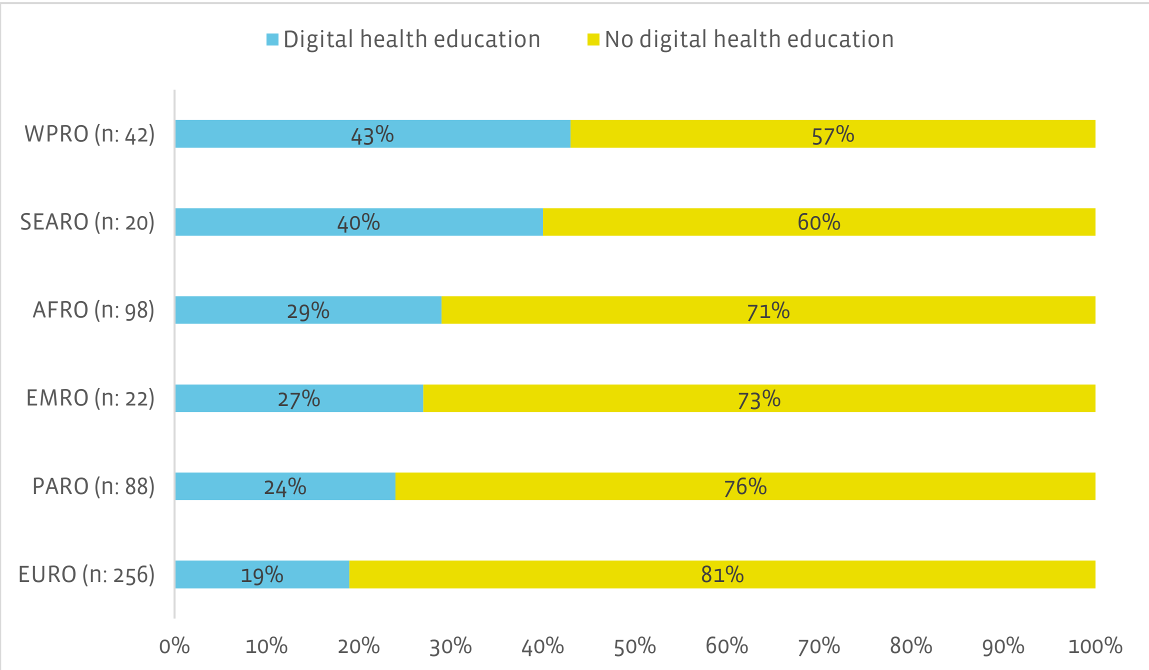

Figure 32. WHO region distribution of respondents by digital health education

The percentage of practitioners with digital health education progressively decreases, moving from low-income to high-income economic regions. However, low-income resource countries had a low response rate, which can increase the risk of the responses being skewed due to bias and being less representative of the true population (see Figure 33). Outside of low-income resource countries, lower-middle-income countries had the highest proportion of respondents receiving any form of digital health education, driven in part by a higher percentage of continuous education. When looking at the type of digital health education received, respondents from lower-middle-income countries had the highest rate at 22% (28/125) of receiving continuous education on digital health outside of formal education in pharmacy school. Continuous education was reported by 15% (42/241) of respondents from high-income countries, 9% (10/103) from upper-middle-income countries, and 0% (0/5) from low-income countries (data not shown).

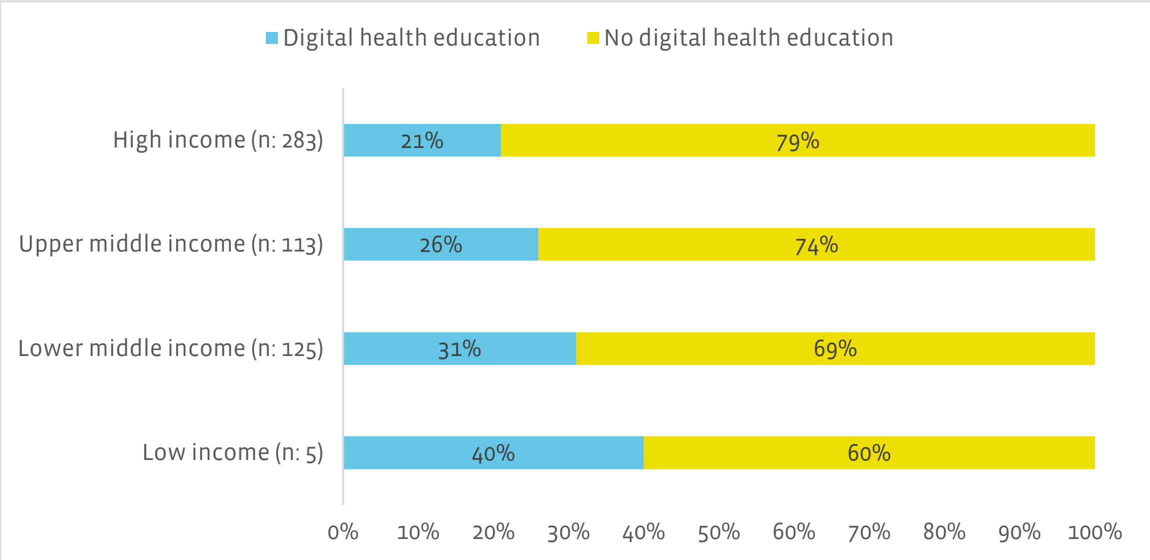

Figure 33. Digital health education among respondents across economic regions

The digital health education background of practitioners varied across pharmacy practice settings, with military and emergency pharmacy the only practice setting where a majority of respondents had received some form of digital health education (2/3; 67%). Community pharmacy had the lowest percentage of pharmacists with digital health education (54/298; 18%). Even within digital health job roles, only around a third of practitioners (6/16) had received previous digital health education (see Table 10).

Community pharmacy has the lowest percentage of surveyed respondents indicating they have received digital health education, which could signal a lower prioritisation or perceived relevance of digital health education in this field. Particularly, if we looked at continuous education, only 12% (35 out of 298) of surveyed community pharmacists received digital health education after pharmacy school, compared to 26% (7 out of 27) of industrial pharmacy and 32% (11 out of 34) social and administrative pharmacy (see Table 12).

Table 12. Digital health education and practice setting

Practice setting	Received digital health continuous education (n: 80)	Received digital health education in pharmacy school (n: 73)	Received any form of digital health education (either in pharmacy school, after pharmacy school as continuous education, or both) (n: 130)
Clinical biology (n: 3)		1	1
Community pharmacy (n: 298)	35	28	54
Digital health (n: 16)	5	2	6
Hospital pharmacy (n: 85)	15	19	27
Industrial pharmacy (n: 27)	7	7	12
Military and emergency pharmacy (n: 3)		2	2
Other (n: 44)	5	4	9

Practice setting	Received digital health continuous education (n: 80)	Received digital health education in pharmacy school (n: 73)	Received any form of digital health education (either in pharmacy school, after pharmacy school as continuous education, or both) (n: 130)
Research and development (n: 16)	2	3	4
Social and administrative pharmacy (n: 34)	11	7	15

The average number of years of professional experience of respondents who did and did not receive digital health education was similar at 16.3 +/- 11.7 years and 17.0 +/- 11.6 years, respectively. Age distribution varied slightly between groups, with those who received digital health education having a higher proportion of respondents over 35 years of age (see Figure 34).

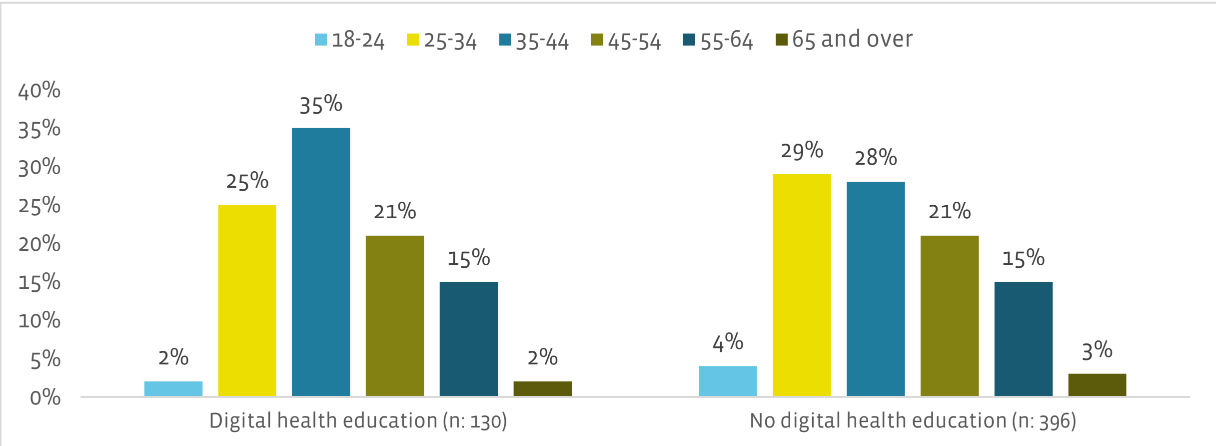

Figure 34. Digital health education and age category

Among practitioners who had received digital health education during pharmacy school, 29% (n: 23) also received digital health education outside of pharmacy school as continuous education compared with only 13% (n: 57) for those who did not receive digital health education in pharmacy school (see Table 13). Practitioners who reported receiving digital health in school were 2.5 times more likely to receive additional digital health continuous education after pharmacy school [X^2 (1, n = 526) = 17.46, $p < 0.0001$]. Increasing digital health education in the pharmacy school curriculum is a critical strategy to increase digital health competencies overall, as it is likely to promote greater awareness and life-long learners of digital health.

Table 13. Cross tabulation of digital health education (n: 526)

		Received digital health education outside pharmacy school	
		Yes (n: 80)	**No (n: 446)**
Received digital health education in pharmacy school	**Yes (n: 73)**	23 (29%)	50 (68%)
	No (n: 453)	57 (13%)	396 (87%)

Among practitioner respondents, 73 (14%) reported they received education related to digital health at pharmacy school as part of the curriculum. Details of when the courses were taken and whether they were compulsory are given in Table 14. Over half of the practitioners who received digital health education took it as a voluntary or elective course. Although there is a potential for selection bias, the high percentage of elective courses suggests an interest in this field.

Table 14. Details of digital health courses taken by practitioners

Details	Categories	Frequencies (%)
Digital health education in pharmacy school (n: 73)		
Type of course delivery	Elective/voluntary	42 (58%)
	Mandatory	30 (41%)
	No response	1 (1%)
How the course was delivered	Received at the undergraduate level	22 (30%)
	Attended a certification course	24 (33%)
	Received at postgraduate level	27 (37%)
Digital health continuous education (n: 80)		
Type of course delivery	Voluntary	60 (75%)
	Mandatory as part of the job training	15 (19%)
	Mandatory for other reasons	5 (6%)

Among practitioners, 80 (15%) reported they received digital health training outside of pharmacy school during practice or as part of continuous professional development. The majority of courses were voluntary (n: 60, 75%) (see Table 14), with digital health practice setting reporting the highest number of respondents (40%) who took courses that were mandatory as part of the job training. Details of digital health continuing education courses broken down by practice setting can be seen in Figure 35. Community pharmacy had the lowest percentage that reported training was mandatory as part of the job (11%), although 11% also indicated it was mandatory for other purposes. It is unclear if digital health education specifically was mandatory for non-job purposes or if it was listed as mandatory because continuous education, in general, is mandatory for licensure purposes.

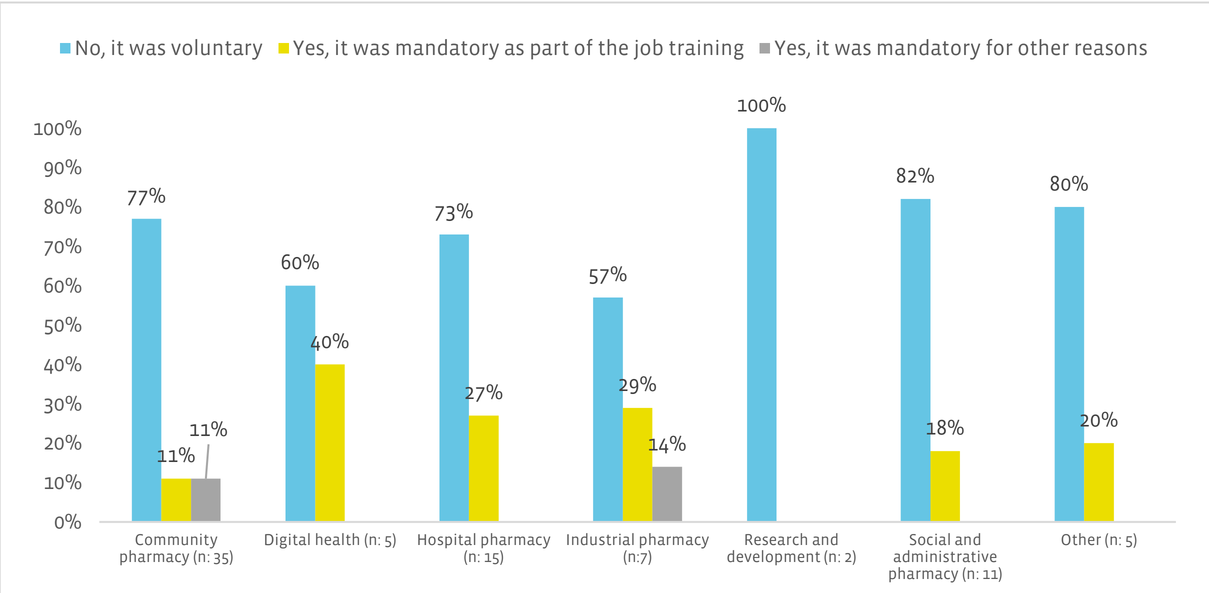

Figure 35. Continuous education courses across practice settings (n: 80)

Digital health in pharmacy practice and pharmaceutical sciences

Among respondents who reported the frequency of digital health technology use, the majority reported use daily (see Figure 36). Frequency of use by WHO region and practice setting can be seen in Figure 37 and Figure 38. A majority of respondents reported using digital health daily, despite lower overall use of digital health tools.

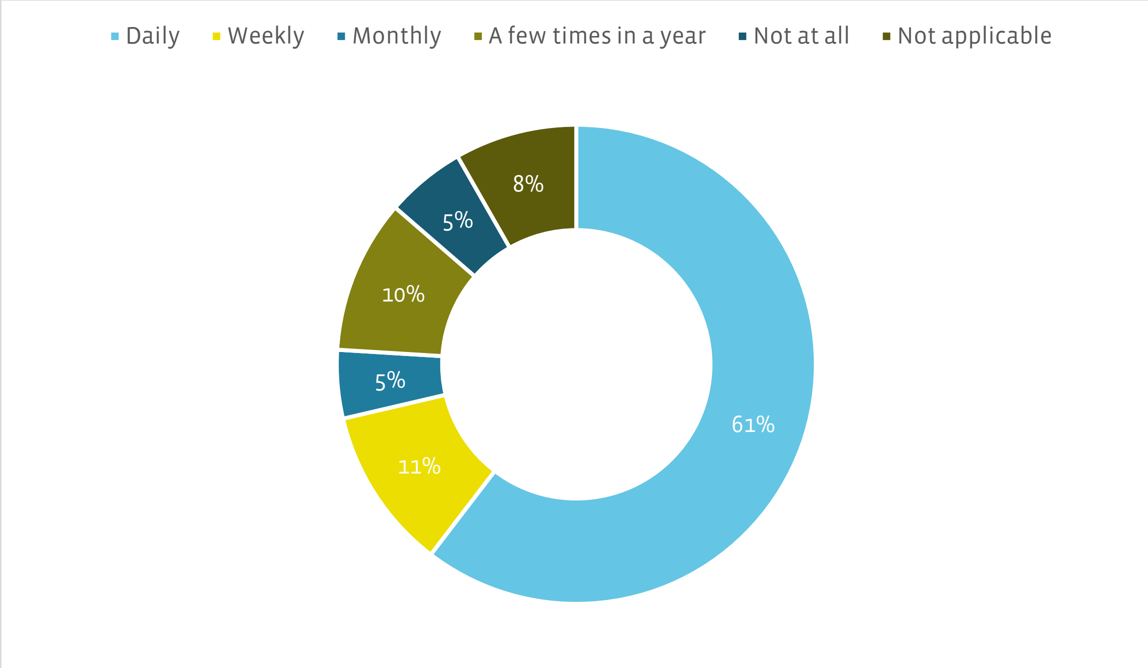

Figure 36. The frequency of digital health technology use (n: 522)

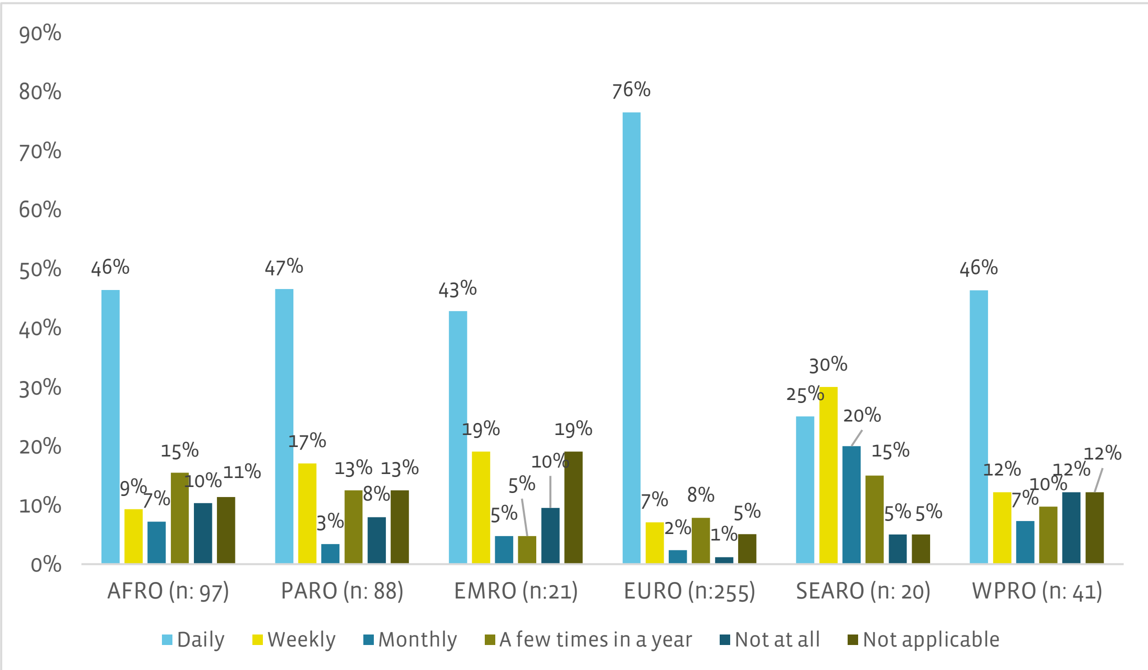

Figure 37. Digital health technology use and WHO region

Community pharmacy and the European region had the highest percentage of respondents who reported daily use of digital health tools (see Figure 37 and Figure 38), which aligns with the European region having the highest percentage of community pharmacist according to the survey. Daily use of digital health tools appears to be driven by the use of e-dispensing, mobile apps, and e-prescribing, and digital tools with the highest reported utilisation rates. Other than EURO, the regions were similar with nearly half of respondents in each region reporting daily digital health use, except SEARO.

Among practice settings, hospital pharmacy had the fourth-highest reported daily usage at 60% (see Figure 38), which could be driven by electronic health record usage.

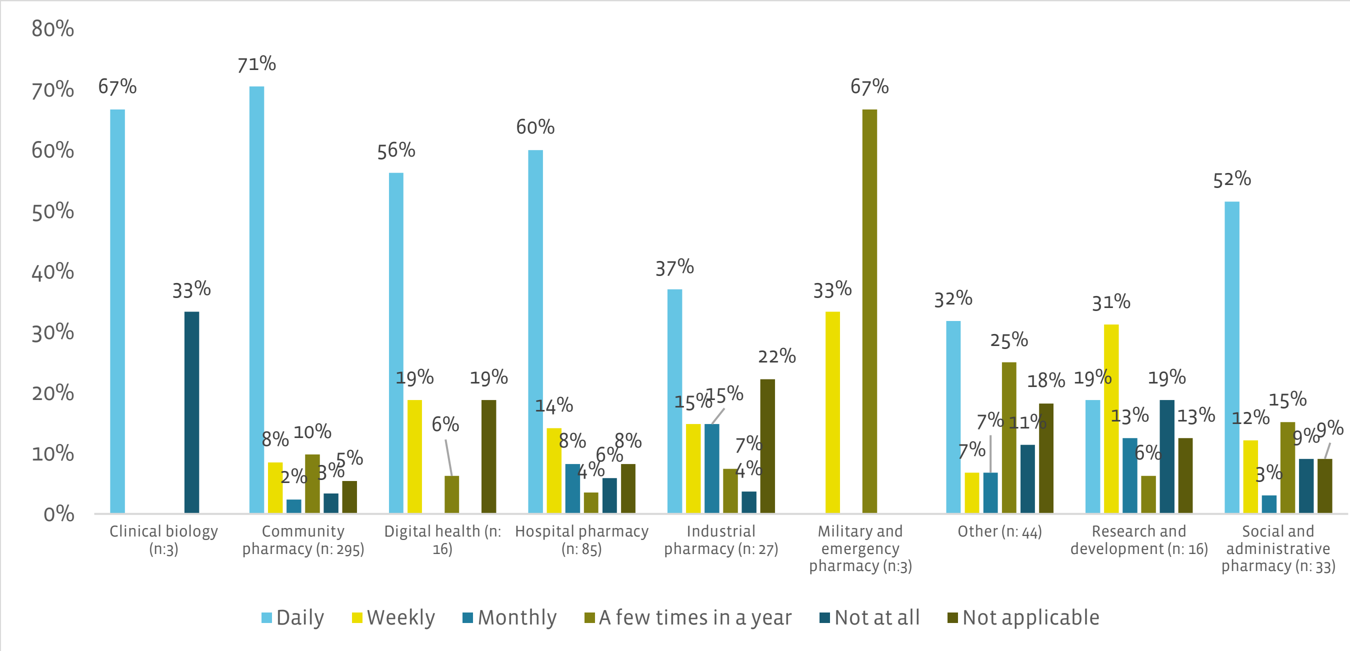

Figure 38. Digital health technology use by practice setting

Among respondents, 446 practitioners answered the question about which tools they used in practice (see Figure 39). Overall, utilisation rates were low for most digital health technologies. Seventy-seven per cent (342/446) use one to three digital health tools in their practice. Among the tools, e-prescribing, mobile applications and e-dispensing are the most commonly used (see Figure 40). Other emerging technologies, such as artificial intelligence and consumer wearables had a low utilisation rate among surveyed practitioners: 4% and 6%, respectively. Outside the top four most commonly used digital health tools, utilisation did not surpass 15%.

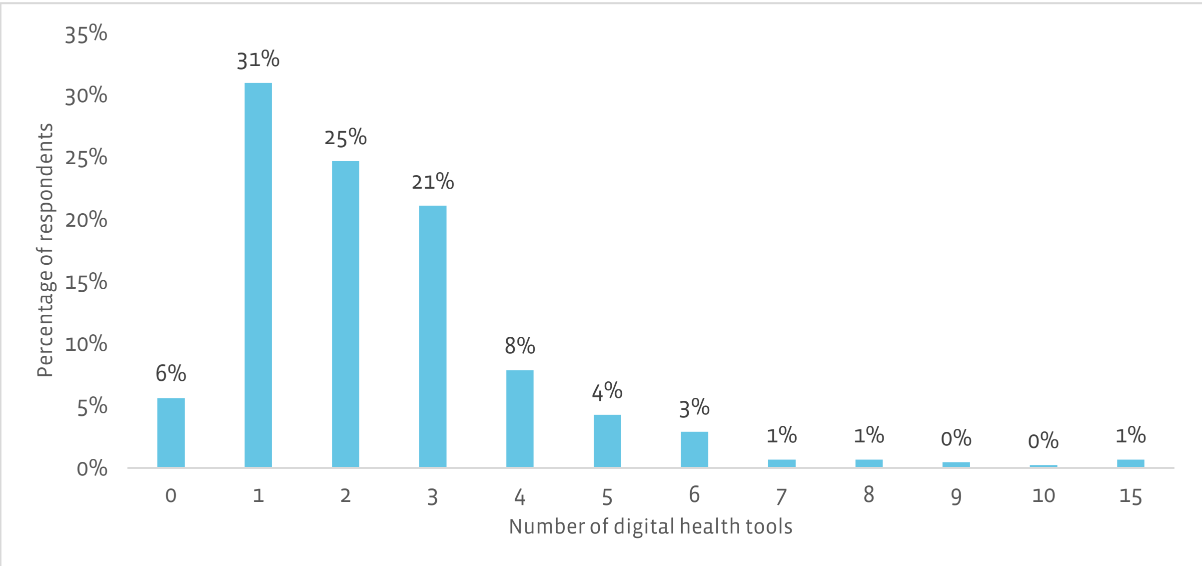

Figure 39. Number of digital health tools used in practice (n: 446)

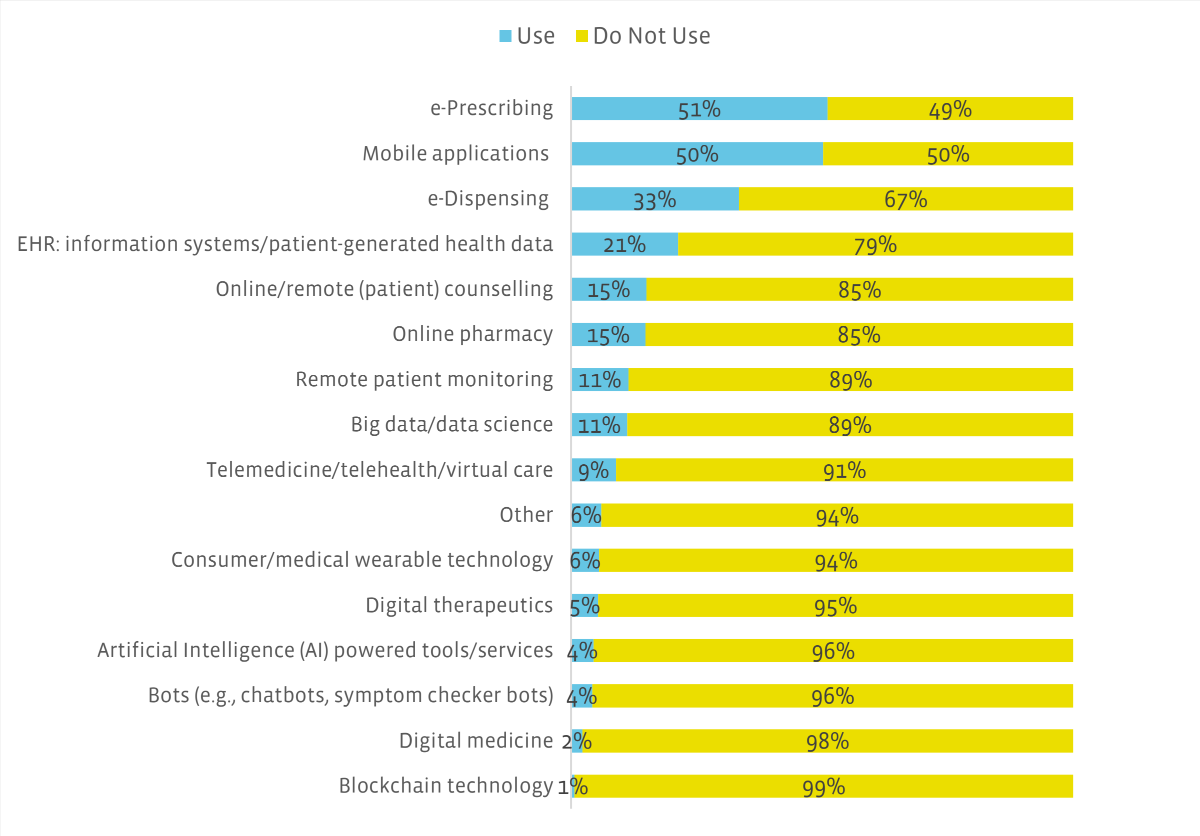

Figure 40. Types of digital health tools used in practice

Perceived relevancy of digital health content in education and training

Tools covered in pharmacy curriculum or continuing education courses can be seen in Figure 41. Mobile applications, e-prescribing, and e-dispensing, the top three tools used in practice, are among the top five tools covered in the pharmacy curriculum or continuing education. There is less alignment between other tools. Although 41% of practitioners who received digital health education reported telehealth was covered in their courses, only 9% reported using telehealth or virtual care in practice. Similar gaps between education and practice were seen for other digital health tools. However, it is important to note that respondents who reported use of tools in practice also include practitioners who have not received digital health education.

It is also important to note that a low percentage of inclusion of specific tools in digital health education could be a factor when the tool was developed compared with when the surveyed practitioner received an education. Given the average years of experience of respondents, some technologies may not have been available or developed at the time the respondent received initial education; however, some of those technologies may have been covered in continuous education, which the survey would then have captured.

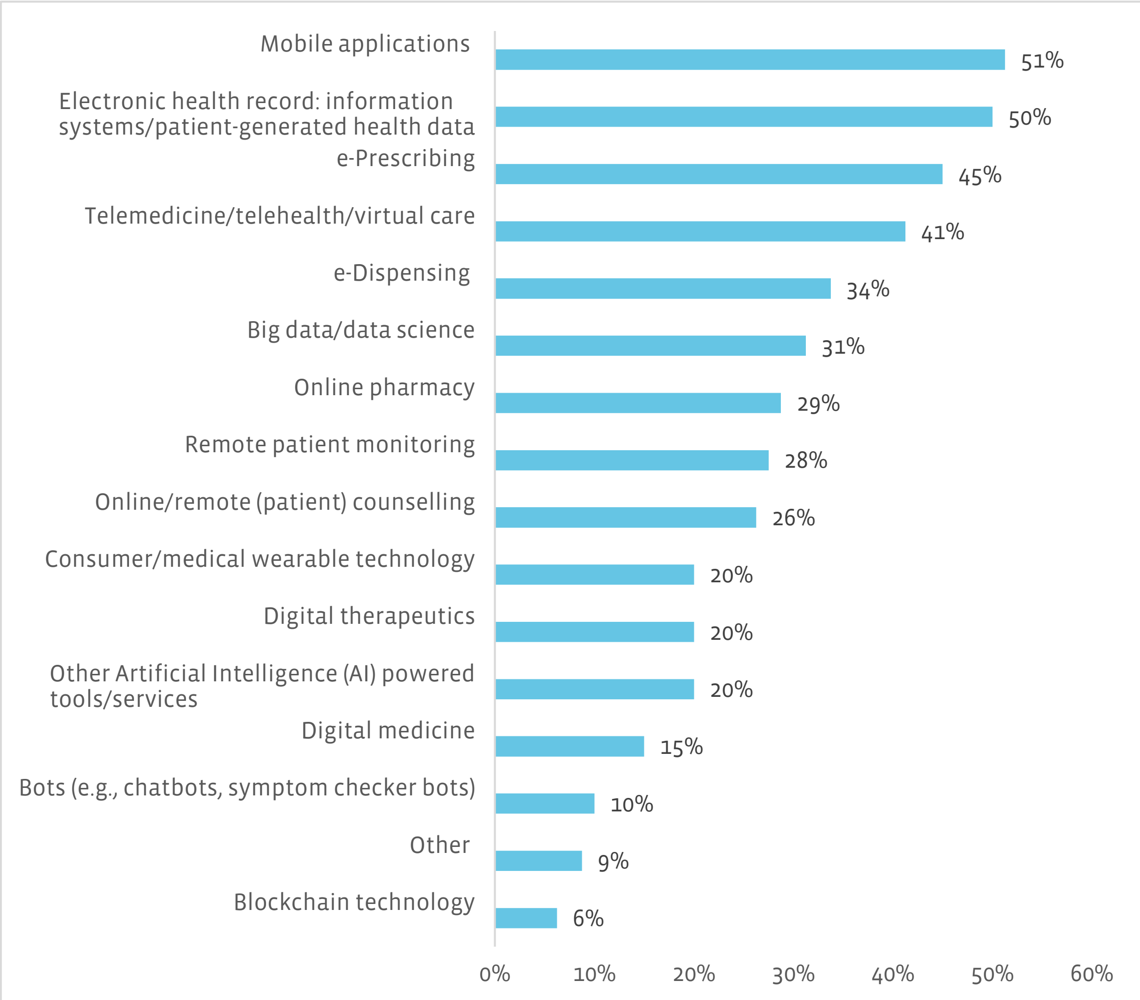

Figure 41. Types of digital health tools covered in the pharmacy curriculum or continuing education courses

Tools covered in pharmacy curriculum or continuing education courses broken down by WHO region are shown in Figure 42. Only four digital health tools were in included in the education of at least one respondent in every region, which included mobile applications, big data/data science, telemedicine/telehealth/virtual care and digital therapeutics.

Some tools showed more variability than others when broken down by region. Greater variability across regions appeared to be seen with mobile applications, telemedicine and online pharmacies.

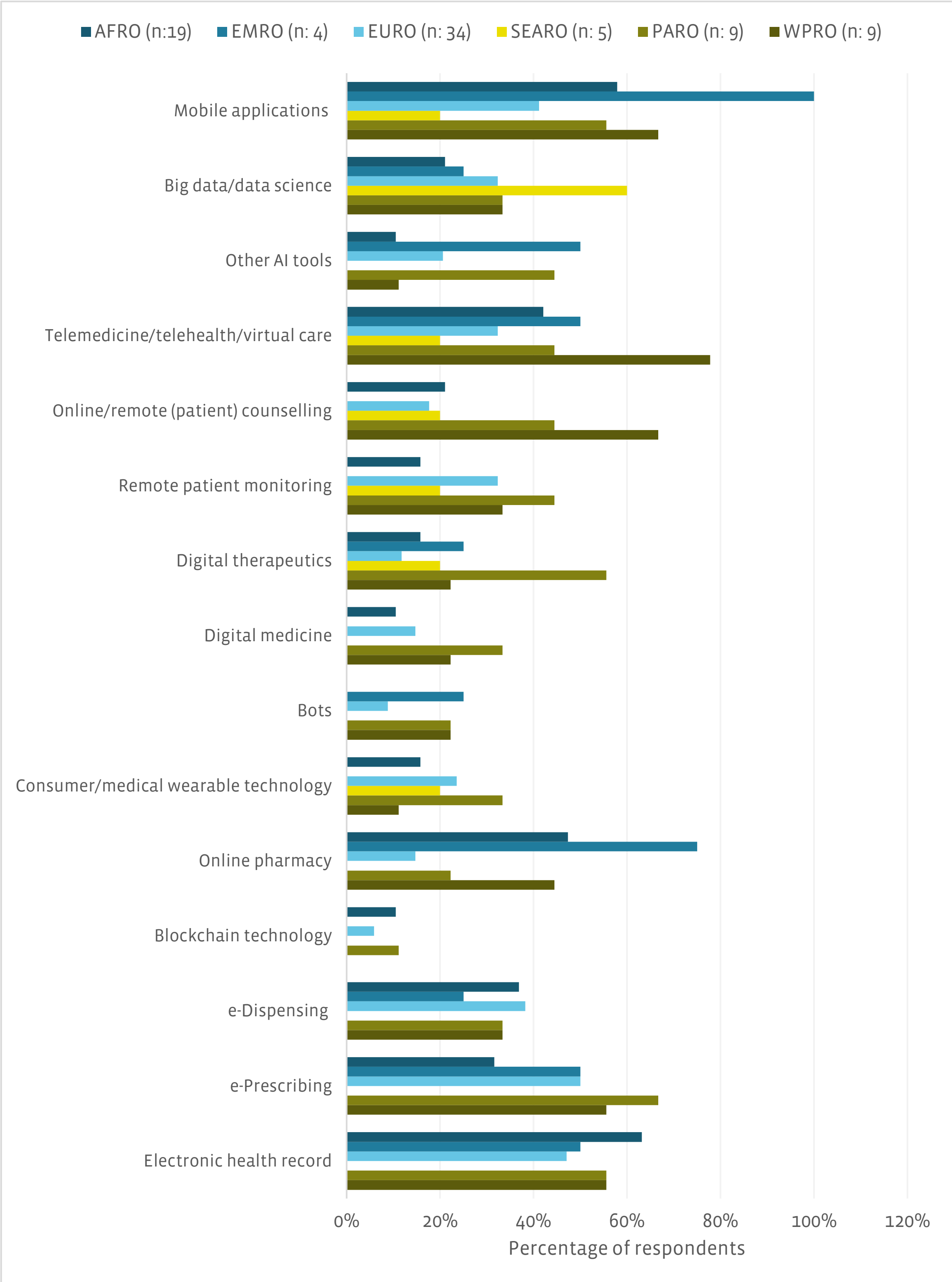

Figure 42. Tools covered in the pharmacy curriculum or continuous education by WHO region

Digital health-related concepts covered in pharmacy curriculum or continuing education courses can be seen in Figure 43. Ethics/compliance and data privacy/security were covered in the education of over half of respondents. Digital health-related concepts covered in pharmacy curriculum or continuing education courses across the WHO region can be seen in Figure 43. Overall, a greater percentage of concepts were covered in digital health education than specific digital health technologies.

Concepts related to implementing digital health tools in clinical care were among the least likely to be included in education (clinical reasoning and decision-making and evidence-based digital medicine). A low percentage of respondents (26%) reported receiving education on clinical reasoning and decision making as it relates to digital health (Figure 43). Evidence-based decision making also had a low percentage (24%). This finding may contribute to the low percentage of clinical or health outcomes related expectations for the use of digital health tools in practice.

Additionally, reimbursement was rarely covered (14%), which could be a barrier to pharmacists successfully incorporating or leveraging these tools in practice in a financially sustainable way. This lack of understanding or ability to reimburse may also signal a key driver that is missing currently in pharmacy practice.

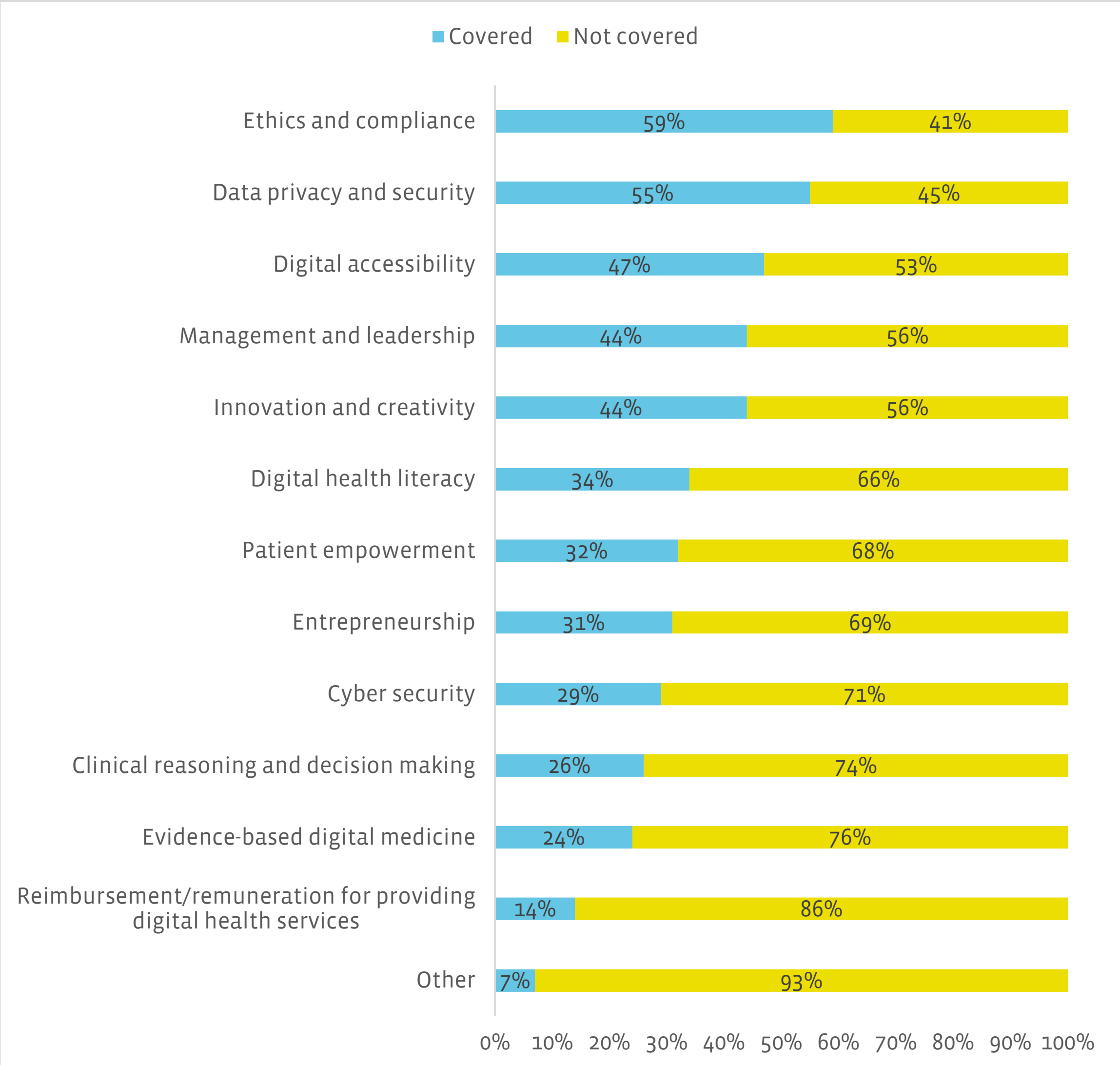

Figure 43. Concepts covered in the pharmacy curriculum or continuous education

Perceived relevancy of digital health education to practice can be seen in Figure 44. The majority of respondents who received digital health education reported that they strongly agree or agree that the content of digital health education they received was relevant to practice. Given the low utilisation of tools outside of e-dispensing, e-prescribing, mobile applications and electronic medical records, the high degree of perceived relevancy could be a factor of education focusing predominantly on those limited technologies and/or focusing only on technologies with administrative purposes.

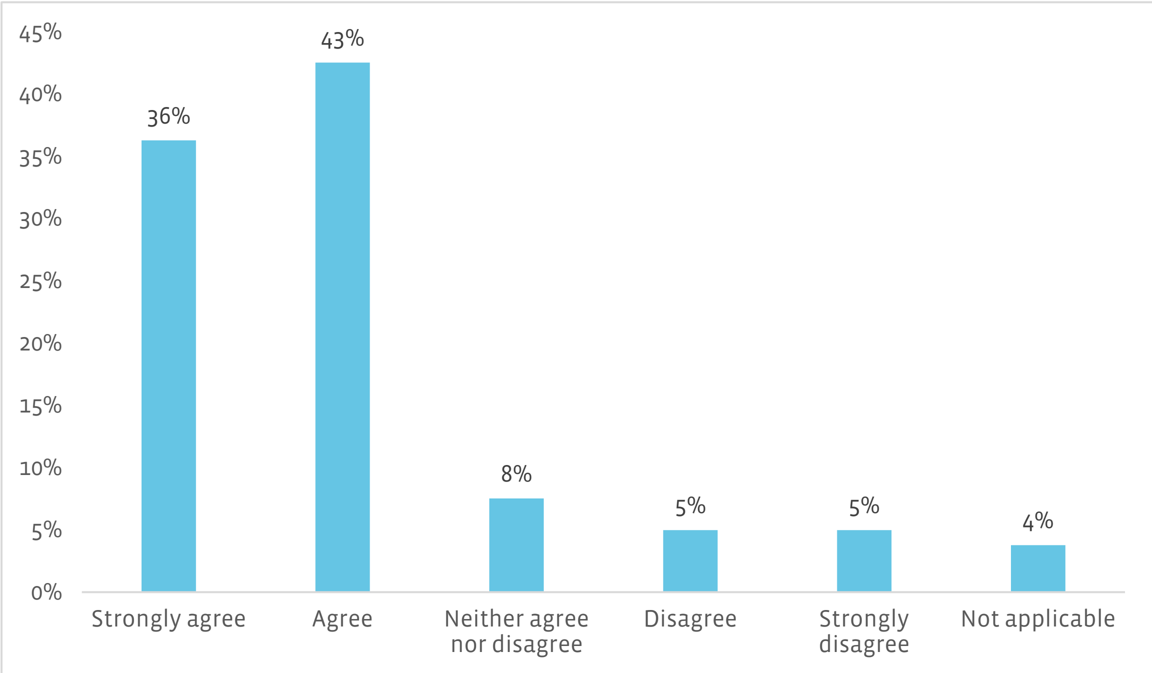

Figure 44. Agreement on the relevancy of the content of the digital health education that respondents received to pharmacy practice

Among respondents who provided information about the relevancy of digital health education to their practice, 50% of those in research and development and 25% of those in digital health responded that they strongly disagreed it was relevant. However, of note, the sample size was small for these two practice settings. Among community pharmacy, which was more represented within the survey population, 9% responded that they disagreed or strongly disagreed that the digital health education they received was relevant to practice (see Figure 45).

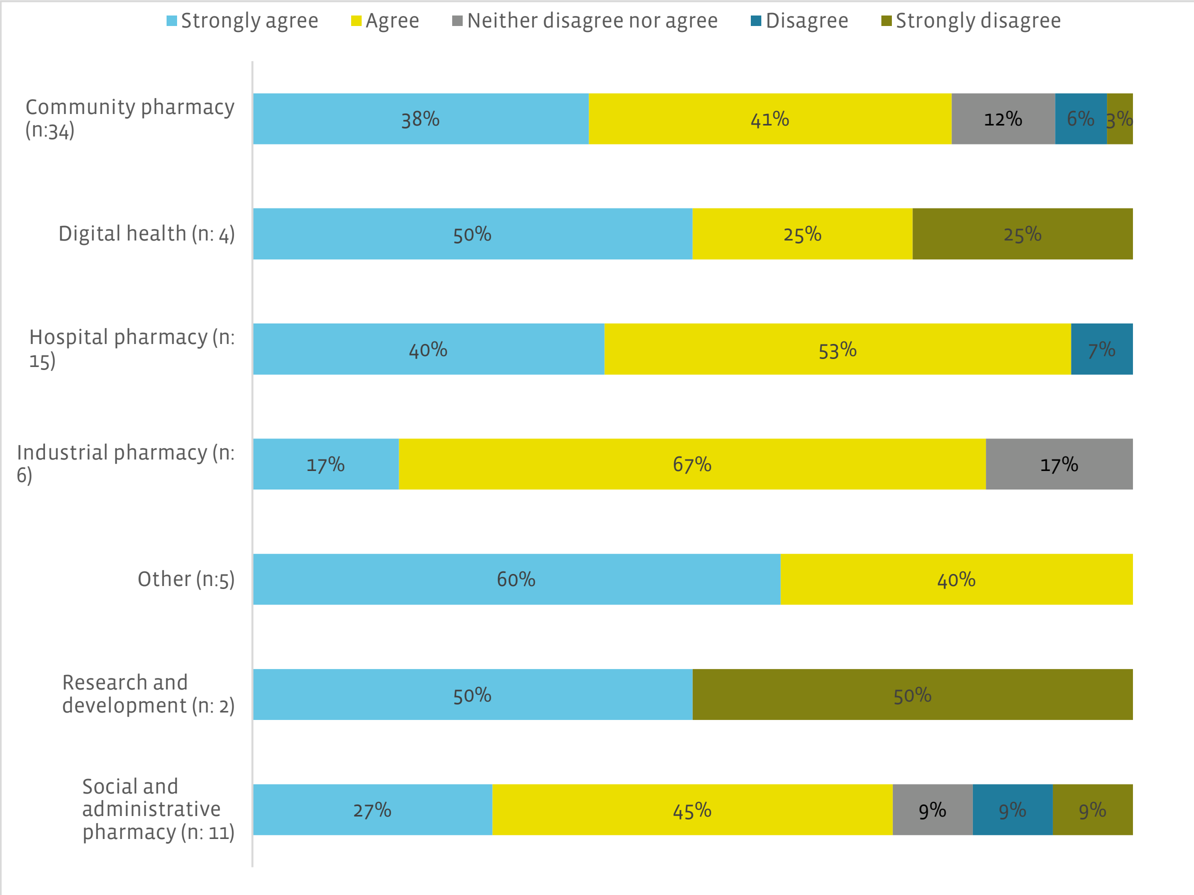

Figure 45. Agreement on the relevancy of the content of the digital health education that respondents received to pharmacy practice based on practice setting

A greater percentage of practitioners who use digital health tools daily reported that they disagree or strongly disagree with the relevance of the digital health education they received compared with those who use digital health tools less frequently (see Figure 46).

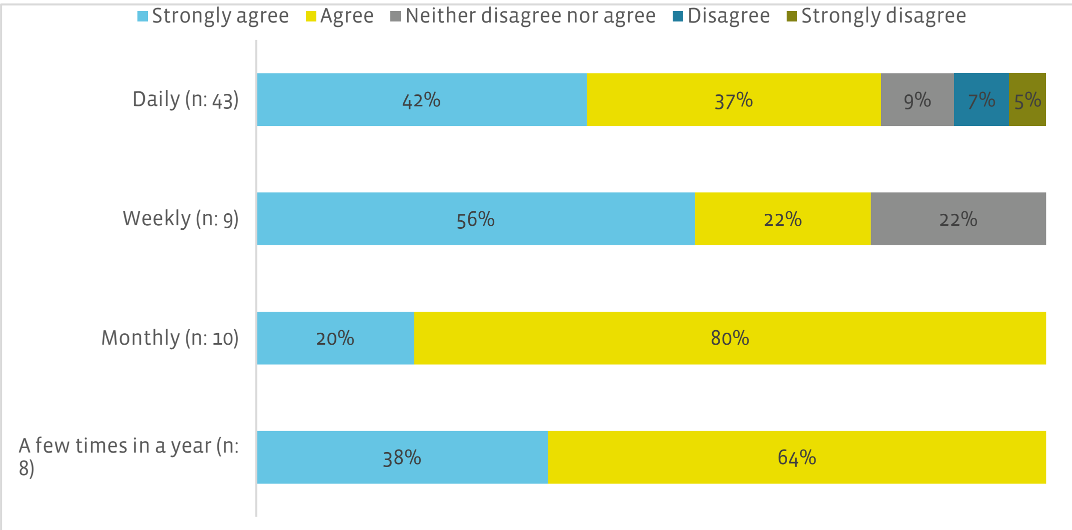

Figure 46. Agreement on the relevancy of the content of the digital health education that respondents received to pharmacy practice based on frequency of use

Top tools that practitioners would you like to learn more about in order to use digital health effectively in their practice can be seen in Figure 47. Among the top tools listed include those that also have the highest reported use by practitioners. A decreased interest in other tools, such as consumer wearable technology, could indicate a lack of awareness of newer technologies.

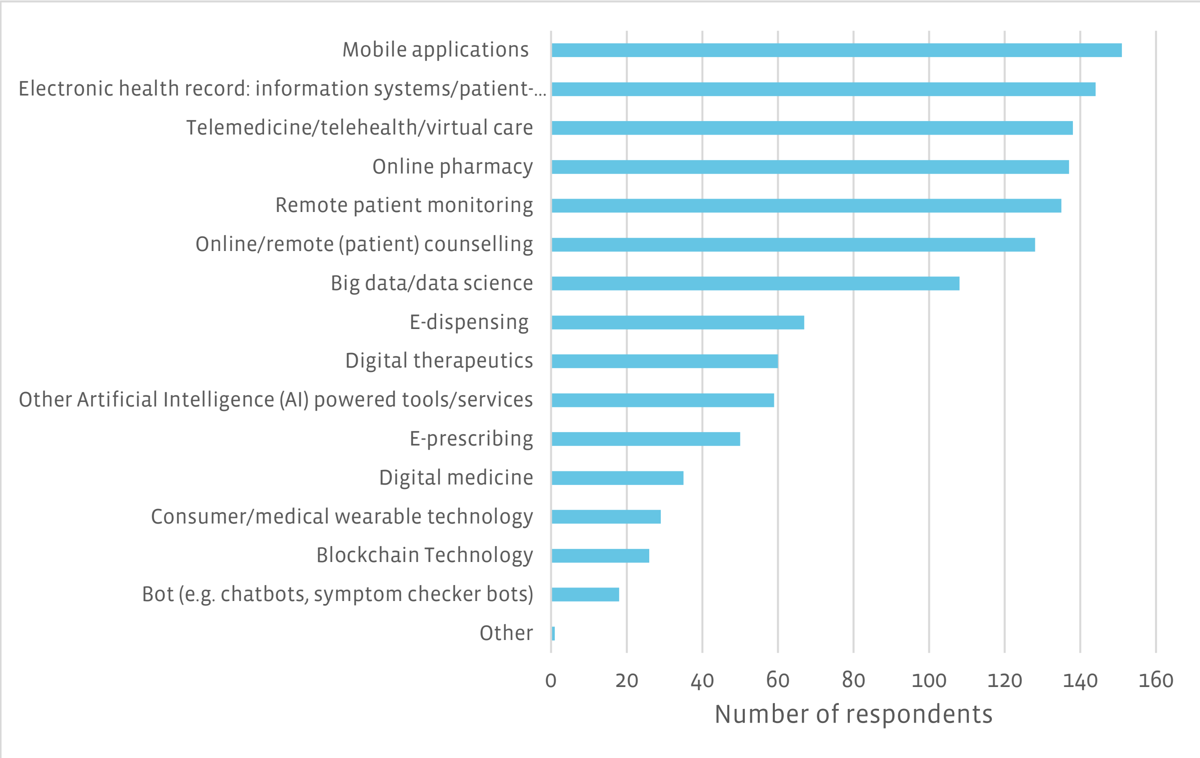

Figure 47. Top tools that practitioners would like to learn more about

Respondents who indicated which technologies were covered in any digital health education they received were then asked to report their level of confidence in using those technologies in practice. Self-reported confidence in using digital health tools that respondents had received education on is shown in Figure 48. Overall, respondents reported a high degree of confidence. Tools members were less confident in using in practice, despite having receiving education on them, include blockchain technology, bots, artificial intelligence and big data. This could be partly attributed to the complexity of these technologies and the associated competencies.

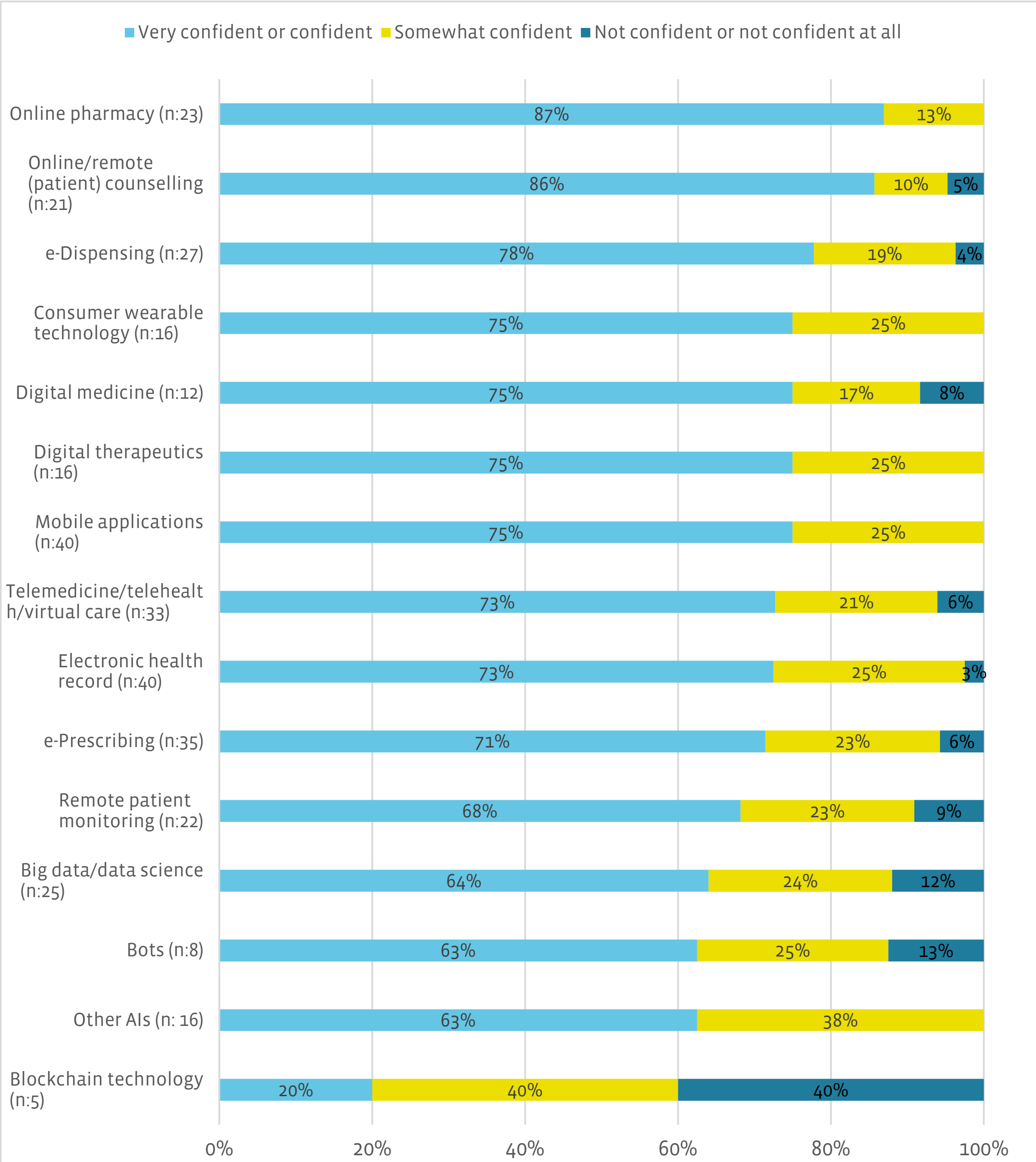

Figure 48. Perceived confidence in using digital tools

Impact and expected outcomes of using digital health in practice

Reported benefits of digital health tools among respondents can be seen in Figure 49 and Table 15. Respondents were asked what the expected outcomes were for the use of each digital tool within their practice. For mobile applications, which had the highest utilisation rate reported among respondents, none of the expected benefits had more than 60% of respondents agree that it was an expected outcome. However, among tools with low reported use in practice, such as AI, there were high expectations (81%) that it would be able to improve health and well-being. Across all tools, digital therapeutics had the highest number of respondents indicate it could improve pharmaceutical care.

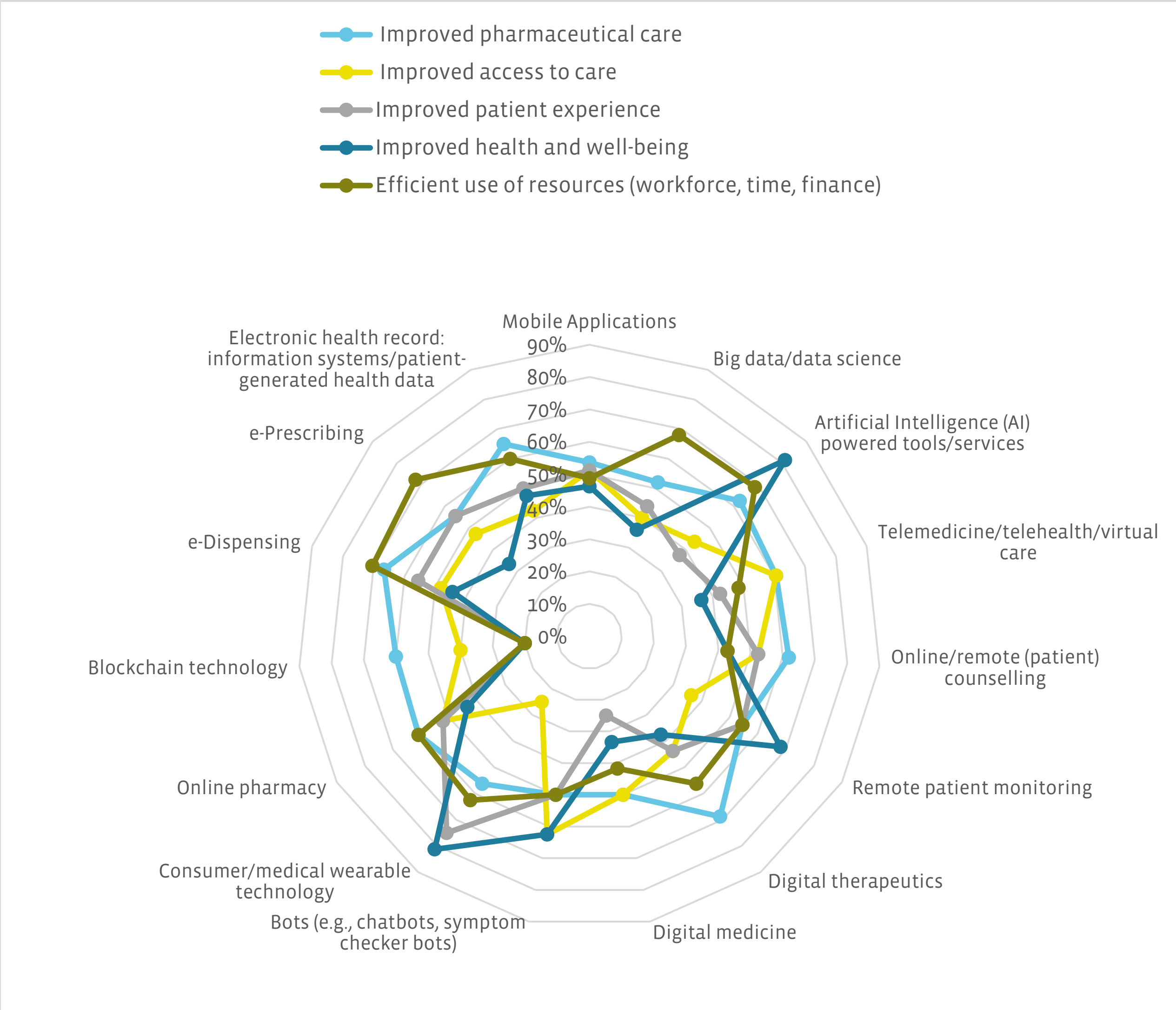

Figure 49. Reported benefits of digital health tools among respondents

It appears that practitioners are less optimistic about the tools used the most (Table 15). This may also be a reflection of practitioners seeing less benefit in how tools are currently being used. Possible causes could be lack of knowledge of how to implement digital health technologies in practice, a lack of appropriate infrastructure and buy-in to allow the tools to be used, a lack of knowledge in how they can be used or an issue with the tools themselves.

Table 15. Details of reported benefits of digital health tools

Tools	n	Improved pharmaceutical care	Improved access to care	Improved patient experience	Improved health and well-being	Efficient use of resources (workforce, time, finance)
Mobile applications	41	54%	51%	51%	46%	49%
Big data/data science	25	52%	40%	44%	36%	68%
Artificial intelligence (AI) powered tools/services	16	63%	44%	38%	81%	69%
Telemedicine/telehealth/virtual care	33	61%	61%	42%	36%	48%
Online/remote (patient) counselling	21	62%	52%	52%	43%	43%

[redacted]

Tools	n	Improved pharmaceutical care	Improved access to care	Improved patient experience	Improved health and well-being	Efficient use of resources (workforce, time, finance)
Remote patient monitoring	22	55%	36%	55%	68%	55%
Digital therapeutics	16	69%	44%	44%	38%	56%
Digital medicine	12	50%	50%	25%	33%	42%
Bots (e.g., chatbots, symptom checker bots)	8	50%	63%	50%	63%	50%
Consumer/medical wearable technology	16	56%	25%	75%	81%	63%
Online pharmacy	23	61%	52%	52%	43%	61%
Blockchain technology	5	60%	40%	20%	20%	20%
e-Dispensing	27	67%	48%	56%	44%	70%
e-Prescribing	36	56%	47%	56%	33%	72%
Electronic health record: information systems/patient-generated health data	40	65%	43%	50%	48%	60%

The most common benefit of digital health reported by respondents is saving time. Less than half of respondents (187/446, 42%) saw digital health as able to improve outcomes of medicines use (see Figure 50). This may indicate a general lack of awareness among practitioners on the different purposes that technology can serve.

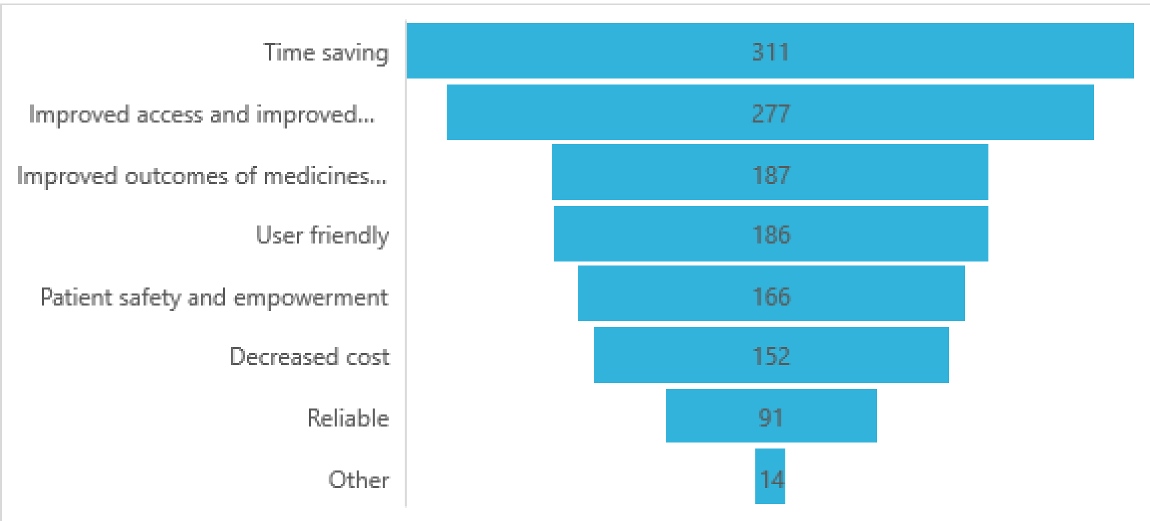

Figure 50. Benefits of digital health reported by respondents (n: 446)

Overall, 81% (n: 361) of respondents reported digital health tools/services being very useful or useful in practice. When broken down by those who had or had not received digital health education, those who had not received digital health education had a slightly higher percentage of respondents than those who reported digital health tools as moderately useful, slightly useful or not useful (see Figure 51). Having received education on digital health in the past appear to have an impact on changing perceptions of the utility of digital health.

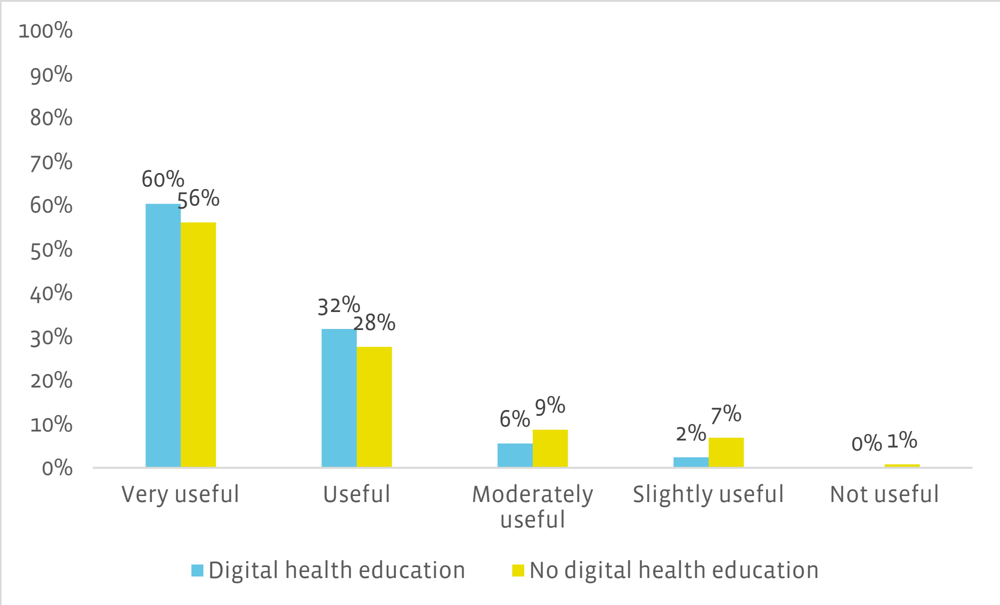

Figure 51. Rate of the usefulness of digital health tools/services in pharmacy practice

Practitioners in community, and research and development see less advantage of digital health than practitioners in other settings (Figure 52).

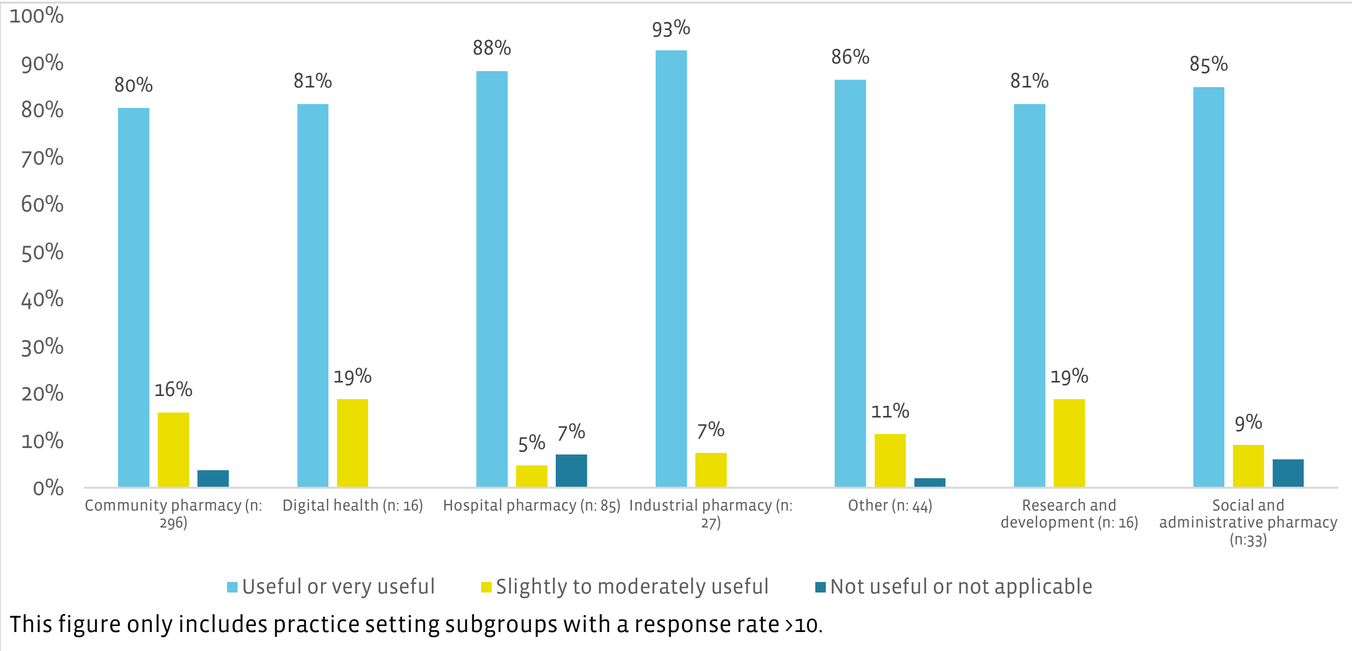

Figure 52. Rate of the usefulness of digital health tools/services in pharmacy practice across practice setting

Composite responses for perceived usefulness of digital health based on which tools respondents reported using in practice is shown in Figure 52. Of the respondents who reported using consumer wearable technology in their practice, 88% ranked digital health as useful or very useful in practice, while only 71% of respondents who reported using digital therapeutics ranked digital health as useful or very useful in practice (see Figure 53). Those who reported using remote monitoring on remote counselling had lower percentages of respondents rank digital health as useful or very useful in practice.

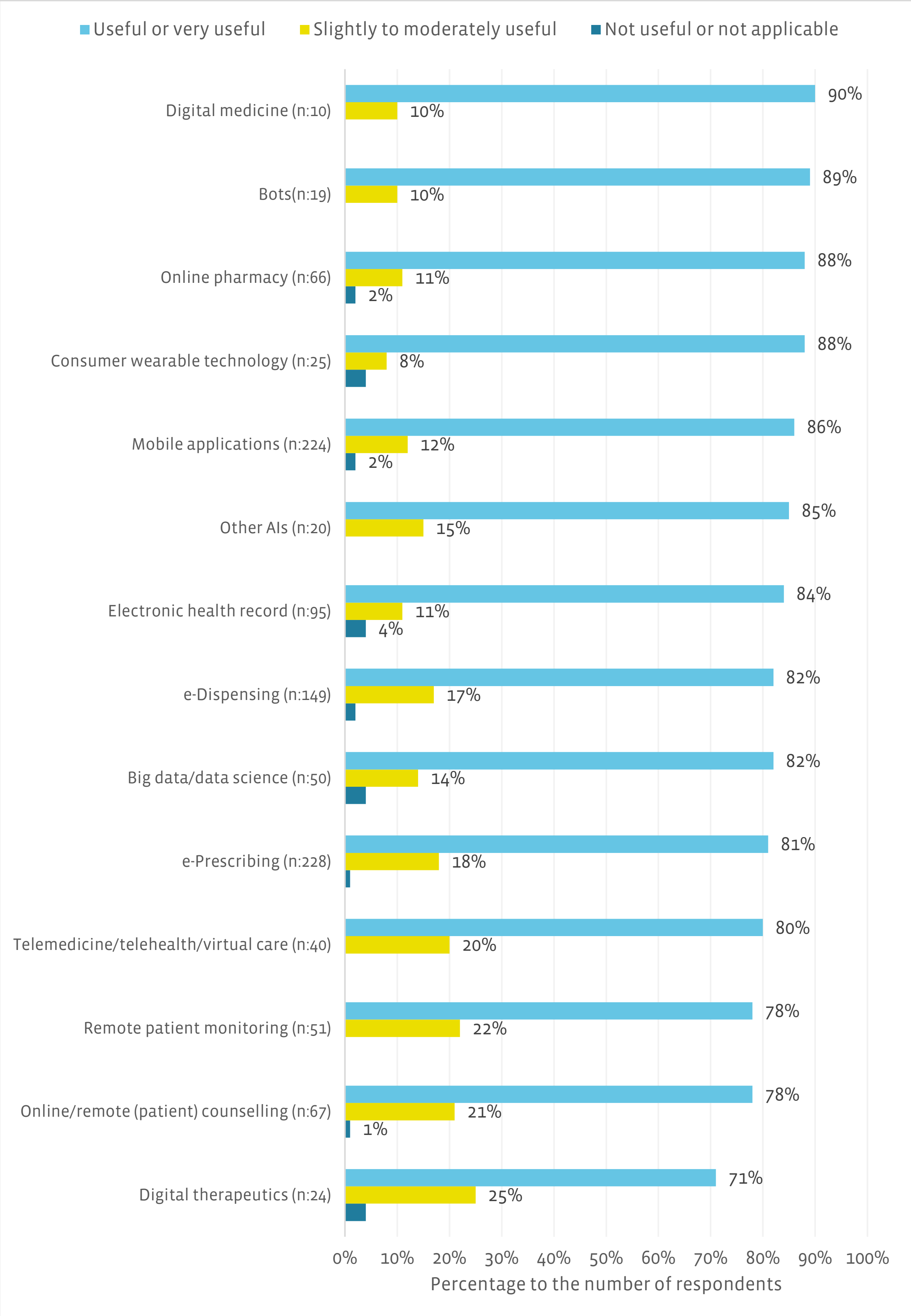

Figure 53. Perceived usefulness of digital health in practice compared across digital health tools

Impact of digital health in practice

The rate of the impact of digital health on collaboration with other healthcare providers is shown in Figure 54. The comparison of impact across WHO regions and practice settings is shown in Figure 55 and Figure 56. Receiving education on digital health appears to have minimal impact on changing the perceived impact of digital health on collaboration with other healthcare providers.

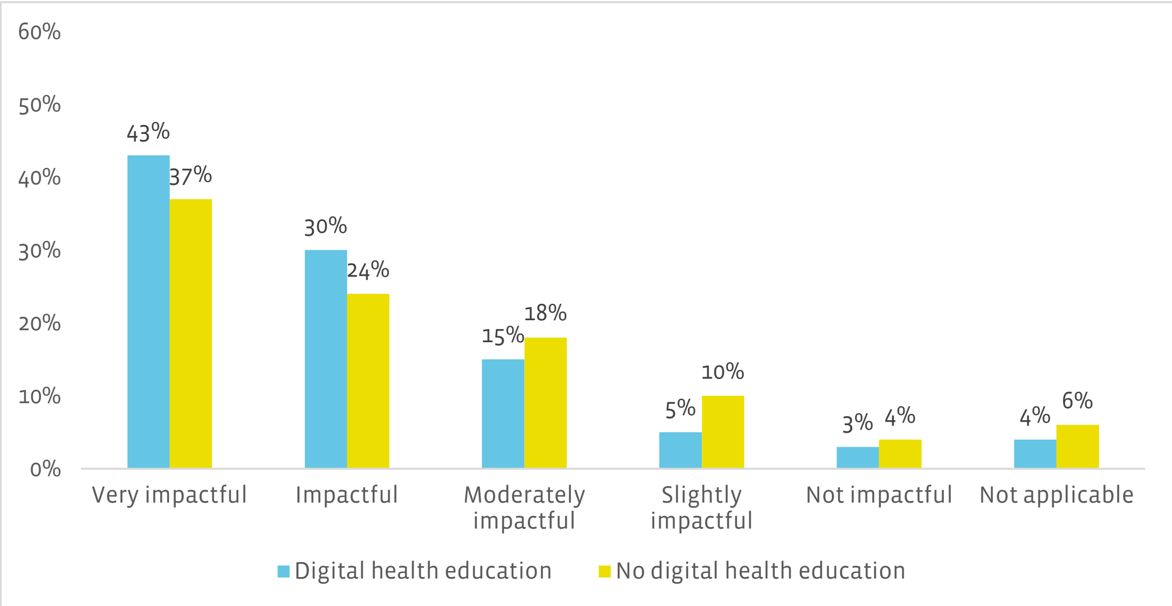

Figure 54. Impact of digital health tools/services in pharmacy practice on collaboration with other healthcare providers

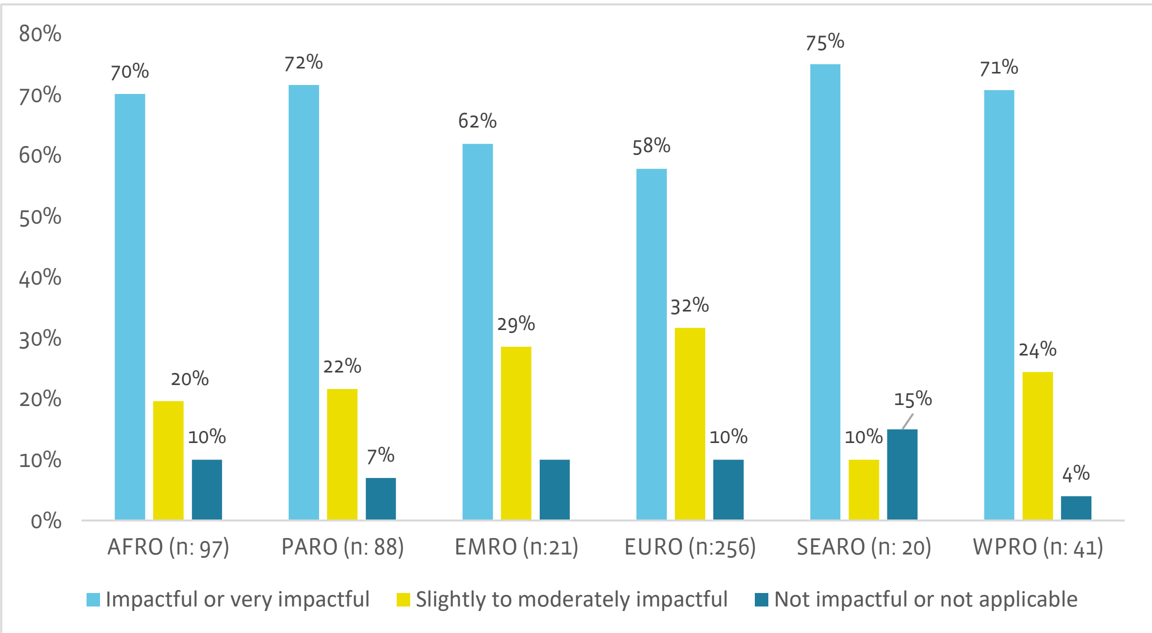

Figure 55. Impact of digital health tools/services in pharmacy practice on collaboration with other healthcare providers by WHO region

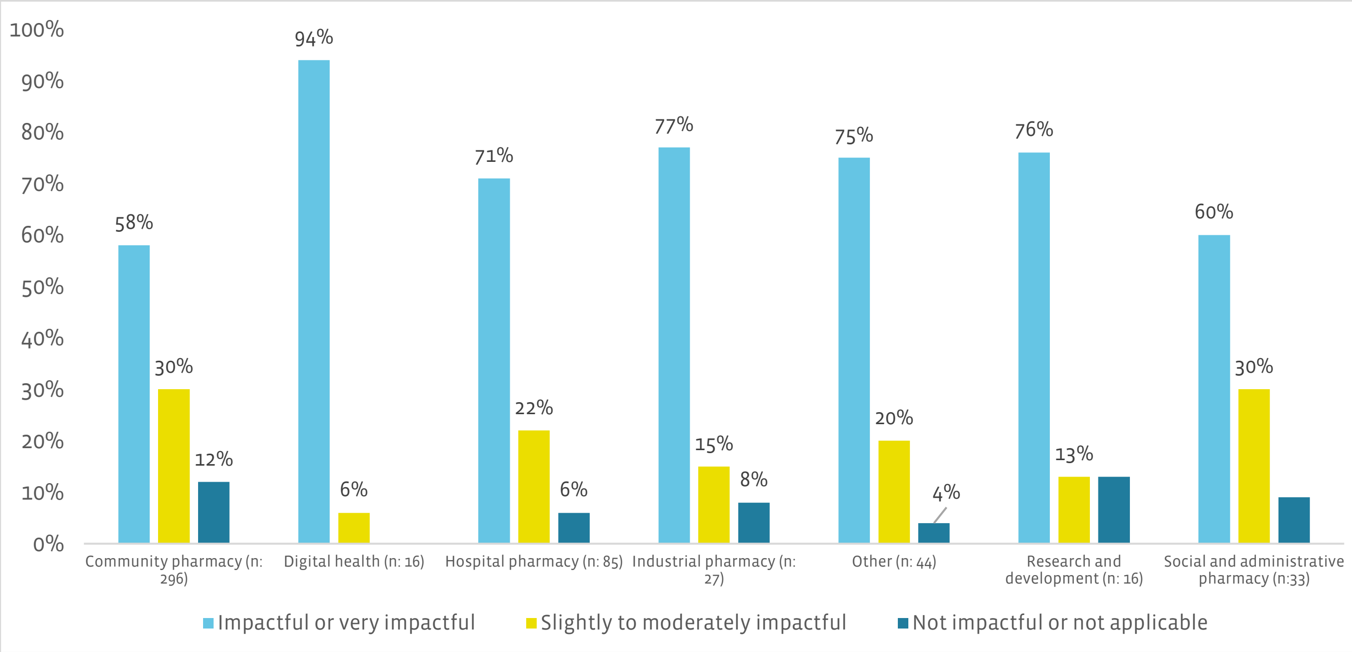

Figure 56. Impact of digital health tools/services in pharmacy practice on collaboration with other healthcare providers across practice setting

The rate of the impact of digital health on patient engagement can be seen in Figure 57. Among respondents who received digital health education, “impactful” was the most frequent response, while “very impactful” was the most frequent response among those who had not received digital health education. The comparison of impact across WHO regions and practice settings is shown in Figure 58 and Figure 59.

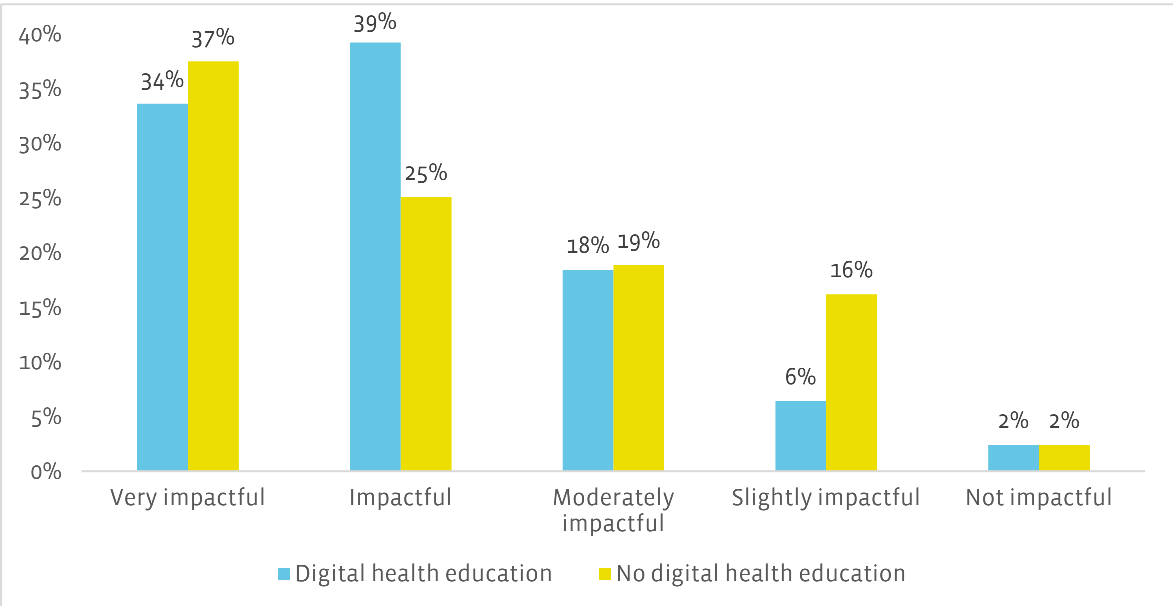

Figure 57. Impact of digital health tools/services in pharmacy practice on patient engagement

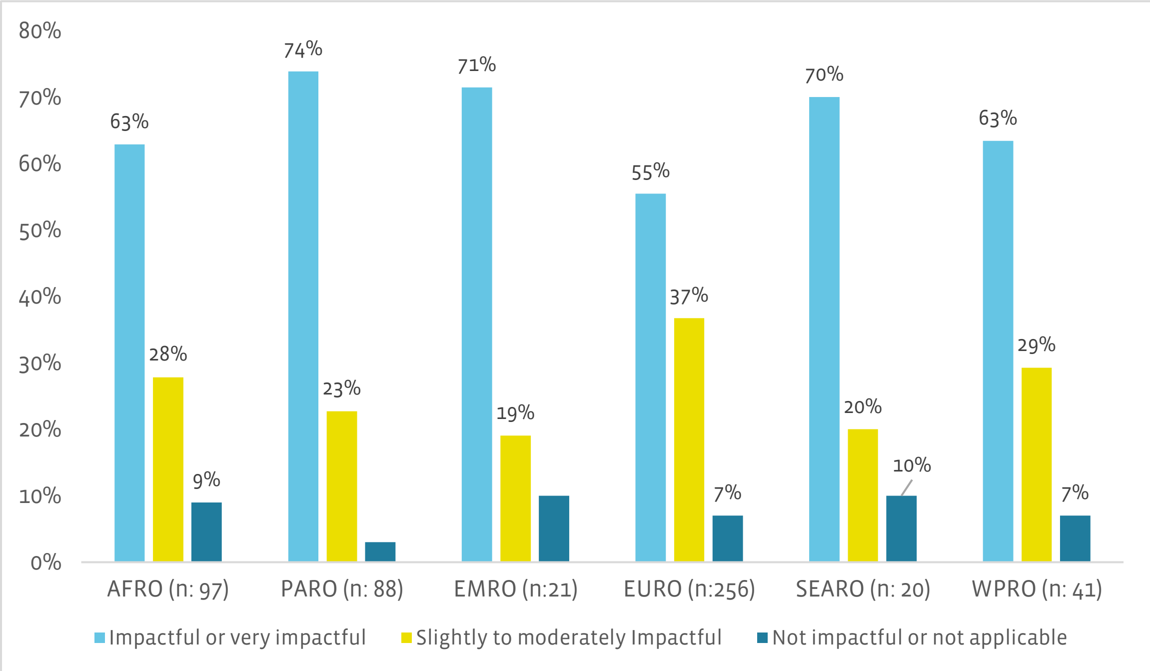

Figure 58. Impact of digital health tools/services in pharmacy practice on patient engagement by WHO region

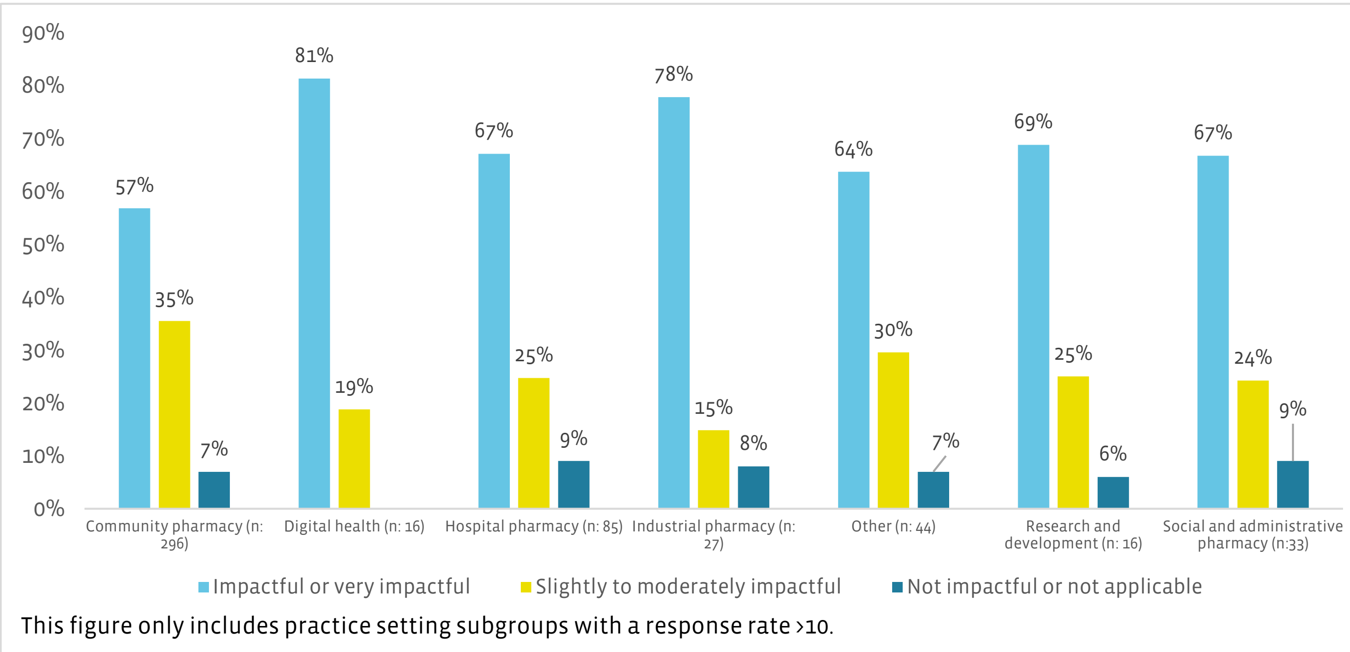

Figure 59. Impact of digital health tools/services in pharmacy practice on patient engagement across practice setting

Challenges of digital health in practice

The challenges of using digital health tools in practice are outlined in Figure 60. More practitioners reported technical limitations than any other barrier, although not by much. Lack of resources/reimbursement was the third least cited challenge, with only 34% of practitioners mentioning it. This challenge may be cited less because it is a downstream challenge. Before resources are needed, there must be the appropriate technological and health system infrastructures and political landscape to allow for the implementation and adoption of digital health tools.

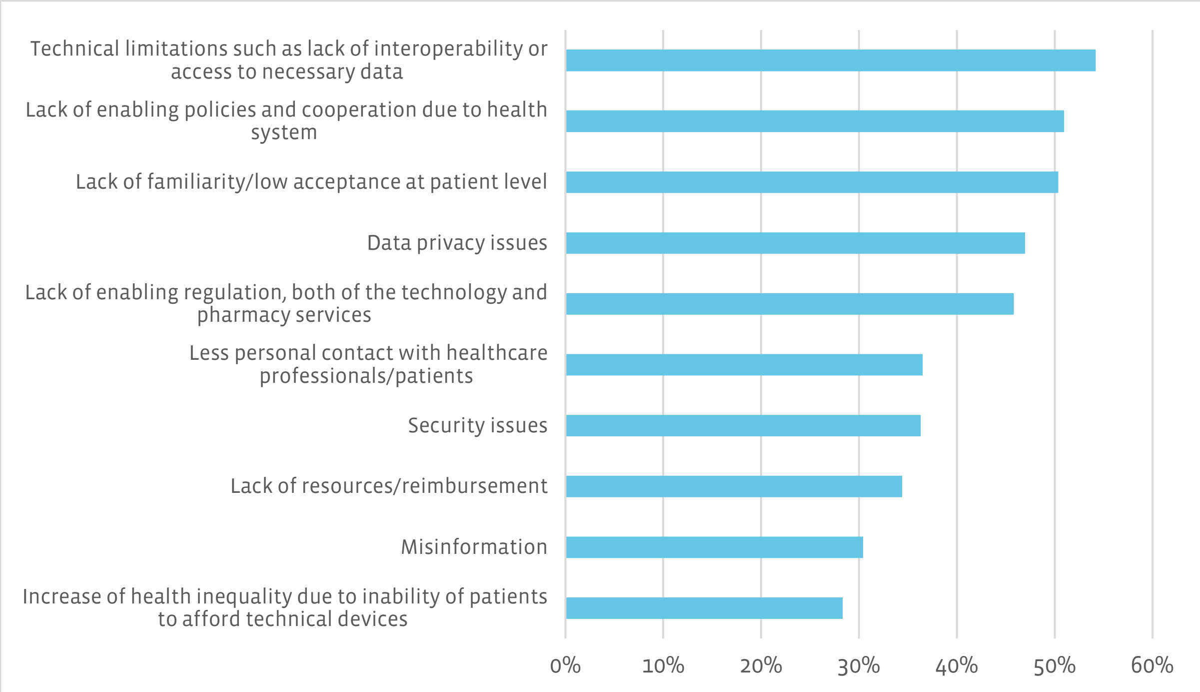

Figure 60. The challenges of using digital health tools in practice

Policy and support to practise digital health

A small number of practitioners (15%) reported having available support or guidance on the development of digital health skills. Additionally, few practitioners noted the expansion of digital health quality and scope in practice being included in their national/regional pharmacy associations, while half of the respondents reported they did not know. The summary of the policy and support for respondents to practise digital health is shown in Table 16.

Table 16. Support or guidance on digital health

	Yes	No	I don't know
Digital health education/training included in the general strategic plan of national pharmacy association(s)	18%	39%	43%
Availability of any support policy or guidance from your national/regional pharmacy organisations for the development of digital health skills?	15%	52%	33%
Are there any long-term strategies defined by your national/regional pharmacy organisations to increase the scope and quality of digital health in practice?	13%	36%	51%

There is an opportunity for pharmacy organisations to develop/communicate their digital health strategy to practitioners to assist and engage them.

Support from FIP

Among practitioners, multiple themes emerged when asked to provide information on the type of support they would like to receive from FIP. Common themes centred around access, education, guidance and information. Respondents requested support for:

- Increased access to digital health technologies and tools;
- Guidance and best practices on how digital health technologies can be used in practice;
- Information on what digital health technologies exist;
- Courses/education to help gain digital health competencies;
- Guidance on how to implement the use of digital health technologies; and
- Information to help stay up to date.

3.3 Strengths and limitations

This survey is the first global study exploring the current situation on the readiness and responsiveness of pharmacy education in digital health and on the knowledge and skill gaps of the pharmaceutical workforce specific to digital health. Since this topic is new and emerging, there was a lack of standardised terminology and universal definitions for digital health tools and concepts. While a glossary was provided at the beginning of the survey, there is still a possibility that the questions may have been misinterpreted by participants, especially where the questionnaire was not in their native language. (The glossary was provided only in English whereas the survey was available in eight languages.) An indication of this misinterpretation was that some surveyed students and academics thought that digital health and online education were the same. This may have resulted in some questions being completed inaccurately. Any inaccurate information that was provided by the respondents may have affected the accuracy of the results and the statistical analysis.

This survey covered respondents across the WHO regions. However, there was a skewed distribution among the different surveyed groups; for example, half of surveyed students and practitioners were from Europe. In surveyed practitioners, a majority of respondents work in the community pharmacy setting, which could be considered to skew the survey results towards this practice setting. It is recognised that, as with other FIP surveys, community pharmacy represents the majority of pharmacists globally. Therefore, the survey population is probably representative of the practice distribution of pharmacists globally.

Due to the retrospective nature of the practitioner questionnaire, there is the possibility of recall bias among respondents; some respondents may have been challenged to accurately recall concepts and tools covered in past pharmacy education.

In surveyed academics, the respondents were a heterogeneous group, and this may interfere with the extent of knowledge participating individuals had with regard to teaching activity in the institution, and policy and strategy. In surveyed students, only a limited number (n: 50; 18%) had taken digital health courses either in school or outside the school, and this may affect the reliability of the survey's results because of a higher variability, which may lead to bias. In surveyed practitioners, interpreting the survey results does not specifically include the perspectives of emerging pharmacy professional roles, including new roles facilitated by digital health technologies. There appears to be low adoption of digital health technologies outside of those used for operational and administrative functions. There is a possibility of having more than one student from the same school answering the survey, which may affect the results. Therefore, the findings could not be used to describe the conditions of the school but rather to describe the individual perspectives on the survey questions.

In light of the limitations cited, the survey presents trends in terms of readiness and skills and knowledge gaps. The strengths of the survey are that it is providing a baseline for the status of digital health and pharmacy education and can be used to guide frameworks and policies at institutional, national or regional level which can be championed by FIP.

4 Case studies: Digital health initiatives from pharmacy schools

Editors

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Key messages

- COVID-19 was a catalyst for many pharmacy schools to introduce courses on digital health due to changes in pharmaceutical care and experiential learning settings. Courses focused on benefits of digital health in disease prevention and health promotion to combat COVID-19.
- Case studies show that pharmacy schools have taken many different approaches to building digital health competencies. Some schools integrated digital health within existing courses whereas others concentrated it within specific courses. Topics covered and learning objectives varied.
- Some schools took a step back and first upskilled their staff and students with digital literacy before moving into digital health courses.
- Students learned overarching principles to apply healthcare informatics in some cases where teaching was targeted to specific technologies in other cases.
- Students who had a chance to practise digital health had the ability to view and understand career expectations in real-life settings, an increase in their ability to take initiatives in digital health.
- Involving students in the course design may lead to the development of a digital health course that closely matches their interests and needs.

4.1 Introduction

In a world of constant technological advances, it is crucial for health professionals to make use of technology to support patients and to improve quality of patient care. The COVID-19 pandemic has catalysed numerous changes in healthcare worldwide and accelerated digital health transformation. Pharmacy education also faces a similar challenge in order to prepare the pharmaceutical workforce to meet the emerging demands of digital health.

One of the objectives of the "FIP Digital health in pharmacy education" report is to describe good practices on course descriptions, examples of assignments and learning activities on digital health from pharmacy and pharmaceutical sciences schools.

Through the "FIP Digital health in pharmacy education" survey, institutions and faculty members were asked to indicate their interest in sharing their experience in their approach and innovations to digital health education by submitting a case study. Interested institutions and faculty members were followed up after the survey to complete the case study template (Annex 5).

Twenty-six case studies from 15 countries were received.

All the cases were assessed against their relevance to digital health education and skills development. Sixteen were found to be relevant and were included in this report. Table 17 shows the distribution of eligible case studies by WHO region with each region being represented by at least one case study. In the other case studies, assessment revealed that they were focused on online/remote education without reference to digital technologies. This finding highlights that there might be a misperception between "digital health" and "online/remote education".

The case studies highlight innovative initiatives on digital health education and skills development which can serve pharmacy educators and institutions as they develop similar initiatives in their curricula and teaching methods to prepare current and future generations of the pharmaceutical workforce to become digitally enabled.

Table 17: Overview of all case studies on digital health initiatives from pharmacy schools

WHO Region	Country	Title
African region	Nigeria	Digital health and pharmacy education in a Nigerian university
Americas region	Bolivia	Complex and transdisciplinary strategies for promotion and prevention in digital health: towards the ecology of knowledge
	Canada	Building a national electronic resource to integrate digital health education into pharmacy curricula
	Canada	Pharmacy informatics course design, pedagogy, and a five-year review of student data
	United States	A framework for teaching applications of healthcare practical information in pharmacy education
Eastern Mediterranean region	United Arab Emirates	Development of early clinical exposure interprofessional education and collaborative care in an Academic Health System
European region	Greece	Enhancing clinical skills of practicing pharmacy students in patients' care using digital health
	Ireland	Inter-professional digital health learning & virtual patient interactions through simulated surgical ward rounds
	Netherlands	Digital pharmaceutical care: co-creation of an elective course
	Spain	Developing a postgraduate course on digital health in Madrid
	Switzerland	Building pharmacists' capacity to partner with patients in their digital health use: a collaborative patient-pharmacist teaching method
	Ukraine	Development of pharmacy students' information competence in the course of studying the biological chemistry discipline
South East Asian region	India	Designing digital literacy programme
	India	Preparing pharmacy graduates for the new world of digital counselling- A paradigm shift in pharmacy education
Western Pacific region	Australia	Digital health in pharmacy at La Trobe University. The story so far.
	Malaysia	Development of digital literacy competencies among educators and students in a public pharmacy school in Malaysia.

4.2 African region

Nigeria: Digital health and pharmacy education in a Nigerian university

Author

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Summary

Digital health (DH) has revolutionised healthcare delivery, impacting both healthcare providers and patients. It covers a wide area of technologies, such as wearable devices, telehealth, e-health, m-health and health telematics. DH application areas include treatment adherence, point-of-care diagnostics, clinical decision making and medication tracking and safety. For the pharmacist to be adequately equipped for optimal patient care, appropriate DH education is a must. Curricula for pharmacy education of the Nigerian university in this case study do not have a course titled "Digital health". Nonetheless, students are taught aspects of DH under

other courses throughout their training. With the aid of smartphones and mobile applications, students implement DH services. A pharmacist trained in this university is currently developing a mobile health app useful in establishing antimicrobial stewardship programmes in hospitals. However, rapid development of DH calls for review and restructuring of pharmacy education curricular to include DH as a course.

Background and context

Healthcare delivery has been transformed by digital technology resulting in the concept of digital health (DH).[1] Digitalisation of health became inescapable in the 2010s. DH is the merging of digital technologies such as information, communication, and data analytics with health and healthcare elements, living and society to increase the effectiveness of healthcare delivery.[2] According to Health Information and Management Systems Society, "digital health connects and empowers people and populations to manage health and wellness, augmented by accessible and supportive provider teams working within flexible, integrated, interoperable, and digitally-enabled care environments that strategically leverage digital tools, technologies and services to transform care delivery".[3] It electronically connects points-of-care to securely share health information. The advent of DH has impacted both healthcare providers and patients, resulting in improved access to health services, increased quality of care, emergence of precision/personalised medicine, boosted patient empowerment, continuity of care, and reduced healthcare costs[1]. DH covers a broad scope of technologies such as telehealth, telemedicine, mobile health (m-health), electronic health (e-health), health information technology, wearable devices, personalised medicine and health telematics.[2] The application areas for DH technologies[4] include research (e.g., remote clinical trials and treatment adherence) and diagnosis (e.g., point-of care diagnostics and portable imaging). Other application areas[4] are treatment (e.g., chronic disease management and clinical decision making) and public health (e.g., medication tracking and safety, and disease and health surveillance). The pharmacy profession has evolved from product-oriented care to individual patient-oriented and population-oriented care. Smartphones and mobile apps that supplement daily medical references enable pharmacists to implement pharmaceutical care interventions.[5] The pharmacist should be equipped with the right knowledge and competences to deliver healthcare digitally to improve patient care. This calls for appropriate digital health education in pharmacy. DH should be properly integrated into the educational curricular[1] of pharmacy.

Educational description

The pharmacy curricula for the Bachelor of Pharmacy, Doctor of Pharmacy and Master of Science in Clinical Pharmacy and Pharmacy Practice programmes of this Nigerian university do not have a course titled "Digital health". However, different aspects of DH are taught as part of other courses in the BPharm curriculum. For example, introduction to routinely used medical instruments/equipment is taught as part of the introduction to clinical pharmacy; literature evaluation and drug information, handling of factual drug information, information storage, retrieval and dissemination, pharmacists' clinical role, monitoring drug interactions, adverse drug reaction detection reporting and patient counselling are taught as part of drug information and pharmacy communication in the third year. Also, inventory management and pharmacy computer systems are taught as part of pharmacy management in the fourth year. Additionally, utilisation of patient medical records; incompatibilities, challenges/solutions in product formulations and prescriptions were thought. Students undergo clinical ward round and clerkship and engage in pharmaceutical care and drug therapy monitoring of hospitalised patients. These subjects are also taught in the PharmD programme. However, there are additional digital health aspects such as information and communication technology taught in the second year, and pharmacovigilance and clinical trials in the sixth year. Regarding the MSc in Clinical Pharmacy and Pharmacy Practice, the curriculum contains DH-related courses such as biostatistics and biocomputing, advanced communication skills and advanced drug information. Others include pharmaceutical care and clinical investigations, pharmacotherapeutics, health informatics, clinical clerkships and drug bioavailability.

Outcomes, lessons learned and recommendations

With the assistance of smartphones, mobile applications and the various DH-related lectures, students undertook pharmaceutical care of inpatients. Another outcome is the production of pharmacists equipped with the required professional skills for optimal patient outcome and healthcare needs. One of the pharmacists trained at this university is currently developing a mobile health application useful in establishing antimicrobial stewardship programmes in hospitals. The digitalisation of health has impacted both healthcare providers and the patients, thereby transforming the healthcare delivery system. To cope with the accelerated speed and complexity of digitalisation of health, pharmacy education curricula should be reviewed and restructured to include DH as a course on its own. It should be taught from the beginning to the end of the programme and not left as aspects of DH that are sandwiched in other courses. DH should be properly structured to contain relevant components and spectra. This will equip future pharmacists to acquire relevant competences in DH to enable them to perform optimally in the healthcare delivery system.

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4.3 Americas region

Bolivia: Complex and transdisciplinary strategies for promotion and prevention in digital health: Towards the ecology of knowledge

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Summary

The objective of this case study is to describe the educational processes that were developed during the SARS-CoV-2 pandemic in the areas of promotion and prevention in digital health. The educational processes were developed as part of the pharmaceutical chemistry and biochemistry curriculum in the subjects of sociology, and public health and epidemiology, public health and sociology in the second year of training in our faculty. The method consisted of case studies based on the virtual learning and teaching process as curricular content and transversal axis of promotion and prevention in digital health. Among the main results are the implementation of synchronous and asynchronous cycles, and the development of digital teaching materials as part of the research process in the classroom to achieve assertive communication strategies in a complex and transdisciplinary approach.

Background and context

Learning-teaching processes in 2020 have necessarily taken a turn from the face-to-face to the virtual, generating new forms of access for students, new virtual didactic dynamics and, without a doubt, new curricular strategies in content management and metacognitive processes. The educational proposal in digital health that we present arises from a need for the population worldwide to become aware of new forms of health promotion and ill-health prevention. Health promotion encompasses any action that human beings must do in order not to get sick and promote self-care, whereas ill-health prevention encompasses any strategy adopted before and during an illness, always seeking the best quality of life for patients. Articulation of the education-health binomial is key in the achievement of healthcare objectives in primary healthcare.[1] The meaningful learning processes in virtual education in this proposal are presented. They take the metacognitive processes as being something more than students simply becoming aware of what they learn.

Rather, students are learning how to reconcile knowledge, skills and values while virtual platforms have been the main form of connection between teachers and their students. The educational materials generated — preventive books on virtual health for patients — must be in a form of language appropriate to patients' context and needs.

Educational description

The digital health proposal consisted of working on metacognitive elements, using complexity[2] and transdisciplinarity as a strategy, in curricular contents of epidemiology and public health as applied to the university educational context in Bolivia. We worked in four stages, taking into consideration the need to work in virtual contexts:

- **Stage 1:** Delimitation of content on health promotion and prevention issues.
- **Stage 2:** The development of learning-teaching processes linked to generating metacognitive elements in healthcare and COVID-19 linked to other prevalent diseases. That is to say, students must become aware of what they learn: not only the memory processes of repeating basic contents, but also supporting promotion and prevention as knowledge, skills and values of human beings.
- **Stage 3:** Construction of educational materials using virtuality to generate preventive health booklets aimed at patients. Booklets take into account a family's need to know about certain diseases in order to support the healthcare of a family member.
- **Stage 4:** Educational monitoring processes of how students apply the educational materials generated to the care of their own health and that of their family members with underlying diseases.

The goal is to reach society through the professional training of the student. One goal at the pharmaceutical level was the correct management of medicines and the correct diagnosis of a disease in the pharmacy. In the booklets, elements of health promotion and disease prevention stand out and the processes of developing professional recommendations that pharmacists and biochemists, students must develop in their professional training. The educational strategy in digital health was built using Google suite and Moodle tools for asynchronous education. These became constant elements of content construction and review of readings, discussion forums and analysis of educational content and the Zoom platform for the synchronous education in which direct communication with the students was maintained. The stages worked on were very important during the months of March to September 2020, taking into account that the incidence of COVID-19 in Bolivia was very high and the students, in addition to changing their way of educating themselves, going from face-to-face to virtual, had new cross-cutting elements in terms of social relationships, stress, responsibility for self-care and family. Students adopted new ways of learning on virtual platforms and the great need to learn about public health and epidemiology was emphasised. The classes went from being an instrumental educational need to a component of continuous, dynamic digital health where role-play, knowledge development, discussions about the need to know how their health is and how they could learn strategies in digital health as part of their everyday life.

Outcomes, lessons learned and recommendations

From the implementation of the experiences, it is possible to generate didactic models in digital health aimed at students of pharmaceutical chemistry and biochemistry according to the Bolivian context. Indicators are consolidated in digital health promotion and prevention for patients with COVID-19[3] and other prevalent diseases. Important results are the assembly and implementation of promotion and prevention primers using language appropriate for patients. The digital tools of Google suite, Moodle in the asynchronous sessions and the zoom platform in the synchronous sessions were not only consolidated as traditional virtual classroom learning spaces, but also as spaces for the exchange of experiences, knowledge and implementation of educational strategies[4] for family members. Based on the achievements, it is recommended to work on new experiences aimed at directing, managing and supporting processes for pharmacological and non-pharmacological treatments for diseases based on the construction of a Google spaces suite of models of virtual learning spaces as "virtual health schools" where we can interact and learn. The main conclusion of the work is that innovative learning and teaching processes allow students to leave their routine learning contexts to join help spaces and connect with society. There should be no difference between face-to-face and virtual education as long as students achieve the educational competencies set out. The ecology of knowledge suggests that incorporating complexity and transdisciplinarity is essential in the search for another way of understanding reality. It is necessary that these experiences are systematised so as to consolidate an interinstitutional network of digital health in order to articulate education-health as an important binomial of pedagogy or andragogy in digital health.

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Canada: Building a national electronic resource to integrate digital health education into pharmacy curricula

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Summary

The Association of Faculties of Pharmacy of Canada (AFPC) and Canada Health Infoway created a national, competency-based, e-resource called "e-Learning for Healthcare Professional Students".[1] This unique programme is aimed at improving graduates' preparedness for work in technology-enabled environments, by integrating digital health into curricula at the 10 Canadian pharmacy schools. AFPC's open-access Moodle e-learning platform features the "Informatics for Pharmacy Students e-Resource" (18 chapters) and interprofessional modules also for use in medicine, nursing, dentistry and pharmacy technician programmes (e-medication reconciliation and e-prescribing).

Pharmacy informatics entry-to-practice competencies for pharmacists were developed.[2] A pharmacy educator peer leader network (PEPLN) was established to promote awareness, provide mentoring and facilitate the uptake of digital health into pharmaceutical care education at their schools. Continual revision and update of the e-resource since its original release in 2014 resulted in several versions and expansion to meet the educational needs of pharmacy and other healthcare professional students.[3]

Background and context

Pharmacy practice continues to change from a drug distribution focus to expanded scopes of practice with a major emphasis on improving patient care and health outcomes. Digital health technology needs are also evolving to enable and support this change. Optimised use of health information and technology is a critical factor for the success of this shift.

While the 10 Canadian pharmacy faculties provided education on health informatics, there was an identified gap in expertise to teach in this area, and a lack of dedicated courses and materials to support instructors. Recognising this gap, the AFPC led the development of a national online, competency-based, educational resource to help prepare undergraduate pharmacy students in optimising the use of digital health technologies.

The "Informatics for Pharmacy Students e-Resource" was developed by the AFPC in 2012 with funding from Canada Health Infoway.[1] Infoway is the federal agency leading the implementation of electronic health records and e-prescribing across the country.

With the goal of continual updating and expanding of the e-resource, modifications and reorganisation resulted in the release of subsequent versions.[3] Multiple evaluations and curriculum mapping helped inform the directions taken to improve and expand it.[4]

This continuous improvement has resulted in a robust, stable platform about health informatics for use in pharmacy education. Given the ever-changing world of informatics, it is important to keep the e-resource relevant and up-to-date. The lessons learned through this design and content review process can be used by others interested in providing digital health education.

Educational description

The first phase of the project was to develop and validate a competency framework related to use of information and communication technologies by graduates of first pharmacy professional degree programmes in Canada.[2] This involved a literature review, review of existing competency frameworks, and consultation/feedback from key pharmacy stakeholders. Three competencies with 31 indicators were developed in: (i) information and knowledge management; (ii) professional and regulatory accountability; and (iii) information and communication technologies.[2]

Version 1 of the e-resource was launched in January 2014 on an open-source Moodle learning management system.[1] The e-resource was written by Canadian pharmacy faculty members and clinicians, with upper year pharmacy students involved in its development. It was intended to engage pharmacy students in a comprehensive foundational treatment of information technology, using media-rich material with innovative learning activities. It was designed to be used within programmes and to support faculty members, and could be completed by students in sections or in its entirety.

To facilitate the integration of digital health education into pharmacy undergraduate curricula, a PEPLN was established in June 2014. A faculty member was identified from each of the 10 faculties of pharmacy across Canada. An informatics special interest group (SIG) was also formed to serve as a resource for pharmacy faculty members to facilitate inclusion of health informatics in pharmacy curricula. The PEPLN and the SIG served as a mechanism to link faculty peer leaders with colleagues to support and mentor them in the use and integration of digital health into the curriculum.

In 2016, the e-resource was modified based upon feedback received from pharmacy students, instructors and peer leaders.[3] Version 2 modifications were focused primarily on navigation issues. Students expressed a strong preference for interactivity, so additional virtual patient cases were added.

Version 3 was released in August 2017 following peer review, editorial oversight, significant revisions and additional learning activity development.[3] All chapters were enhanced and updated, with improved navigation and formatting for a streamlined learning experience. Selected chapters were also translated into French. In 2017, a curriculum mapping activity was undertaken to identify where informatics competencies were addressed and to provide insight about strategies to improve uptake of informatics teaching.[4]

In June 2018, two interprofessional chapters were released: "e-Medication reconciliation" and "e-Prescribing".[5] The chapters included a suite of cases illustrating a family moving through transitions in care in the healthcare system. The chapters can be used in uniprofessional educational settings or interdisciplinary settings with medicine, nursing, and pharmacy students.

In 2019, the need for education on the electronic creation and transmission of prescriptions and secure e-communications between prescribers and pharmacists was identified as a priority. An analysis phase included an environmental scan, needs assessment and prototype evaluation. The project, "Fostering e-prescribing end user readiness in Canada — e-learning for healthcare professionals", focused on safe and effective e-prescribing and practice site implementation considerations. The courses include content for interprofessional students, community-based prescribers (physicians, nurse practitioners, dentists) and pharmacy professionals (pharmacists, pharmacy technicians).

Outcomes, lessons learned and recommendations

The development of a national informatics e-resource was helpful in supporting the digital health education of pharmacy students. Developing a competency framework and continual evaluation/review was a useful approach as it helped guide the content, the approach and modifications. Before integrating the e-resource into their curricula, faculties asked for assurance that the content would remain up to date and accurate, especially with the evolving nature of health informatics. This has been achieved with the support of the APFC, external funding and the commitment of several faculty members. Ongoing technology support for faculty and students was also identified as important to help support use; user manuals were developed and an email address for technical help was established. The AFPC committed to continue to support the e-resource in the long term.

Establishing a pharmacy informatics SIG and a PEPLN with representation from each faculty across Canada helped with awareness and integration of the e-resource. This network also enabled a community of practice of like-minded individuals, with professional connections being made beyond digital health learning. The availability of a focused, peer-reviewed and quality e-resource with national utility greatly helped adoption.

Continual evaluation and review kept the e-resource current and relevant. An active evaluation strategy that included feedback from students, faculty and peer leaders helped identify areas for revision/expansion and was important to its success. Some of the revisions included modifying navigation, developing interprofessional modules, translating chapters into French and expanding the e-prescribing content. The identification of emerging areas in health informatics has been useful for new chapter development. Having support from Canada Health Infoway and a leadership team from the AFPC who were engaged and committed to this work was fundamental to its success. The lessons learned can be used by others who are interested in incorporating information and communications technology education into their curricula.

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Canada: Pharmacy informatics course design, pedagogy and a five-year review of student data

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Summary

Pharmacists are expected to effectively use enabling technologies in practice, yet few examples exist of how pharmacy education is adequately preparing students for that practice. The purpose of this case study is to share the development process, pedagogical strategies and student opinions of a novel pharmacy informatics course at the University of British Columbia, Canada. Using a cognitive constructivism approach to course design, a two-credit pharmacy informatics course was developed. Novel assessment and active-learning strategies were incorporated, including an academic electronic health record. Course evaluation and student feedback were mixed-methods in design. Students rated the course favourably and identified three mini-series as the most interesting: (i) pharmacy practice management systems; (ii) electronic health records; and (iii) consumer health informatics. Numerous ways to improve the course were revealed, including incorporating more technical computer skills. This case study offers a unique example of pharmacy informatics course design and pedagogy.

Background and context

The ongoing evolution of pharmacist scope of practice and the subsequent adoption of enabling health technologies has exposed a critical gap in informatics skills, knowledge and behaviours that have largely been overlooked in pharmacy education. Efforts by national pharmacy education bodies and accreditation councils have resulted in explicit mention of pharmacy informatics as a critical component of curricula, including the Association of Faculties of Pharmacy of Canada and the Accreditation Council for Pharmacy Education in the United States.[1,2] Despite this guidance, informatics curricula suffer from meagre offerings of stand-alone pharmacy informatics courses and a heterogenous array of informatics concepts being incorporated at varying depths into existing courses.[3] To add to the challenge, students are exposed to different health information technologies while on experiential practicums, offering immersive experiences with a small number of systems focusing on rapid adoption rather than teaching theoretical principles and digital health literacy skills.

One of the potential barriers to the development of pharmacy informatics content is the dearth of literature in this domain that can be generalisable to new educational initiatives.[4] Of the scholarly examples available, many are contextually limited to one or two specific informatics domains (e.g., drug information or electronic health records) or lack adequate description of teaching philosophies and the pedagogical theory underpinning the approach to course development.

The purpose of this case study is to share the development process, pedagogical strategies and student opinions of a novel, stand-alone pharmacy informatics course at the University of British Columbia (UBC), Vancouver, Canada.

Educational description

"PHRM 161: Technology in healthcare" is an introductory course covering a diverse breadth of theory and applications of technologies to enhance patient care. This two-credit course is part of the standard first-year PharmD curriculum and enrolls approximately 224 students annually. PHRM 161 was a new stand-alone course created as part of the transition from BSc(Pharm) to an entry-to-practice PharmD at UBC in 2015. The global goal of the course is to build the foundation of digital literacy to foster student interest, knowledge and skills in the development and implementation of health technology.

PHRM 161 was developed by author JM, grounded in a cognitive constructivism worldview and teaching philosophy. This was deemed well-suited based on the assumption that students were increasingly likely to be digital natives yet remain characterised by a wide range of digital health literacy. In addition, learning-centred activities were incorporated to better gauge student baseline competencies of course content to best tailor teaching, which is reflected in the assessment strategies below.

PHRM 161 incorporated topics most related to clinical practice (Table 18). An emphasis on a broad range of topics was favoured over depth. These topics were divided into mini-series, ranging from two to six hours in length. To highlight relevancy to practice, mini-series were divided into didactic lectures focusing on theory and principles, followed by an activity or guest speaker showcasing the application of informatics principles in practice.

Table 18: PHRM 161 schedule

Mini-series	Didactic topic(s)	Guest topic or activity
Informatics systems and standards	Informatics concepts, definitions	-
	Information transfer and standards Privacy, security, ethics	-
Electronic health records	Use by stakeholders, data mining/analytics	Personalised medicine, pharmacogenomics
	Patient access, e-prescribing and CPOE (Computerized Prescription Order Entry)	Adverse drug reaction reporting
	Team-based records, registries, automation	Academic electronic health record (activity)
	Midterm	e-Resource (activity)
Pharmacy practice management systems	Drug information systems, PharmaNet, data repositories, personal health records	Innovations in PharmaNet
	Distribution and inventory systems, barcoding	Point of care devices

Mini-series	Didactic topic(s)	Guest topic or activity
Consumer health informatics	Online medical information, technology and patient relationships, technology induced errors	Database management systems and querying
	Decision-support tools	Critical appraisal of mobile apps
Public health informatics and remote delivery	Remote services, telehealth and telepharmacy	Rural and remote indigenous practice
	Surveillance, reporting, coordinated responses	Institutional medication safety
Future of informatics	Big Data, AI, deep fakes Final exam review	Indigenous data sovereignty

There were five assessment strategies used: (i) formative, in-class quizzes (10% of final grade); (ii) an asynchronous self-study activity using the Association of Faculties of Pharmacy of Canada's online informatics e-resource (https://elearnhcp.ca/) (10%); (iii) an activity within a novel academic electronic health record system (10%)[5]; (iv) one midterm examination (30%); and (v) one final examination (40%).

To better engage the class, a social comparison theory approach was applied to motivate students as this was deemed relevant to digital natives. Digital badges were made available within the course learning management system, Canvas, and awarded to top performing students on assessments throughout the course. A real-time, online badge leaderboard was used, celebrating top-badge earners. Students were able to opt-in to badges and the leaderboard, or remain anonymous.

Outcomes, lessons learned and recommendations

Students overall felt positively towards the course as seen in post-course evaluation data since inception (Table 19). The three mini-series that students found most interesting were: (i) pharmacy practice management systems, (ii) electronic health records, and (iii) consumer health informatics.

Table 19: PHRM 161 evaluation summary

Statements	Mean scores (Strongly disagree=1, disagree=2, undecided=3, agree=4, strongly agree=5)				
	2015	2016	2017	2018	2019
The learning objectives for this course were clear	4.6	4.8	4.9	4.6	5.0
The instructional methods facilitated achievement of the learning objectives	4.4	4.5	4.8	4.1	5.0
The assessments of learning in this course were related to the learning objectives	4.5	4.7	4.9	4.6	5.0
Considering everything, I learned a great deal in this course	4.2	4.1	4.5	3.7	5.0
Responses/total	**118/218**	**112/221**	**116/217**	**157/215**	**13/221**

Qualitative feedback has been diverse and largely positive:

> *"This was a course that I would never have taken if it wasn't mandatory but glad I did because I learned a lot about technology and how it will apply to our practice in the future"*

> *"Very interesting and it would be nice if there was an upper class with more information on the technology used in practice or new technology that is coming out soon"*

Three primary themes emerged for what could be improved about the course: (i) some topics were deemed too basic or not necessary; (ii) some guest lectures did not seem relevant to pharmacy practice; and (iii) there was a need to include more technical computer skills.

> *"Try to keep things more technical. Like say I'm working in [a community pharmacy] and my computer crashes…some fundamental computer knowledge would be good"*

Future iterations of the course will also look to draw stronger connections to institutional practices and highlight career paths of pharmacist informaticians.

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USA: A framework for teaching practical applications of healthcare information in pharmacy education

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Summary

As healthcare becomes increasingly dependent on technology, it is critical for pharmacists to possess requisite skills and knowledge in healthcare informatics. Here we describe a curricular framework for building competency in healthcare informatics within a four-year PharmD programme. The objectives of this framework are to give students an applied understanding of data and technology in healthcare including: how to leverage these advances to support the medicines use system and holistic patient care; and limitations and challenges. This framework includes integration across the curriculum and concentration in a dedicated course. The curriculum is designed to focus on application of knowledge and to encourage students to take risks in thinking creatively. To accomplish these goals, applied case-based activities are employed.

Background and context

As healthcare becomes increasingly dependent on technology, it is critical for pharmacists to develop the requisite skills and knowledge to effectively leverage technology and data to support the medicines use system. This includes an understanding of the potential strengths and limitations of health information technology (health IT) and how it can be applied across a diverse range of patient situations and settings. Educational accrediting bodies and the National Academy of Health reinforce the need for all pharmacists to be competent in key aspects of healthcare informatics.[1,2] To build these competencies, schools and colleges of pharmacy have taken many different approaches. Some approaches are integrated across curricula and others are concentrated within specific courses. Further, the topics covered and learning objectives vary. With the rapid pace of technology advancement, an educational framework is needed that focuses on teaching practical application, allowing students to grasp transferrable informatics concepts and a systems-based mindset that can be applied to emerging advances and used to approach any future problem. The purpose of this paper is to describe a framework for building competency in healthcare informatics within a four-year PharmD programme. The objectives of this curricular framework are to give students an applied understanding of data and technology in healthcare including: how to leverage these advances to support the medication use system and holistic patient care; and limitations and challenges. Students are introduced to related topics early in their curriculum followed by a two-credit hour required course in their third year. In this section we will describe the design of the course and provide an example teaching method.

Educational description

Informatics course overview: Aligned with the curricular objectives, the healthcare informatics course is designed to focus on application of knowledge and to encourage students to take risks in thinking creatively. The course is designed to build the necessary competency expected of an entry level pharmacist, not a specialist. Prior to this course, topics covered include a general overview and how to leverage data to both manage the local medicines use system and conduct drug safety surveillance. The course requires students to asynchronously complete self-study material that covers foundational knowledge. Students receive formative and summative feedback through short multiple-choice quizzes and the opportunity to ask clarifying questions. Then their knowledge is applied during group assignments strategically designed to integrate multiple topics and build on the self-study material. Assignments are introduced during synchronous class sessions. During these sessions, instructors circulate among the groups to provide guidance. Students are given 110 minutes during class to work on assignments, which are due six days later. For all assignments, students are provided a detailed grading rubric. However, to promote a safe environment for creative thinking, students are encouraged to justify their decisions. Credit is given for well-reasoned decisions, given that it is unreasonable to expect students to have expansive knowledge of health system clinical workflows, cultural norms or the technical capacity of electronic health records.

Assignment example: The learning objectives of the health IT design activity are to: apply strategies to design a user interface for a health IT solution that promotes a good user experience; design health IT solutions that "do no harm"; apply implementation strategies to design effective health IT solutions; and create an evaluation plan for a health IT solution. To meet these objectives, students first complete self-study material covering foundational knowledge of design thinking and computerised clinical decision support (CDS) with corresponding quiz questions. Then students work in groups to complete two clinical case scenarios that apply the self-study material. In the first scenario, students are informed that the health system wants to create a CDS tool within the electronic health record to notify clinicians which patients should be evaluated for COVID-19. The students are asked to define the requirements for a CDS that both identifies patients who should be evaluated for COVID-19 and provides clinicians with an appropriate recommendation. Students are instructed to follow the Centers for Disease Control and Prevention's latest recommendations, and asked to provide descriptions of: the target population; when, during the patient visit, it should trigger the algorithm, e.g., a decision tree, Boolean logic; the notification method for delivering the recommendation; methods to minimise alert fatigue; and an evaluation plan. In the second scenario, students are given two different static, graphical representations for one CDS tool. Students are asked to review the different representations and provide constructive feedback on how to improve the tool. Students are asked questions about usability, how it might encourage/discourage a clinician from accepting the recommendation, and if the information is accurate and complete.

Outcomes, lessons learned and recommendations

The course was well-received by students. Qualitative feedback and quantitative evaluation scores were positive. Keys to the success of the course were clear communication about expectations, instructors circulating among groups to provide guidance on assignments, and continual encouragement of students to be creative. To support students in being creative, they were graded based on the rationale for their decisions versus the "right" answer. This grading approach created a safe environment for them to be creative without being penalised. Healthcare informatics is a team science in which no discipline can be expected to have all the answers; thus, this was practically applied to the course. Although students were given six days to complete assignments, most students completed them in the live class session. Group assignments have been conducted in person and via Zoom video conferencing. While in-person sessions may be preferred by students and the faculty, video conferencing proved effective. Our healthcare informatics curriculum has evolved over the years and continues to change as new advances emerge. However, we have strategically designed our curriculum to build competencies that apply across the spectrum of healthcare informatics and patient care situations; students learn overarching principles that apply broadly to healthcare informatics versus teaching to specific technologies. This approach to building competency fosters students' ability to adapt to emerging innovations. To refine our healthcare informatics curriculum, we are prioritising earlier immersion and integration across courses. Healthcare informatics is a necessary component of the medicines use system and should be taught as such.

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4.4 Eastern Mediterranean region

UAE: Development of early clinical exposure interprofessional education and collaborative care in an academic health system

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Summary

Interprofessional education (IPE) is a means to interprofessional collaborative care. It is best to start IPE early in the curriculum. We implemented IPE from week 2 of year 1 for students across all undergraduate programmes at Gulf Medical University. The early clinical exposure IPE activity integrated healthcare professionals and students in the university academic health system. The university campus has three hospitals; a general hospital, a dental hospital, and a physiotherapy and rehabilitation hospital. The main challenge we faced in conducting IPE across programmes was in scheduling and assessment. Enhanced use of digital education and healthcare helped us try it for the first time in year 1. The activity was a combination of synchronous and asynchronous communications between different stakeholders in healthcare. Students form the different health professional programmes learned from, with and about each other. The plan is that in the future students will engage in more interprofessional care and digital health.

Background and context

Gulf Medical University (GMU) has a committee for interprofessional education (IPE). It has been working on different activities to improve IPE, but the main challenges were in scheduling such activities across programmes in addition to assigning marks for the IPE activities. It was natural for students from different programmes to come together in co-curricular and extra-curricular activities, sharing resources, including classrooms, laboratories, library, simulation centre, examinations centre and hospitals. The University Council meeting before autumn 2020 decided to capitalise on the opportunity of increasing digital health to schedule and network all concerned stakeholders. Learning from our previous success in some cases of onsite clinical placement activities and the importance of IPE in the early years,[1] we decided to launch the first official introductory IPE activity in study plans across all programmes. IPE can also integrate evidence-based practice which will help create new IPE activities.[2] GMU's IPE committee is led by the College of Pharmacy with membership from all GMU colleges. In the past the committee has focused on IPE activities in later years especially during the APPE (advanced pharmacy practice experiences) phase of the curriculum.

Educational description

Early clinical exposure IPE is an experience of first-year students of all GMU undergraduate programmes. It started in the second week of joining the university and continued for 10 weeks, meeting for one to two hours every week on Thursday afternoons. All meetings were conducted entirely online using Google Meet. This project involved over 300 students, a few patients, and healthcare professionals in the GMU academic health system.

Students from anaesthesia technology, dentistry, healthcare management and economics, medical imaging, medical laboratory, medicine, nursing, pharmacy and physiotherapy programmes were grouped. Each student group had a faculty supervisor. Supervisors were members of the IPE committee to ensure they were well versed in monitoring IPE learning outcomes. All of them had collaborative practice at on-campus healthcare facilities and were involved in a series of meetings to develop early clinical exposure. In addition to supervising their student group from multiple professions, the supervisors developed a video of their own profession. We acknowledge the contributions of all supervisors in developing and conducting this IPE activity. The videos of different health professions had interviews with healthcare professionals and some of their patients in real practice settings. Patient consent was obtained for video recording and its use in IPE.

Teaching delivery was a combination of synchronous and asynchronous (recorded) approaches showing digital health opportunities of both ways of care (asynchronous: patients could record their problems and share with healthcare professionals). A healthcare professional's video on their interprofessional care was rolled out before students were asked engagement questions from group discussions. The role of the group faculty supervisor was as a facilitator. Students were responsible for meeting their faculty members at their respective colleges to clarify any specific issues and come back to the discussion the week after, letting students learn from each other.

The first week was a virtual tour of facilities and short interviews of different health professionals. From the second week onwards, it focused on each health profession in detail, covering four core interprofessional education collaboration (IPEC) competencies: values/ethics for interprofessional practice; roles and responsibilities; interprofessional communication; and teams and teamwork .[4] Students discussed and built their portfolio reflection on collaborative care. Group discussions and reflections at the end of the activity were evaluated as part of one of the year 1 courses to ensure students are motivated to participate.

Outcomes, lessons learned and recommendations

The early IPE and collaborative care activity online were well received by the students and faculty members involved. Being entirely online solved many inconveniences in scheduling the event. The primary concern was crowding of students at healthcare facilities and limited free time available on their timetable. This was solved by making even the tour of facilities virtual. All sessions happened in parallel in groups of 20 to 30 students per supervisor. Students used their microphones as well as chat options to discuss things on Google Meet. No students or faculty members struggled in digital communication. This IPE activity served to prepare students from the very beginning to be collaborative practitioners and digital communicators. We expect the students to communicate more freely with other health professionals and use more digital applications in the future to provide patient care. Our recommendations at this point include embedding IPE activities in every year in the curriculum across all health professional colleges because the more they work together as students, the more easily they will be able to work together with professionals from other disciplines in the future in harmony recognising the roles of other healthcare professionals. This will make the students better prepared to serve their patients and provide the best possible care.

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4.5 European region

Greece: Enhancing clinical skills of practicing pharmacy students in patients' care using digital health

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Summary

The COVID-19 pandemic brought us to a period where many in-person pharmacy services including medication adherence interventions and blood pressure measurements were postponed. Due to this situation in combination with the social distancing rules, final-year pharmacy students who conducted their practice during the pandemic had to stop. Therefore, they did not have the opportunity to get training and to use their communication skills with real-life patients. An educational solution incorporating digital health and experiential learning methods was designed to make sure that our students continued to learn during the lockdown until they could restart their face-to-face practice in the community pharmacies again. This educational intervention enhanced the ability of practising students to communicate and counsel patients remotely and at the same time improved patients' attitudes towards medicines use.

Background and context

As a result of the COVID-19 pandemic, government guidance imposed social distancing measures and individuals, especially the vulnerable, stayed at home.[1,2] Social distancing affected the provision of pharmaceutical care due to the resultant limited face-to-face contact between individuals and community pharmacists.[2] This therefore influenced some of the most important services pharmacies provide in order to ensure safe and effective medicines use, medication adherence interventions and blood pressure measurements.[3] Patient education and counselling is one of the core roles of the community pharmacist to support medication adherence and to prevent problems. Technology is an important element of our daily lives and is an essential tool in healthcare settings. Digital health brings together technology and healthcare leading to better healthcare provision and enhanced personalised care. Furthermore, digital health could be a great tool in the pharmacists' role because one of its main components is "telepharmacy", which allows pharmacists to offer pharmaceutical care remotely using videoconferencing.[4]

In Greece, due to the COVID-19 pandemic lockdown period, final year pharmacy students had to stop practising in community pharmacies for about two months. Therefore, students could not get involved in the non-essential pharmacy services provided by practising pharmacists. Because of this, two questions arose. The first one was how practising students could be trained to offer services during emergency situations like the COVID-19 pandemic. The second was how we, as academics, could help our students to enhance their counselling skills and competencies during the lockdown period.

Educational description

As academics, we had to find an educational solution incorporating digital health during the lockdown to make sure that our final-year students continued to learn until they could restart their face-to-face practice in community pharmacies.

Experiential learning in pharmacy education, especially during the practice year, plays an important role as it can enhance students' learning experience and prepare them for success in their future professional role.[5] The main aim of the pilot experiential learning exercise we designed was to enable practising students to enhance their communication skills and clinical knowledge, and to improve patient care. More specifically, it aimed to allow practising students to monitor the pharmacotherapy of patients with chronic conditions where it was identified that they were not properly adhering to their medication regimens. All practising students were informed about the scheme through an email invitation sent by their pharmacy practice lecturer. Of the 125 practising students who were invited, 36 responded positively.

Before the provision of the digital intervention, students had three online sessions (two hours each) with their pharmacy practice lecturer using Skype. At first, practising students had an induction session in order for us to describe the structure of the service and to make sure that they had up-to-date knowledge about medicines including doses and side effects, how to use the British National Formulary (BNF), and how to identify drug interactions. Additionally, during the online training sessions practising students had a mock digital medication adherence intervention using the role-playing technique.

Patients who agreed to participate provided their informed consent by signing digitally the form given by the practising student. Patients were randomly selected by the responsible pharmacists, who then referred patients to our practising pharmacy students. The consultation sessions were conducted using Google Meet and Zoom platforms. Each session lasted for about 30 minutes. After the sessions, practising students were required to submit diaries reflecting on their digital intervention experience for assessment by the pharmacy practice lecturer.

After the termination of the scheme, an overall feedback was given by their pharmacy practice lecturer.

Outcomes, lessons learned and recommendations

Through this experiential learning intervention practising students were encouraged to think "out of the box". They used digital solutions to communicate with and counsel their patients under special circumstances and they had the opportunity to apply what they had been taught during their studies to solve "real world" problems related to patients' medicines. They also tested their understanding of the main principles of their practice, including their communication skills, how to improve patients' medication adherence, and how to identify any issues that patients' have with their medicines. Furthermore, practising students had the opportunity to reflect on their practice to achieve the best patients' outcomes.

This not only helped the providers (practising students) but also the receivers (patients). Through the virtual sessions, patients discussed with our practising students any issues that they faced with their medicines use and doses, as well as any side effects. Once students identified issues, they informed their responsible pharmacists in order to conduct quick referrals for further investigations, leading to improvement in patients' conditions.

Secondary outcomes of this experiential learning procedure included an increase in practising students' ability to view and understand career expectations in real-life settings, an increase in their ability to take the initiative, and to use the "leadership skills" component of the WHO/FIP "7-stars pharmacist"[6] concept. To our knowledge, this pilot was innovative as we are the first Greek language pharmacy programme to offer such opportunities to our practising pharmacy students.

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Ireland: Inter-professional digital health learning and virtual patient interactions through simulated surgical ward rounds

Authors

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Summary

This case study outlines a collaborative, inter-professional approach to digital learning through a hybrid, simulated surgical ward round incorporating telemedicine with live simulation. Pharmacy and surgical students learn with, from and about each other to deliver a shared approach to safe patient-centred care. Pharmacy students have the opportunity to interact with patients via a virtual platform, taking medication histories and consulting with surgical students to develop patient care plans. Challenges identified and overcome included complex operational logistics, interactive participation for all and ensuring a psychologically safe environment for learning and virtual debriefing. Students demonstrated an interactive, collaborative, patient-centred approach despite the complexities and additional potential barriers of their short duration of interaction and working remotely from one another — communicating solely via a digital interface.

Background and context

Due to the COVID-19 pandemic, remote consultation has become the new normal, even if telemedicine cannot replace in-person interactions for all clinical scenarios. Remote consultations are likely to become embedded in clinical practice in the future and patients will expect telemedicine options where appropriate. Unfortunately, the healthcare workforce across the spectrum of professions has received little dedicated training to prepare for virtual interactions, and both patient safety and satisfaction may suffer. Moreover, more frequent telemedicine consultations may impact opportunities for inter-professional collaboration and communication.

Simulation-based strategies in virtual environments lend themselves to enable healthcare professionals to work together to practise inter-professional teamwork and patient-centred care while experiencing technology-mediated interactions via telehealth platforms. To investigate this, a simulated surgical ward round was designed to explore the impact of hybrid inter-disciplinary tele-consultations on pharmacy students and Master's in Surgical Science and Practice (MSSP) students' abilities to collaboratively deliver patient-centred care.

A critical component of the surgical ward round is inter-professional working. Formal training in inter-disciplinary teamwork has previously proven beneficial to all professions involved.[1] The Department of Surgical Affairs, Simulation and School of Pharmacy and Biomolecular Sciences at the Royal College of Surgeons IN Ireland (RCSI) instigated a collaborative approach to bring pharmacy students and MSSP students together during weekly simulated surgical ward rounds over a period of five weeks. This training was delivered through simulation in a virtual hospital environment. The educational pedagogy underpinning this training includes experiential learning[2] and social constructivism.[3] Communication, collaboration and team work are facilitated to ensure safe patient-centred care.

Educational description

Face-to-face inter-professional ward rounds ran on site in 2019–20 were evaluated very positively by students. The COVID-19 pandemic presented major challenges to the continuity of the inter-professional component. A hybrid digital approach using tele-consultations was therefore developed for the simulated rounds.

Methods: A steering group comprising the surgical and pharmacy faculties, a simulation technician and programme administrators was formed to develop and plan this new digital learning event. The challenge was to develop a highly interactive learning event where the MSSP students were on site at RCSI Dublin and the pharmacy students were based off-site. It was critical to ensure both shared learning outcomes and discipline-specific learning outcomes were achieved for all participants. All students participated in an introductory session and a pre-class discussion on their perceptions of the responsibilities of their own and other healthcare professional roles on a surgical ward round. The value and comfort of working with others was also explored alongside an introduction to how the virtual platform interactions will work.

Two pharmacy students were teamed with an MSSP student. Both pharmacy students were based off-site and joined the patient consultations via a remote videoconferencing platform. One performed a remote patient consultation and was observed by a peer. To facilitate feedback, the peer had a structured observation sheet to complete. Subsequently the pharmacy student observed the MSSP student do a live patient consultation and participated where relevant. Following the consultations both students collaborated to address queries from the patient and agree a shared management plan. Both students presented the patient to the consultant surgeon and subsequently communicated the treatment plan with the patient and answered any questions. All students and faculty members were then brought together virtually for a joint debrief session. Following our first round, we realised that we needed to create more interaction for pharmacy students undertaking observer roles so that they felt more involved from the inter-professional collaboration element. Their observations form a useful and insightful element of debrief sessions.

Evaluation: The inter-professional rounds and tele-consultations were video-recorded on Blackboard Collaborate and CAE Learning Space platforms. Using a 360-feedback approach, students received feedback from peer observers, simulated patients and faculty members. They were also provided with access to their video recordings to facilitate reflection on their actions and identify areas for further development. Each student completed a 500-word reflection on their experiences, including feedback and perception of telehealth approach to both patient and MSSP student/pharmacy student interactions. Our innovative approach formalised training through interactive and iterative simulation using a hybrid digital learning method. This ensures students are upskilled for the reality of clinical practice through digital platforms in the future.

Outcomes, lessons learned and recommendations

There are many logistical and operational aspects to consider when planning such a complex, hybrid approach to learning. Having MSSP students on site and pharmacy students accessing remotely means additional technical requirements and concise time scheduling are necessary.

It is important to bear in mind the elements of creating a psychologically safe simulated learning environment and the additional considerations for remote interactions and virtual debriefing.[4]

It is also imperative that on-site students remember that the remote students are "also in the room", albeit virtually. This aspect depended on natural behaviours and instincts from the MSSP students in remembering to introduce themselves to pharmacy students and ensuring that cameras faced patients and MSSP students to enable collaboration and participation.

Debrief sessions provided insight into student views of their experiences from a collaborative perspective.

- Despite the short duration of interaction and working remotely from one another, students demonstrated effective collaboration and support for one another.
- All students reported that discussion of cases and reaching joint management plans gave confidence in decision making. Similarly, if both were concerned but unsure about the management of a particular issue, they felt greater confidence in bringing to consultant review.
- A pharmacy student found that she was looking for complexity when actually a simple issue had big impact for the patient. She realised that although a pharmacist may see something as clear and simple, this may not be everyone's perspective.
- All shared that there were certainly challenges involved in the remote versus on site aspects of the collaboration but that the digital platforms provided a useful telehealth consultation option when alternative onsite options could not be available.

This opportunity provided pharmacy students with the scope to develop their virtual communication and telehealth skills for interaction with patients and other healthcare professionals.

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Netherlands: Digital pharmaceutical care — co-creation of an elective course

Authors

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Summary

In June 2019, Utrecht University developed an elective course in digital pharmaceutical care in co-creation with five master pharmacy students. The five students participated in a pilot course with two objectives: to gain insight into various aspects of digital pharmaceutical care; and to develop an elective, five-week full-time course for future students. The students were simultaneously introduced to different aspects of pharmaceutical care as well as educational concepts. They worked on both an individual project which

consisted of developing a digital solution for a daily-practice pharmaceutical care challenge as well as a group product, i.e., a framework for the elective course. The pilot course was concluded by pitches of their individual projects to pharmacists and digital care specialists, and a presentation of the next course framework for faculty members. Their developed elective course was successfully introduced in the next pharmacy curriculum in 2019–20.

Background and context

Utrecht University was interested in expanding its number of elective courses offered to master pharmacy students. At the same time, Claudia Rijcken, an expert in digital pharmaceutical care, approached the School of Pharmacy to see whether it was interested in providing education to pharmacy students in this field. Since both the director of the school (Aukje Mantel) and Claudia Rijcken were not sufficiently aware of the basic student knowledge, skills and interests in the evolving area of digital health, they decided to involve students in the course design. The concept of co-creation[1] had been used successfully to develop an alternative elective course within the curriculum, so it was decided to replicate this approach. Students with a specific interest in digital health were invited to apply for a pilot course. During the application process, the students had to argue on their knowledge on the topic, why they believed the topic was relevant for an elective course and how they saw their active role in the course development process. The goal from the beginning was to develop in co-creation with the students a regular elective course which would be offered in the pharmacy curriculum in the year thereafter. The pilot course was awarded the same number of credits as a regular elective course. Five pharmacy students with diverse interests (e.g., artificial intelligence, pharmaceutical care, education, wearables) were selected to participate.

Education description

The development of the pilot course started with the decision to use co-creation, call for applications and selection of students. In terms of preparing the course itself, we tried to find the right balance between having a fixed programme and leaving room for student initiatives and thoughts. First, we defined learning outcomes focused on digital pharmaceutical care and on course development, and we agreed upon the way this pilot course would be assessed, i.e., as an individual project related to a challenge in pharmaceutical care (50% of the final mark) and a group project, i.e., developing a course framework (50% of the final mark). Lastly, we defined learning activities, invited guest speakers and developed an attractive course programme. This pilot co-development course ran as a five-week full-time course in May–June 2019. We selected the book 'Pharmaceutical care in digital revolution', edited by Claudia Rijcken,[2] as the basis for the course. Students learned about the various tools available in digital care, such as apps, wearables, chatbots, artificial intelligence, blockchain and virtual and augmented reality. They were also exposed to conditions needed to drive digital innovation such as health literacy, digital health compliance, ethics and educational needs. Guest speakers were invited for interactive workshops and came from a broad range of organisations and institutions, including other university departments (e.g., innovation sciences), medical and pharmaceutical practice and small start-ups. As an individual assignment, students needed to develop a potential digital solution for an existing and recognisable pharmaceutical care practice challenge.

Challenges were selected under supervision and regular feedback was given about their potential solutions. By the end of the course, students presented their projects in a freely chosen format (e.g. short video, PowerPoint presentation, recorded lecture etc). To conclude the course, they pitched their propositions before a group of pharmacists and digital care specialists. One idea was selected as most feasible for daily pharmacy practice (in this case, that was using a chatbot effectively in a pharmacy). During course development in the first week, the students were exposed to a number of interactive lectures on theory of education and course development, such as use of Bloom's taxonomy to describe learning outcomes, constructive alignment, etc. Further support was provided by Educate-it, a university-wide programme supported by and supportive of teachers and students. It helps teachers enhance and future-proof their courses. Besides assisting teachers to (re)design their courses by incorporating the teaching methods and ideas of blended learning, Educate-it also offers practical and technical support for IT tools that have proved their educational value. Finally, students could use the teaching and learning lab of the Faculty of Science[3] to further stimulate out-of-the-box thinking and student interaction. Students received a standard template for course development as used within the school. This guided them through the various steps of course development, such as formulating learning outcomes, defining the assessment and its criteria, and describing the learning activities needed. Feedback on their product was given throughout the course.

Outcomes, lessons learned and recommendations

The outcomes of this exercise were three-fold:

1. A framework for an elective course on digital pharmaceutical care which was included in the programme in 2019–20 and has been offered once (ca. 20 participants). This course was appreciated highly by participants and will be offered again in 2020–21;
2. Potential digital solutions for challenges in pharmaceutical care, developed by individual students and presented as pitches to pharmacists and digital care specialists; and
3. An article in the journal of the Dutch Royal Dutch Society for the Advancement of Pharmacy (KNMP) jointly written by the five students, Claudia Rijcken and Aukje Mantel.[4]

We learned that involving students leads to the development of a course that closely matches their interests and needs. One of the things they were keen to include in the new course was a hackathon. Some of their choices were surprising to us, e.g., they insisted on including an individual knowledge test as part of the assessment. The size of the group (five participants) turned out to be excellent for this pilot course and also the variety in interests and backgrounds — despite all being pharmacy students at Utrecht University — was very useful for the whole process.

The students perceived learning how to develop a course while being simultaneously introduced to the new field of digital care as a positive challenge. They spend more than the intended number of hours (200 hours per student) and were only able to cope with these two tasks because they were more experienced and highly motivated students. We would not recommend a similar approach for a programme involving bachelor students, because their level of experience may not yet be mature enough to understand the dynamics of the healthcare system and of digitisation in it. We recommend that bachelor students are first introduced in depth to the topic and to the working environment before they develop a course.

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Spain: Developing a postgraduate course on digital health in Madrid

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Summary

The evolution of the pharmacy workforce requires the development of the skills, attitudes and behaviours to become digitally competent and confident. Here we present the development of a postgraduate degree on digital health at the Complutense University (Madrid). Contents will cover specific topics related to technology and to general skills. Students will have to successfully present a business case proposal and work as interns in digital health related settings. Successful navigation of complex university internal rules before the

approval of the degree, a practical approach of the contents blending the right knowledge and skill development and offering attractive settings to work as interns are key for the success of the programme.

Background and context

We are at a unique juncture in the history of medicine, with the convergence of genomics, biosensors, the electronic patient record and smartphone apps, all superimposed on a digital infrastructure, with artificial intelligence to make sense of the overwhelming amount of data created. This remarkably powerful set of information technologies provides the capacity to understand the uniqueness of each individual, and the promise to deliver healthcare on a far more rational, efficient and tailored basis. Healthcare workers require new expertise and guidance so they can evaluate the new technologies using real-world evidence. Education and training are vital here to ensure the workforce is supported. There is a need to raise awareness of digital literacy among the health and social care workforce. The latter requires the development of the skills, attitudes and behaviours that individuals require to become digitally competent and confident. The levels of digital literacy, the workforce's awareness of the required capability, access to training and support, and skills to enable patients and citizens to improve health and wellbeing through technology will all need to be improved as a fundamental shift in the balance of skills in the workforce takes place over the next two decades. This will present new career opportunities for some of the workforce. At the same time healthcare professionals will be very important to drive the adoption of digital health in the future. Introducing support, training and educational materials that can help overcome the barriers to e-health adoption and facilitate the take-up of digital health tools is paramount for the pharmacy workforce.

Educational description

In collaboration with the Department of Pharmacology, Pharmacognosy and Botany of the Complutense University (Madrid), a postgraduate course on digital health is being developed.

The programme will try to equip students with a holistic knowledge about digital health: at this stage of its development, the contents will cover specific topics related to technology and to general skills, and a preliminary introduction to digital health and healthcare systems (Table 20).

Table 20: Various technical knowledge and skills with teaching hours

Technical knowledge (teaching hours)	Skills (teaching hours)
Virtual care (5h)	Management and leadership (7h)
Automation and bots (4h)	Management of multidisciplinary teams (5h)
Wearables, and other devices for seamless and continuous monitoring (4h)	Communication (4h)
Internet of things (4h)	
Data (7h)	
Digital therapeutics (5h)	
Modified reality (5h)	
Digital safety (4h)	
Law and regulation (5h)	

Any Complutense degree has to comply with the existing and specific norms before its approval and renewal. Those norms apply to the all aspects of the degree (i.e., faculty, modality, fees, sponsorship, reservation of places, rights and admission of students and their evaluation, and reservation of places for handicapped persons, victims of terrorism and Complutense staff). As an objective measure for the evaluation of Complutense degrees, their duration is measured in ECTS (European Credit Transfer System) credits (Table 21). (One ECTS credit is equivalent to 25 hours of student work. Each credit includes 7.5h of face to face activities [face to face learning] or 4h of teaching and/or tutoring [distant learning]. The rest, up to 25h, can be dedicated to studying hours, seminars, assignments, practices or projects, and time required for the preparation and completion of exams and assessment tools.) According to the number of hours, degrees can be of the types shown in Table 22.

Table 21: Number of credits required for accomplish each degree

Name	ECTS credits
Master	60–180
Diploma of specialisation	30–59
Expert	20–29

Table 22: Types of degrees

Degree type	Face to face learning (%)
Face to face	80–100
Blended	30–79
Distant learning	0–29

A blended degree approach was decided upon, with teaching in both English and Spanish. To graduate, students will have to successfully present a team proposal with a practical approach to solve an existing problem in healthcare, using the knowledge and skills learned in the course. The proposal must provide details about the proposed technologies, business metrics and a business case, analysis of potential stakeholders, and potential ethical and legal issues associated with their proposed solution, among other things. Finally, students will work as interns in national companies and settings in order to have a final practical approach to digital health.

Outcomes, lessons learned and recommendations

Navigation inside a well-regulated and big institution like the Complutense University can be tricky. We found it especially important to incorporate in the team a member of the university staff experienced in the approval of Complutense degrees.

Some students expect that their investment in the degree fees provides them with job opportunities. Despite the difficulties to find private companies in the field of digital health based in Spain, it is vital for the success of the degree to incorporate these companies for post degree internships, so students can practise and potentially work there.

The degree will be blended, combining face to face with distant learning, to ease registration of people outside Madrid, and especially to facilitate the incorporation of foreign experts as faculty members.

Two previous voluntary seminars for pharmacy students on digital health, and an event for the "2020 Madrid Science Week" were used to gauge the interest of potential students.

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Switzerland: Building pharmacists' capacity to partner with patients in their digital health use — a collaborative patient-pharmacist teaching method

This case study is dedicated to the late Professor Olivier Bugnon (1964–2020), who envisioned, co-created, and implemented this teaching method.

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Summary

Professionals' knowledge can be paired with patients' experience-based knowledge to improve pharmacists' education. Patients' digital health use —informing themselves about their own health issues through the internet, social media and internet of things — has changed the patient-pharmacist relationship. Properly leveraged, this dynamic can create a valuable synergy and partnership.[1] Although patients use digital health, this does not mean that they use the tools properly. Pharmacists can play a key guiding role. We implemented a teaching approach to ensure that future pharmacists are better equipped to respond appropriately. Our experience in delivering classes jointly by a pharmacist and a patient expert has shown that this model can increase pharmacists' ability to communicate appropriately with patients to make digital health use a positive, collaborative experience.

Background and context

e-Patients, i.e., patients who regularly use digital health, are determined to be proactive in their own health journey. They use digital resources to inform themselves about their health and medication and to interact with healthcare professionals. The knowledge transfer between healthcare professional and patient was once accepted as top-down, paternalistic or vertical. Today, the internet, social media, and the internet of things (IoT) have rapidly changed the healthcare landscape, enabling the patient-professional relationship to become horizontal. Pharmacists, like all healthcare professionals, can and should be a resource and support to patients in acquiring health literacy. With the right approach, pharmacists can leverage the use of the internet, social media and the IoT to enhance trust and develop an empowering collaboration with the patient. It is essential that pharmacy profession educators develop curricula that directly respond to this new digital patient need. Future pharmacists must be able to understand the patient perspective, be open to a more horizontal conversation with patients, and be able to guide them towards useful aids for self-education. This approach has the potential to support improved patient outcomes. A methodology to effectively train future pharmacists to better meet the needs of patients, especially e-patients, has been set up since 2014 at the Institute of Pharmaceutical Sciences of Western Switzerland (University of Geneva/University of Lausanne).

Educational description

It was determined that classes delivered in the initial years of study could set a strong foundation to raise future pharmacists' awareness about e-patient needs and train them in appropriate responses. A key new resource available is patient experts who can teach healthcare professionals about their own illness-related experiences, as well as how they use digital resources in their quest to self-inform. Aiming for holistic and relevant learning, we decided to establish classes given jointly by a pharmacist and an expert e-patient. This consolidation of academic and experience-based knowledge creates more meaningful and impactful content, given that all stakeholders are part of the process and conversation. The patient perspective is included from curriculum development, aligning with the e-patient motto: "Nothing about us without us."[2] When discussing practical situations, students can ask patients questions directly, instead of making assumptions about what the patient perspective might be. A noteworthy aspect of this patient-pharmacist joint teaching method is the personal storytelling of the patient experience, which gives students insights into real-life situations to drive home the learning. Internet use also presents public health and safety challenges, such as the online purchase of medicines. When pharmacists create relationships of trust with patients, patients become more willing to disclose information about their online ordering activities. This enables pharmacists to better direct patients towards safe decision-making, with quality information and proper guidance.[3] Our in-person classes feature a total of eight hours of theoretical teaching and four hours of group workshops. Students must also independently complete a paper based on a guided interview with a patient with chronic disease. We then discuss the results and findings from this experience together. The theoretical section covers content pertaining to: the impact of digital health on pharmacy practices; different strategic visions and Swiss cyberhealth laws (notably the electronic health record); the evolution and impact of the web and digital health tools and apps; the definition of e-patient and e-patient culture as well as the evolution of the patient role from passive recipient to proactive partner; and ways to best guide patients towards quality information. Every new session, the classes are revised and updated to ensure the most relevant theoretical content, because knowledge quickly evolves within digital health. In the first workshop, students analyse various internet sites. They examine the quality of their content and usability, who is behind the site, what the site's objectives are how patient data is stored, and whether the site information is strictly commercial or if the content has an added value for the patient. The data compiled from the guided patient interviews represents tangible material to analyse together in class, often leading to discussions around concrete patient situations that the pharmacist may encounter. This exploration teaches students what practical points help guide the patient for value-added use of the internet in health and how-to best partner with the patient towards a constructive relationship.

Outcomes, lessons learned and recommendations

According to structured student satisfaction surveys, the overall feedback is positive. Students appreciate the hands-on approach and the opportunity to "pick the brain" of a real patient. Students emerge with a better appreciation of the patient perspective in the relationship with the pharmacist. This sets the groundwork for effective skills in partnership communication styles within professional practice and a collaborative approach that aims to enhance trust, improve patient knowledge, facilitate individualised care strategies and improve patient safety. Discussing different aspects of digital health from a professional point of view builds students' capacity to assess digital tools objectively. Students are reassured that their chosen profession remains one of human interaction — digital tools can enhance patient-pharmacist relationships, not replace them. The expert patient's unique skill set and experience are central and this method requires partnership with patients in both curriculum development and class delivery. Expert patients must be carefully selected to bring both health literacy and teaching ability. On top of this, their role requires them to share highly personal stories about their health journey, which can be difficult or emotional for them. A patient expert needs to have understanding and hindsight of their health situation and have developed ease in talking about it publicly. In our experience, this combination of professional and patient perspective promotes an ideal learning experience. As Dave deBronkart — "e-patient Dave" — wrote: "Patients are the most underused resource in healthcare."[4] In future, the integration of such a course into every pharmacist training curriculum should be developed. Not only is online and digital activity an ever more central aspect of daily life, but the trend towards patients' participation in their own health is more widely accepted in healthcare[5] and increasingly expected by patients, particularly younger generations.

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Ukraine: Development of pharmacy students' information competence in a biological chemistry course

Authors

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Summary

This case study looks at pharmacy students' information competence in a biological chemistry course. It is based on a report of an anonymous survey of third-year students of the Faculty of Pharmacy that monitored their skills and abilities in searching for scientific and educational information on the internet, and its analysis and use. Students showed a high self-evaluation of computer literacy (85%), the use of video lectures (80%), electronic textbooks and online resources (75%) for self-preparation and self-assessment, and dissatisfaction with information found on the internet (50%). The authors conclude that it is necessary to include in the biological chemistry curriculum a component that ensures that future specialists in the pharmaceutical industry can competently navigate information, and apply it to solve emerging professional problems and enhance self-education.

Background and context

A modern development in pharmaceutical education is ensuring the use of information and communication technologies is part of future pharmacists' professional competencies. In modern times, pharmacy students are required not only to have knowledge of fundamental sciences, such as organic chemistry, biochemistry and pharmacology, but also to have the ability to constantly replenish their intellectual expertise with new information, continuously engage in self-education and use information sources as efficiently as possible to solve professional and social problems. The ability to select the necessary information, systematise it assimilate it at a high level, and navigate the ever-increasing information flow are important components of a student's information competence.[1] Computer technologies are at the heart of distance learning, which has moved to a new level of development as a result of the COVID-19 pandemic.[2] In the context of the ever-expanding use of digital means of communication (mobile phones, smartphones, tablets, computers and laptops, e-books, and the internet as a means of learning), students' independent work becomes particularly important, because it is the main means of assimilating educational material in a class-free time. The aim of this case study was to analyse the level of information competence of third-year pharmacy students at the Bogomolets National Medical University of the Ministry of Health of Ukraine and to determine how to improve the information competence of students studying the biological chemistry component.

Educational description

The working programme of the biological chemistry component for second and third year students of the pharmaceutical faculty provides six credits (180 hours), among which face-to-face classes amount to 100 hours (30 hours of lectures and 70 hours of practical training), and students' independent work amounts to 80 hours. The content of student's independent work in the biological chemistry discipline is determined by the working curriculum, teaching materials, and test tasks of the Unified State Qualifying Exam, stage 1. The aim of students' independent work is to master the methods of obtaining new knowledge, acquiring the skills of independent analysis of biochemical processes in the body, and to reinforce the scientific foundations of practical activities with the aim of understanding drug effects on the body. To assess the level of students' information competence, we conducted an anonymous survey among third-year pharmacy students at the Bogomolets National Medical University of the Ministry of Health of Ukraine. Seventy-eight students, aged 19 to 21 years, participated in the survey. Sixty of the students (77%) were women. Students answered a questionnaire, which contained nine questions on the topic: "Sources of information for students' independent work to prepare for practical training and self-control in the biological chemistry discipline". Pharmacy students' self-evaluation of their knowledge in the field of computer literacy was high (85%). Most students (70%) spend one to two hours on self-preparation for a practical class in biological chemistry. Of students surveyed, 75% use electronic textbooks and online resources to prepare for a practical class in biological chemistry and 90% preferred the Google search engine and YouTube channels. To find information, 50% of students use sites with the domains gov.ua, edu.ua, nmu.ua. When searching for information on the biological chemistry discipline topics, 50% of students prefer illustrations, and 20% of students choose websites that are presented first in the list of proposed sources. It should be noted that 50% of the surveyed students were not satisfied with the information found. The reason, in our opinion, is the dominant principle behind which students choose a reliable source of information, namely, text understanding. Among respondents, 35% considered scientific sources of information useful for self-preparation, but 2% noted the difficulty of comprehending the texts in scientific publications. To prepare for classes in biochemistry, 80% of students used didactic materials such as video lectures, lecture slide-decks, and assignments for self-study that are posted on the web-page of the department of pharmaceutical, biological and toxicological chemistry on the educational information platform NEURON[3] for distance learning. Only 5% of respondents believed that internet resources are not practical and useful for self-preparation for practical classes and self-assessment in biological chemistry, and 98% indicated that they wanted to use internet resources to prepare for a practical class in biological chemistry.

Outcomes, lessons learned and recommendations

Experience shows that about 30% of first to third year students are able to independently work with internet sources of information. However, 85% of students, during self-preparation for practical classes and self-assessment in biological chemistry, felt the need to consult with a teacher. The role of pedagogical support for students' independent work is significantly increasing in the context of the expanding use of digital communication and information transfer as a means of distance learning. Information and communication technologies today are a necessary tool for the development and implementation of information competence. Developing information competence requires teachers to make appropriate changes in the educational process associated with the revision of traditional methods, technologies and teaching aids. The improvement of the efficiency of students' independent work is facilitated by teachers' preparation of educational and methodological literature using information technologies (electronic textbooks, computer training programs, video workshops, etc.), which: (i) allows students to independently master biological chemistry knowledge; (ii) facilitates the creation of computer classes, laboratories and special classrooms for students' independent work; (iii) allows online consultations between students and teachers; and (iv) makes combining education with other activities possible. Correctly organised students' independent work forms stable positive motivation in students for self-education and self-improvement. Information competence will help students to expand the range of their knowledge, and will allow them to quickly and efficiently adapt to changing professional requirements in the context of informatisation of all spheres of pharmacists' professional activities.

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4.6 South East Asian region

India: Designing a digital literacy programme

Authors

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Summary

Digital literacy is the ability to steer through various digital platforms and understand, assess and communicate through them. Imparting education online is the new normal now. The world is undergoing rapid change due to the COVID-19 pandemic.[1] Revamping the education sector is crucial especially for higher educational institutions. With this in mind the School of Pharmacy and Research, Peoples University Bhopal, initiated a "digital literacy programme". The objective was to provide pharmacy teaching staff and students with continuous learning and development around digital assets and contents. The programme was successful in developing a culture of digital literacy at the School of Pharmacy and Research.

Background and context

Keeping the pandemic situation in consideration, the School of Pharmacy and Research decided to develop a digital literacy programme for its teaching staff and students.

Traditional pedagogy involving face-to-face instruction is not possible during the current pandemic, especially during lockdowns. Promoting a culture of digital literacy and the development of digitally enabled contents was the best option available without compromising the quality of education.[2] Digital modules were developed in various subjects under the BPharm and MPharm curricula. However, it was not easy to develop digital contents with limited resources.

Online teaching with digital content can be used to impart excellent understanding about the basics of pharmaceutical manufacturing, packaging, quality control, clinical research and pharmaceutical salesmanship to students. The key drivers of the programme were as follows:

- Lockdown and mass gathering restrictions;
- Unavailability of any sustainable e-enabled content;
- Enhancing digital literacy among staff and students; and
- Ensuring continuity.

Educational description

The digital literacy programme was designed by the School of Pharmacy and Research with two major components: the development and enhancement of digital literacy, and the development of digital content. To roll these out, the following methodology was adopted:

- A knowledge gap assessment, which was an essential and critical component in this programme, was looked at first. To deal with it, the profiles of students and staff were taken in account. Also, to respond to the pandemic situation immediately, the assessment of digital content was carried out in a very short space of time.
- A team of experienced professors, PhD scholars and technical experts was formed to review the available digital content and suggest new modules.
- A basic digital literacy training programme was designed for staff using a well-defined training needs assessment procedure. Subsequently the training was conducted for teaching staff members, including PhD scholars. Students was also asked to attend these sessions and provide feedback.
- In developing the digital content, some of the parameters taken into account included:

  - Student profiling — student profiles were taken in account, especially their digital literacy and the availability of technological infrastructure to them.
  - Instructional strategy — a proper instructional strategy was created that included an excellent way of presenting the content.
  - Scripting — The content to be used for each course was finalised and divided into modules.
  - Audio-visual — The on screen and audio contents were finalised. All decisions that were based on the presentation of the content on screen, interactivities to be applied, colours, images, and animations were finalised at this point with the help of technical experts.
- A prototype module for digital content was developed and the workshop was conducted based on that.
- Both intellectual and infrastructural capacity was built and developed.
- A feedback mechanism was designed for digital contents.

Outcomes, lessons learned and recommendations

Outcomes included the following:
- Creation of a knowledge hub;
- The development of a number of useful artifacts and resources;
- Students were able to take courses multiple times and even go back to the courses that they left midway. This has enhanced their understanding of the topic easier.
- The development of digital content can be accessible online from anywhere;
- The development of a sustainable model/platform for creating and sharing digital contents;
- The transformation of staff and students as digital change agents;
- Capacity development; and
- Readiness for lockdown situations.

Lessons learnt/suggestions included the following:
- Assessments should be done honestly with clear vision of the possible outcomes;
- Student profiling, instructional strategies and scripting should be in place and have an option of scalability;
- Always prefer to develop Digital Content on open source software and the content should be platform independent.
- A strong feedback mechanism and assessment plan should be developed before any digital content development;
- Preferably, a prototype module should be developed and workshop conducted along with industrial experts;
- Interactive content should include cases, scenarios, and avatars; and
- Digital content should be updated at regular intervals and should align with changing pharmacy regulations.

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India: Preparing pharmacy graduates for the new world of digital counselling — A paradigm shift in pharmacy education

Authors

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Summary

The COVID–19 pandemic has had a significant impact on patient counselling. It has increased the use of virtual rooms and paved a way for digital patient education as a novel means. Patients were counselled using telephonic and videotelephony methods, and their quality of life during COVID-19 along with comorbidities was determined using SF-12v2 (Short form 12-item health survey version 2). A total of 360 subjects were included above the age of 50 years. A Cronbach's alpha of physical composite score 0.81 (40.12±10.35) and a mental composite score 0.83 (50.08±9.9) were observed. There was a significant impact observed in the quality of life during the pandemic. Videotelephony interviews had similar effectiveness to traditional patient counselling. Theus this new tool can serve as a cornerstone of future patient counselling.

Background and context

The COVID-19 pandemic has forced counsellors around the globe to use online videoconference programs to provide patient counselling, teaching, and supervision. Videotelephony[1] is not new terminology in the 21st century; it was a concept in 1910, and it was commercialised by AT&T (telecoms company) in 1970 under the name "Picturephone". Videotelephony was popularised in the 2000s, via free internet services such as Skype and iChat. Adopting video technology and online counselling have some unique challenges and benefits. The current COVID-19 crisis has forced some novel ideas in patient counselling, which might be of help to healthcare professionals in the near future. In this chapter, we will look at how good videotelephony is compared with a traditional telephone call in patient counselling in community pharmacies.

Educational description

During the initial outbreak of COVID-19, we concluded, after watching various world news items, that the disease was not a simple threat. So some of our prefinal PharmD students came up with some ideas about challenges we might face during a lockdown. After seeing lockdown patterns in China, we concluded that we would soon be having one in India. So we created a pilot study to follow up patients with chronic multiple clinical conditions. We identified three community pharmacies that were willing to support our work and help these patients during the lockdown. The project was divided into three phases:

- **Phase I:** Identifying potential patients in each pharmacy by their telephoning the pharmacy to refill prescriptions. Prescriptions were received digitally using WhatsApp or email. The delivery was done as per the Government norms. Ethical clearance was obtained from the university's ethics committee.

- **Phase II:** During the second prescription refilling, all the patients were asked to participate in either videotelephony or telephone counselling.

- **Phase III:** Patient counselling was conducted by two sets of students for each community pharmacy.

Our simplified SF-12v2[2,3] questionnaire contained 12 items evaluating eight subscales relating to health-related quality of life (HRQoL). The eight subscale scores (physical functioning, role-physical, bodily pain, general health, vitality , social functioning, role-emotional and mental health) range from 0 to 100 (higher scores indicating better health status). Besides these scores, SF-12v2 gives estimates of summary scores for physical and mental components ranging from 0 to 100 (higher scores indicating better physical and mental health), with a mean of 50 and SD of 10, calculated by SPSS v20. Participants were asked: "Has a doctor ever told you that you had chronic diseases (for example, hypertension, diabetes, cardiovascular disease, osteoarthritis, eye problems, ear problems or others)?" Eye problems included age-related macular degeneration, glaucoma, cataract, etc; ear problems included otitis media, hearing difficulties, etc.

Outcomes, lessons learned and recommendations

In Phase I, 403 patients participated in the study. Phase II, which included 360 patients, helped to build good relationship with the patients. In phase III, 360 patients were questioned using SF-12v2. Of these, 199 agreed to counselling by videotelephony, and 161 by telephone. For videotelephony patients, the physical component score was 0.89 and the mental component score was 0.86 which has good reliability where telephonic interview (n=161) the PCS was 0.72 and MCS was 0.73, which shows the acceptability was determined by Cronbach's alpha. The pharmacist can carry out videotelephony counselling with patients to enhance medication adherence, regardless of patients' of geographical location. A reliable HRQoL measure is critical to quantify the efficacy of interventions in order to further improve quality of care. This in turn reduces medical costs for this chronically ill population, which also helps to manage their health and predict likely major issues.

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4.7 Western Pacific region

Australia: Digital health in pharmacy at La Trobe University — the story so far

Authors

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Summary

The role of the pharmacists in Australia is rapidly changing to keep pace with changes in the digital health landscape. La Trobe University is progressively implementing a vertically aligned digital health curriculum that is integrated into the existing curriculum. Students in first year are introduced to the basic concepts of aspects of digital health and are expected to demonstrate an understanding of the concepts. In the second year, students are asked to apply their knowledge through evaluation of an app in terms of relevance to practice. Our aim for third and fourth years will be to integrate digital health into aspects of existing subjects through case studies and highlighting how and where digital health tools can be useful, as well as requiring students to utilise digital health tools in existing OSCE (objective structured clinical examination) and role-play assessments.

Background and context

The role of digital health is rapidly increasing in Australia, and the practice of pharmacy is evolving to keep pace.[1] In recent years, pharmacists have had to adapt to the roll-out of a national electronic health record,[2] real-time prescription monitoring systems[3] and electronic prescription transmission and dispensing. Further, many hospitals are in the process of implementing their own electronic medical records. The Pharmaceutical Society of Australia, the leading professional body for pharmacists in Australia, describes the current landscape as the "third wave of technology, after the introduction of computers in 1980s and the introduction of the internet 2000s.[4] To ensure our graduates continue to be work-ready, La Trobe has worked to incorporate these concepts into our undergraduate curriculum in a way that is meaningful to students and will help them to develop an understanding of the place and use of these technologies in their future practice.

Educational description

La Trobe is progressively rolling out a vertically aligned, constructivist curriculum to help our student pharmacists grasp a sound understanding of various aspects of digital health in pharmacy practice. While second year contains a stand-alone digital health component, digital health is being integrated into the existing curriculum in first, third and fourth years.

Our first-year programme starts from a very basic level and introduces students to concepts of electronic prescribing, the token model of e-prescriptions, the basic principles and differences between an electronic medical record and a paper-based system, and the documentation of clinical interventions and service provision. They are introduced to “Project Stop”, an electronic supply monitoring system to minimise misuse of pseudoephedrine along with principles of decision support systems. Students are given activities to complete within their own electronic health record to give them experience in the types of information contained within, and in navigation of the platform. At first year, students are assessed on their understanding of various concepts within the digital health module in an oral exam.

In the second year, our students undertake a component titled “Understanding digital health”. The subject is run by health Information management experts and provides our students with exposure to a different point of view from that of a pharmacist. In this second-year subject, students build on the concepts that were introduced in first year, while also exploring in more detail concepts such as big data, artificial intelligence and robotics, telehealth and the exploding world of mobile applications.

Another key area of learning that is threaded through the year levels is the legal and ethical implications of using technology in practice. In professional practice subjects, students are faced with weekly cases and must discuss the ethical and legal aspects of these cases in an online discussion forum to reach conclusions or recommend actions. They are then asked to explain their conclusions in a face-to-face session.

Students are taught the basics of using an electronic records system for prescriptions, and are exposed to a variety of electronic record systems, clinical information, medical records, and prescription monitoring systems including “safe scripts”, a real-time prescription monitoring system for high risk drugs, through experiential placements within the course. Resources include interviews with professionals who outline their use of technology in the workplace. Material from relevant peer-reviewed journals, contemporary literature such as blogs and online professional journals and even relevant government publications and media articles are utilised to maintain currency of the topics discussed in this fast-changing environment.

Assessments in the second year include completing an evaluation of the functionality of a pharmacy-related app in the style of a submission to national digital health publication, *Pulse IT*. Students also create an online survey to run with their family and friends and present results to the class. The final assessment is a summative exam that includes short- and long-answer questions. The curriculum and assessments for third and fourth year continue to be developed as the students roll up through the updated curriculum as described below.

Outcomes, lessons learned and recommendations

The digital experience at La Trobe is very much a work in progress. We have currently rolled our programme up to the second of our four-year BPharm (honours) programme. Planning is under way for integration of these concepts into the third and fourth years from 2021 and 2022, respectively. We are working to find ways to integrate the use of real-world digital health technology into our course that will be meaningful to and resonate with our students. Our aim is to include elements of digital health into our OSCE and role-played assessments such that students will need to access and review electronic health records to make clinical decisions and formulate a treatment plan for a presenting patient. We plan to seek feedback from our second-year students at the conclusion of the current semester, with a particular focus on the vertical alignment of concepts between years 1 and 2. We will be trying to identify the concepts that linked well and strengthen those that did not.

Working with the health information management staff has been highly beneficial in the development of our course. This opportunity for collaboration has exposed both pharmacy staff and students to different ways of thinking and different ways of presenting information. Given the vast number of health disciplines that will be using similar central data repositories, a great potential that has been identified is to expand this subject to include other health disciplines.

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Malaysia: Development of digital literacy competencies among educators and students in a public pharmacy school in Malaysia

Authors

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Summary

Digital health education, which gives easier access and greater flexibility for students, is proven to be a useful educational approach for several health professional education programmes. Digital health education has a broad scope of modalities that facilitate its uptake by educational institutions, even at different readiness levels. Following the emergence of the COVID-19 pandemic, many educational institutions became forced to utilise digital approaches to proceed with the learning process. However, the readiness and competency of educators and students was a challenging issue. In this case, we are describing our experience with the digital transformation challenge. Also, we highlight our adopted gradual approach of developing digital literacy competency among educators and students in a Malaysian public pharmacy school.

Background and context

Digital health education is considered effective as traditional education for health professions, giving its easier accessibility and higher flexibility for learners.[1] Digital education modalities broadly involve offline and online learning, serious gaming, virtual reality, virtual learning environments and digital skills trainers.[2] In this case, we discuss the online digital modalities developed and adopted by the educators in our institution. After the declaration of the COVID-19 pandemic in March 2020 and the subsequent lockdown of all educational institutions, our university was not exceptional in facing the sudden digital transformation challenge. All educational activities were temporarily suspended to ensure stakeholders' safety, forcing us to assess our ability and readiness to pursue education via a digital medium. Despite having online learning management software (LMS), we were challenged by the fact that we did not uniformly integrate digital tools as a standard in the courses' delivery and design. Instead, it was dependent on individual lecturers' initiatives, which were usually affected by their perceived usefulness of the LMS.[4] Therefore, we realised there would be difficulties in starting a digital transformation of the mode of learning delivery if there were no proper preparation of educators and students to enable a smooth pursuance of the learning process in the new normal. This case discusses the initiatives taken at the university and at faculty levels to foster the digital literacy competency of the academic staff so they can be ready to assist the students properly in the new learning mode.

Educational description

An initial survey was distributed among the students to assess their degree of readiness for digital transformation. More than half of the respondents claimed that they were not ready to proceed with the digital learning mode unless there were special arrangements and adjustments made. The university then built a team of digital educators with representatives from all faculties. The team in each faculty was required to plan for alternative teaching and learning delivery and assessment methods using digital platforms. Both of the digital educators' teams, created at university and faculty levels, have put on tremendous efforts in conducting a series of e-learning clinics to train and support all educators with their e-learning competencies.

The training covered, but was not limited to, the university LMS, Google Classroom and Meeting, Microsoft Teams, social media tools such as Telegram and WhatsApp, as well as approaches to maintain validity, reliability and fairness of the online assessments. The final e-learning plan was eventually communicated to students. The feasibility of such a masterplan was also evaluated and discussed from time to time among the educators. Simultaneously, several initiatives were conducted among all pharmacy students to identify the current challenges for starting a digital transformation in their learning process, such as conducting trial-runs with different digital platforms, references retrieval coaching and integrating a complete assessment protocol for every required assessment.

A few challenges were identified, mainly related to optimising the reliability, validity and fairness of online examinations. These challenges were further addressed by adjusting the time and the format of the online examinations, which were mainly conducted as synchronous online sessions. In some courses, the individual assessments' designs have required educators to create a high number of assessment sets for enabling the maintenance of fair and non-discriminative assessment through the digital medium. In addition to that, a significant revision of the university's LMS was performed to make it more inclusive and comfortable for all users. Besides, the online learning plan was set to transform all experiential learning, virtually building on our previous experience in this regard.[3] We considered conducting a briefing or trial run session for any learning activity that will be conducted online for the first time to ensure that all students are well informed and prepared for the learning activity. In the meantime, we have ended up with a complete digital transformation of all didactic, practical and experiential learning activities that utilise several online learning and social media platforms in addition to the university's LMS.

Outcomes, lessons learned and recommendations

The overall digital transformation in an institution that was not uniformly integrating the digital health modalities in the learning process was challenging but achievable. An exact needs-driven digital literacy training for educators was crucial to inculcate interest and raise their digital confidence and competency. To maintain a successful digital transformation, a dedicated support team should be assigned to investigate the updates, provide alternative solutions and assist educators throughout the process. We acknowledge the challenges faced in setting more reliable individual assessment that was more likely associated with the need to create multiple sets of questions in our attempt to maintain fair and non-discriminative assessment. The flexibility given to the educators to discuss things with their students on the most suitable online and social media platforms that will be adopted for the course was helpful and well-received by students.

After the initial complete digital transformation of the delivery of learning activities, we are considering streamlining the number of digital learning tools for students in order to maximise convenience and long-term acceptability. In addition, digital integration in the content will be among our future digital upgrading plans that will adopt augmented and visual reality in the experiential courses.

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5 Way forward

This report is first of its kind in providing a global overview of digital health in pharmacy education to investigate the readiness and responsive of pharmacy education and to identify knowledge and skills gaps of the pharmaceutical workforce.

This chapter aims to provide a focus on and suggests action for four areas, which are unique in their messages but also complement each other. These focus areas are:

1. Capitalising on the benefits of digital health;
2. Digital health education and training for the pharmaceutical workforce;
3. The impetus for integrating digital health into pharmacy education and practice; and
4. Developing the digitally enabled pharmaceutical workforce and FIP global curriculum and training resources for digital health education

While the report focused on education and skills, the results provide a broader status of digital health in pharmacy and pharmaceutical sciences. We believe this report will catalyse further research and developments in the area to increase the adoption of digital health by the pharmaceutical workforce.

Capitalising on the benefits of digital health

"Digital health" is a broad term, and its definition will continue to change as new health technologies emerge. To keep up with this pace and ensure there is a common understanding across all members of the pharmaceutical workforce, a living, comprehensive global digital health in pharmacy glossary must be developed. The FIP Technology Forum has already taken the lead on this initiative, building on the glossary in Annex 3 developed for the purposes of this report.

Digital health is beyond increasing efficiencies in healthcare and its contribution to good health and well-being should be widely recognised by pharmaceutical workforce. This mindset change can shift the roles of pharmaceutical workforce from being users to designers and system shapers in digital health. FIP Technology Forum may lead further research in this area to expand digital health horizons of the pharmaceutical workforce.

Digital health education and training for pharmaceutical workforce

Different members of the pharmaceutical workforce will have different digital health roles. Existing roles will be transformed by digital health innovations while specialty roles continuously emerge and some roles are replaced due to digital health. As digital developments are getting more and more complex, pharmacy and pharmaceutical sciences need specialised professionals in digital health to manage all the digital aspects and problems in daily practice. Pharmacy schools should seek to develop and provide postgraduate courses on digital health.

Digital health education will need to be integrated throughout the curriculum, as technology is now a relevant and important aspect to consider for almost every area in pharmacy. It is important not to think of it in isolation or as a separate curriculum.

All pharmacy and pharmaceutical sciences students need to graduate with basic knowledge and skills in digital health. In order to upskills and train the existing workforce with digital health skills, continuous education, continuous professional development and specialisation are critically important. There has been insufficient attention given to workforce development for implementing new systems of digital health delivery. Employers and universities can unlock the potential of the pharmaceutical workforce through education strategies.

The array of digital health technologies covered in education should be broadened as the focus has been on e-health and mobile applications. There is a need to delineate the difference between informatics (e-health) and digital health. Practitioners indicated a lack of familiarity with emerging digital health technologies such as blockchain technology, bots, digital medicines and artificial intelligence. The FIP Technology Forum can lead further research in this area to increase the level of understanding in digital health tools.

Educational frameworks should provide broader capability development through including topics such as governance, ethics and security to provide safe ways of working with new technologies.

In order to mitigate the variation of the readiness and responsiveness of pharmacy education and training, collaboration across institutions could be a way to speed up the adoption of digital health education. Chapter 4 of this report provides good practices from academic institutions on adoption of digital health in pharmacy education.

To strengthen current and existing pharmaceutical workforce's skillset and knowledge to apply digital health to solve existing clinical problems and improve pharmaceutical care, digital health education has to focus on providing experiential and practical elements.

This report provides an initial evaluation of the pharmaceutical education and workforce and provides statements more relevant to pharmacy education. Further work and research are required on the scientific workforce as well as on digital health in pharmaceutical sciences education.

The impetus for integrating digital health into pharmacy education and practice

Professional organisations should support the pharmaceutical workforce by providing access to digital health tools, investing in digital health education and developing guidance on how to apply digital health technologies in practice. A professionally driven advocacy effort can ensure integration of digital health into pharmacy education and support the inclusion of digital health in educational and accreditation standards. The FIP Technology Forum is ideally positioned to guide professional organisations on how each digital health tool mentioned in this report can be integrated into different areas of pharmacy and pharmaceutical sciences.

Pharmacy as a profession historically has embraced information technologies. Further research and inter-professional collaboration with experts from the digital health industry is now needed to demonstrate how digital health can be integrated into pharmaceutical practice and pave the way for new and exciting developments in the pharmacist's digital health toolbox.

FIP intends to purposefully engage with its global network of four million pharmacists, pharmaceutical scientists, educators and its partners to amplify the messages and "way forward" areas highlighted in this report to support global integration of digital health in pharmacy education and practice.

Developing the digitally enabled pharmaceutical workforce

The FIP Development Goals are a key resource for transforming the pharmacy profession over the next decade globally, regionally and nationally. They align with FIP's mission to support global health by enabling the advancement of pharmaceutical practice, sciences and education and are set to transform pharmacy in alignment with wider global imperatives underpinning the UN Sustainable Development Goals.

FIP Development Goal 20 (digital health) commits to globally having enablers of digital transformation within the pharmacy workforce and effective processes to facilitate the development of a digitally literate pharmaceutical workforce.

Building on the findings of this report, the following mechanisms will support implementation of FIP Development Goal 20 nationally, regionally and globally:

1. Developing courses, training material and experiential learning opportunities in initial education and early career training to prepare a digitally literate workforce;
2. Incorporating digital health and literacy competencies and skills in pharmaceutical competency, advanced and specialist frameworks;
3. Developing multi-disciplinary learning strategies for digital health literacy that include interprofessional education;
4. Providing opportunities for continuous education and development to ensure the workforce remains up to date with digital health changes and innovations; and
5. Incorporating digital health within workforce development policies, including employment policies, such as employment opportunities in digital health sector.

The FIP Academic Pharmacy Section (AcPS) and FIP Academic Institutional Membership (AIM) can provide global leadership to support pharmacy and pharmaceutical sciences faculty members and educators to improve their digital health literacy skills through organising digital events and resources. The AcPS and AIM are global networks that can provide mechanisms and platforms to support the sharing of experiences and good practices in digital health education. These initiatives will support both individual and institutional level adoption of digital health in pharmacy education.

The FIP Health and Medicines Information Section has run a survey in parallel with the development of this report in order to elucidate the policy approaches of professional pharmacy organisations in different countries. The results of this survey can address the incorporation of digital health within workforce development and employment policies.

Developing a digitally enabled pharmaceutical workforce will require a holistic approach to pharmaceutical education. The FIP Board of Pharmaceutical Sciences in collaboration with FIP Education will carry out a global assessment of pharmaceutical sciences graduate education which will inform the role of digital health unique to pharmaceutical sciences (e.g., AI in drug discovery, pharmacometrics) during 2021. This may lead to a follow-up report on digital health education with a focus on pharmaceutical sciences education.

The COVID-19 pandemic has exposed long-standing disparities in access to and provision of both healthcare and education. While healthcare and education are transforming with digital health, we can only ensure national, regional and global implementation of FIP Development Goal 20 (digital health) through considering ways to address disparities in order not to increase disparities we face today. FIP commits to share best practices, affordable solutions and resources to advocate support for digital healthcare and education.

Building on the findings of this report, FIP will continue to identify next priorities for action and areas that needs further investigation and understanding, such as supporting the existing workforce or addressing barriers on the implementation of digital health education.

Developing the FIP global curriculum and training resources for digital health education

This report underlines the global need for educational resources and standards for digital health in pharmacy education. Building on the digital literacy competencies in the FIP Global Competency Framework Version 2, developed by the FIP Workforce Development Hub, FIP will be designing and developing a global curriculum and training resources for digital health in initial pharmacy education that includes baseline digital health literacy and how digital health integrates with professional practice. This will facilitate national, regional and global implementation of FIP Development Goal 20 (digital health). Academic pharmacy leaders and education providers will be key to the adoption of digital health transformation by portraying change leadership and bridging practice and education.

FIP's global curriculum and training resources will promote mindsets and behaviours needed for the digital reform in education as there might be cultural, regulatory or systematic barriers preventing its adoption. Development of digital health competencies will, in return, strengthen the ability of pharmacists to develop and display the other competencies required to perform their duties.

Broader capability development will be included in the curriculum and training resources to cover areas such as governance, ethics and security to provide safe ways of working with new technologies to pharmaceutical workforce.

The national integration of digital health curriculum and training resources into pharmacy education should be supported by governments and relevant ministerial representatives, professional pharmacy bodies, universities and education providers, accreditors, practitioners, patients and the broader community.

The future of pharmacy and pharmaceutical sciences is digital and it is exciting. A digitally enabled and agile pharmaceutical workforce will capitalise on the benefits of digital health to serve the higher purpose of providing good health and well-being for all, leaving no one behind.

Annexes

Annex 1 — List of academic institutions that participated in the survey and requested to be acknowledged in this report

Country	Name of the academic institution
Argentina	Universidad Metropolitana para la Educación y el Trabajo
Australia	University of Technology Sydney
Australia	Monash University
Australia	La Trobe University
Australia	Charles Sturt University
Australia	University of Newcastle
Australia	University of Western Australia
Australia	James Cook University
Brazil	Federal University of Rio Grande do Sul
Brazil	Federal University of Sergipe
Brazil	Pontifical Catholic University of Rio Grande do Sul
Brazil	Centro Universitário do Estado do Pará
Brazil	Federal University of Santa Catarina
Bulgaria	Medical University of Plovdiv
China Taiwan	National Taiwan University
Cyprus	University of Nicosia
Cyprus	Near East University
Dominican Republic	Eastern Central University
Estonia	University of Tartu
Ghana	University of Ghana School of Pharmacy
Ghana	University for Development Studies
Hong Kong, China	The Chinese University of Hong Kong
India	University of Kashmir
India	Manipal College of Pharmaceutical sciences
India	GRT Institute of Pharmaceutical Education and Research
India	JSS College of Pharmacy
India	Nandha college
India	Bharati Vidyapeeths Institute of Pharmacy
India	Vikas Institute of Pharmaceutical Sciences
India	Acharya and BM Reddy College of Pharmacy
India	Amity Institute of Pharmacy
Indonesia	Airlangga University
Indonesia	Bandung Institute of Technology
Iraq	Mustansiriyah College of Pharmacy
Kenya	University of Nairobi
Latvia	Rigas Stradins University
Lebanon	Lebanese American University
Lebanon	Lebanese International University

Malaysia	International Islamic University
Malta	University of Malta
Mexico	Benemérita Universidad Autónoma de Puebla
Nepal	Kathmandu University
Netherlands	Utrecht University
Nigeria	Usmanu Danfodiyo University
Nigeria	University of Uyo
Pakistan	Lahore College for Women University
Pakistan	Punjab University College of Pharmacy
Pakistan	University of Sindh
Philippines	St. Dominic College of Asia
Philippines	University of San Carlos
Philippines	University of the Assumption
Russian Federation	St. Petersburg State University of Chemistry and Pharmacy
Russian Federation	Kazan State Medical University
Spain	Ramon Llull University
Spain	Miguel Hernández University of Elche
Spain	University of Seville
Spain	University of Castilla-La Mancha
Spain	Saint Anthony Catholic University
Spain	University of Navarra
Spain	University of Salamanca
Sweden	Uppsala University
Tanzania	Sengerema Health training institute
Thailand	Burapha University
Turkey	Ankara University
Turkey	Van Yüzüncü Yıl University
Turkey	Acıbadem University
Turkey	Ege University
Ukraine	Bogomolets National Medical University
United Kingdom	UCL School of Pharmacy
United States of America	Chapman University School of Pharmacy
United States of America	University of Colorado Skaggs School of Pharmacy and Pharmaceutical Sciences
Zambia	University of Zambia

Annex 2 — FIP digital health in pharmacy education survey

The International Pharmaceutical Federation (FIP) invites you to take part in our global survey on digital health in pharmacy education. The use and scale up of digital health (see the glossary for definitions) can revolutionise how people worldwide achieve higher standards of health, and access services to promote and protect their health and well-being. This is an exciting time to benefit from and capitalise on technological advances. The COVID-19 pandemic has catalysed numerous changes in healthcare worldwide and accelerated digital health transformation. The 2020s may be the decade when digital technology reshapes the health system. Relevant content in pharmacy curricula and digital health training are needed to prepare the pharmaceutical workforce, but little is known about the skills and knowledge that it currently has or about its educational needs. FIP is conducting this survey to investigate the readiness and responsiveness of pharmacy education to train current and future pharmacists on digital health and to identify the knowledge and skill gaps through feedback from pharmacy schools, pharmacy faculty members, pharmacy students and pharmacy practitioners worldwide. Good practices on digital health courses, learning activities and skills will be identified as well. Participation in this study is voluntary but your contribution will be essential for better understanding the current global workforce situation. This survey will take around 10 minutes to complete. The survey is available in 8 languages: Arabic, Chinese, English, Russian, French, Spanish, Brazilian Portuguese and Turkish. To support our respondents with a common understanding of digital health terminology, we added a link to our glossary at the top of every page. All information provided will be confidential, and cannot be used to identify individuals who take part. Access to data with identifiable information is restricted to the research team directly involved in this study. We would like to thank you in advance for your contribution. Please complete the form below to participate in the study and to indicate your consent.
FIP Digital Health in Pharmacy Education Project Team

I agree to participate in the research study. I understand the purpose and nature of this study, and I participate voluntarily

1. Yes

My response is:

1. Representing an academic institution/pharmacy school
2. Representing my individual views

I am:

1. A pharmacy student (initial education, e.g., BPharm/MPharm/PharmD)
2. A pharmacist/pharmaceutical scientist
3. A faculty member of an academic institution/pharmacy educator/pharmacy preceptor

A. Survey for academic institutions

This section asks you to provide information related to your institution.

1. In which country is your institution?

2. Name of your pharmacy school:

3. City/Town:

4. Website of your pharmacy school:

5. Your position/job title:

6. Type of your pharmacy school:

1. Public
2. Private

3. Other ______________________________

Process: Processes for digital health in pharmacy education

This section asks you to provide information related to processes in your pharmacy school which involve delivering digital health in pharmacy education.

7. Is digital health being taught in your pharmacy school? (Digital health is the field of knowledge and practice associated with the development and use of digital technologies to improve health. Digital health expands the concept of e-Health to include digital consumers, with a wider range of smart-devices and connected equipment. It also encompasses other uses of digital technologies for health such as the internet of things, artificial intelligence, big data and robotics.)
1. Yes, it is a standalone course
2. Yes, it is integrated in already existing courses
3. No

8. Is digital health being taught in a mandatory or elective course in your pharmacy school?Please select those which apply.
1. Mandatory
2. Elective
3. Through an optional certificate programme
4. I don't know

9. In which of the following degrees does your pharmacy school provide courses on digital health to your students?Please select those which apply.
1. B.Pharm
2. M.Pharm
3. Pharm.D
4. Other __________

10. In which year does your pharmacy school provide courses on digital health to your students? Please select those which apply.
1. First year
2. Second year
3. Third year
4. Fourth year
5. Fifth year
6. Other __________

11. How many lectures are allocated to digital health in your pharmacy school?
1. 1–2 lectures over an academic year
2. 3 or more lectures over an academic year
3. An entire module or course within the curriculum
4. I don't know

12. How does your pharmacy school provide the courses on digital health to your students? Please select those which apply.
1. In a classroom setting
2. In a practice setting, e.g., hospital
3. In a virtual setting

13. Who is delivering digital health courses or lectures offered in your pharmacy school? Please select those which apply.
1. Lecturer(s) from pharmacy department
2. Lecturer(s) from other departments
3. Guest speaker(s) from digital health industry
4. Visiting faculty
5. Other __________

14. Is digital health taught to pharmacy students separately or as part of interprofessional education together with other students? Please select those which apply.
1. Only to pharmacy students
2. With other healthcare students (e.g., medicine, nursing, etc)
3. With other disciplines (e.g., engineering, etc)

Needs-based education: Locally determined, socially accountable, globally connected, and quality assured education

This section asks you to provide information related to programmes which have been prepared for your students on digital health in pharmacy education.

15. Do you agree or disagree with the following statement?

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
My students are equipped with the competencies to	❑	❑	❑	❑	❑

deliver digital health services after graduation.					
In the ever-changing landscape of digital health, my school is able to readily identify and include new digital health skills/competencies in the curriculum as they emerge in practice.	❑	❑	❑	❑	❑

16. Which of these tools/services are covered in digital health education in your pharmacy school? Please select those which apply.

1. Mobile applications
2. Big data/data science
3. Other Artificial Intelligence (AI) powered tools/services
4. Telemedicine/telehealth/virtual care
5. Online/remote (patient) counselling
6. Remote patient monitoring
7. Digital therapeutics
8. Digital medicine
9. Bots (e.g., chatbots, symptom checker bots)
10. Consumer/medical wearable technology
11. Online pharmacy
12. Blockchain technology
13. e-Dispensing
14. e-Prescribing
15. Electronic health record: information systems/patient-generated health data
16. Other ______________________________

17. Which of the following concepts are covered in digital health education in your pharmacy school?Please select those which apply.

1. Ethics and compliance
2. Innovation and creativity
3. Data privacy and security
4. Management and leadership
5. Entrepreneurship
6. Digital accessibility
7. Patient empowerment
8. Reimbursement/remuneration for providing digital health services, such as virtual care
9. Digital health literacy
10. Clinical reasoning and decision making
11. Evidence-based digital medicine
12. Cyber security
13. Other ______________________________

18. Which of the following infrastructures are provided to support digital health education in your pharmacy school? Please select those which apply.

1. Laboratory to test digital health concepts and tools
2. Access to clinical care digital platforms or software
3. Analytics/statistical software or other relevant data management tools
4. Active learning sessions
5. Capstone
6. e-Learning
7. Hackathon
8. Living lab
9. Masterclass
10. Product/idea pitch presentation to a panel
11. Testing devices
12. Other

19. What are the competencies that are linked to the learning outcomes of your digital health courses or lectures in your pharmacy school? Please select those which apply.

1. Technology literacy
2. Design thinking
3. Service design
4. Entrepreneurship
5. Patient-centred digital health
6. Knowledge of digital health tools
7. Technology confidence
8. Quality assurance and improvement
9. Compliance/ethics
10. Intraprofessional and interprofessional collaboration
11. Familiarity with health systems and healthcare
12. Familiarity in interpreting and working with different types of health data
13. e-Professionalism
14. Other ______________________________

20. Does your pharmacy school provide any postgraduate courses on digital health in pharmacy education?
    1. Yes
    2. No

21. Does your pharmacy school provide any certificate programmes on digital health to practising pharmacists as part of continuous education or continuous professional development (not linked to a degree)?
    1. Yes
    2. No

Structure: Academic infrastructures to support digital health in pharmacy education

This section asks you to provide information related to infrastructures at your pharmacy school for delivering digital health education.

22. Is digital health education included in the general strategic plan of your university or pharmacy school?
    1. Yes
    2. No

23. Do you receive any support, policy or guidance from your national/regional pharmacy organisations for the development of digital health courses or lectures in your pharmacy school?
    1. Yes
    2. No

24. Are there any challenges faced by your pharmacy school in providing education on digital health? Please select those which apply.
    1. Lack of guidance
    2. Lack of resources
    3. Lack of experts to facilitate learning experience
    4. Lack of time
    5. Lack of interest among faculty members
    6. Lack of interest among school leadership
    7. Lack of interest among students
    8. Other __________

Outcomes & Impact: Impact of digital health in practice

This section asks you to provide information relating to the impact of digital health in practice.

25. What are the desired outcomes of including digital health in the curriculum of your pharmacy school? Please select those which apply.
    1. Digital health applied in practice settings
    2. Advancing pharmacy practice
    3. Outreach activities carried out by the school to disseminate awareness of digital health
    4. Increase the value of the pharmacy programme for prospective students
    5. Expanding employment options for graduates
    6. Students to gain transferable skills
    7. Other __________

Support in delivering digital health courses or lectures

26. What kind of support would you like to receive from FIP to deliver digital health in your pharmacy school?

27. FIP will publish the results of this survey in a Global Report on Digital Health in Pharmacy Education. Please indicate your preferences by selecting all that apply.
    1. I would like my institution to be acknowledged in this Global Report using the institutional name provided above
    2. I would like to receive a copy of the FIP Global Report on Digital Health in Pharmacy Education
    3. I, or a colleague, would like to provide a descriptive CASE STUDY for this Global Report, showcasing an innovation developed by my institution in response to digital health. (FIP will contact you to collect the case study with a template)
    4. None of the above

B. Survey for pharmacy students

This section asks you to provide information relating to your background.

1. I am:
    1. Female

2. Male
3. Prefer not to say

2. Currently, in which country do you study?

3. Name of your pharmacy school:

4. What academic degree are you currently studying and do you have in view?
    1. B.Pharm
    2. M.Pharm
    3. Pharm.D

5. Which year of study are you in?
    1. First year
    2. Second year
    3. Third year
    4. Fourth year
    5. Fifth year
    6. Sixth year

Process: Process for digital health in pharmacy education

6. Have you taken any courses on digital health in your pharmacy school? (Digital health is the field of knowledge and practice associated with the development and use of digital technologies to improve health. Digital health expands the concept of e-Health to include digital consumers, with a wider range of smart devices and connected equipment. It also encompasses other uses of digital technologies for health such as the internet of things, artificial intelligence, big data and robotics.)
    1. Yes
    2. No

7. Have you taken any courses on digital health in other places (other institutions, online etc) apart from your pharmacy school education?
    1. Yes
    2. No

8. How often have you learnt about concepts related to digital health in your pharmacy school education?
    1. 1–2 lectures over an academic year
    2. 3 or more lectures over an academic year
    3. An entire module or course within the curriculum

9. How does your pharmacy school provide the courses on digital health to you? Please select those which apply.
    1. In a classroom setting
    2. In a practice setting, e.g., hospital
    3. In a virtual setting

Needs-based education: Locally determined, socially accountable, globally connected, and quality assured education

This section asks you to provide information regarding your educational programme and experience in relation to digital health.

10. How do you rate your knowledge on the use of digital health tools/services?
    1. None
    2. Some
    3. Reasonable
    4. Good
    5. Very good

11. Give your own definition of digital health in few words.

12. How confident do you feel about your skills to deliver digital health services after graduation?
    1. Not confident at all
    2. Not confident
    3. Somewhat confident

4. Confident
5. Very confident

13. Which of these tools/services are covered in digital health education in your pharmacy school? Please select those which apply.
1. Mobile applications
2. Big data/data science
3. Other Artificial Intelligence (AI) powered tools/services
4. Telemedicine/telehealth/virtual care
5. Online/remote (patient) counselling
6. Remote patient monitoring
7. Digital therapeutics
8. Digital medicine
9. Bots (e.g., chatbots, symptom checker bots)
10. Consumer/medical wearable technology
11. Online pharmacy
12. Blockchain technology
13. e-Dispensing
14. e-Prescribing
15. Electronic health record: information systems/patient-generated health data
16. Other ______________________________

14. Which of the following concepts are covered in digital health education in your pharmacy school? Please select those which apply.
1. Ethics and compliance
2. Innovation and creativity
3. Data privacy and security
4. Management and leadership
5. Entrepreneurship
6. Digital accessibility
7. Patient empowerment
8. Reimbursement/remuneration for providing digital health services, such as virtual care
9. Digital health literacy
10. Clinical reasoning and decision making
11. Evidence-based digital medicine
12. Cyber security
13. Other ______________________________

15. Which of the following infrastructures are provided to support digital health education in your pharmacy school? Please select those which apply.
1. Laboratory to test digital health concepts and tools
2. Access to clinical care digital platforms or software
3. Analytics/statistical software or other relevant data management tools
4. Active learning sessions
5. Capstone
6. e-Learning
7. Hackathon
8. Living lab
9. Masterclass
10. Product/idea pitch presentation to a panel
11. Testing devices
12. Other

16. What kind of infrastructure you would like to have in your pharmacy school for a better learning experience related to digital health?

17. What are the skills related to digital health that you gained in your pharmacy school? Please select those which apply.
1. Technology literacy
2. Design thinking
3. Service design
4. Entrepreneurship
5. Patient-centred digital health
6. Knowledge of digital health tools
7. Technology confidence
8. Quality assurance and improvement
9. Compliance/ethics
10. Intraprofessional and interprofessional collaboration
11. Familiarity with health systems and healthcare

12. Familiarity in interpreting and working with different types of health data
13. e-Professionalism
14. Other ______________________________

18. What would you like to learn more about on digital health in pharmacy school (e.g., tools/services, concepts, skills, etc.)?

Support in digital health

19. After you graduate, do you have any career plans to focus on digital health in pharmacy practice?
   1. Yes
   2. No

20. Have you received any support or guidance from your school about employment opportunities in digital health?
   1. Yes
   2. No

21. Have you received any support or guidance from your national/regional pharmacy students association for digital health education/skills?
   1. Yes
   2. No

22. What kind of support would you like to receive from FIP to improve your skills in digital health?

Thank you very much for completing this survey. FIP will publish the results of this survey in a Global Report on Digital Health in Pharmacy Education. Would you like to receive a copy of the report?
   1. I would like to receive a copy of the FIP Global Report on Digital Health in Pharmacy Education.
   2. No, I don't like to receive a copy of the report.

C. Survey for practitioners/scientists

This section asks you to provide information relating to your background and your current practice.

1. Your age (years)
   1. 18–24
   2. 25–34
   3. 35–44
   4. 45–54
   5. 55–64
   6. 65 and over

2. I am:
   1. Female
   2. Male
   3. Prefer not to say

3. Currently, in which country do you live?

4. How many years of professional pharmacy experience do you have?

5. My current job title is:

6. My main (or principal) sector of work and practice is:
   1. Academic pharmacy

2. Community pharmacy
3. Social and administrative pharmacy
4. Military and emergency pharmacy
5. Hospital pharmacy
6. Industrial pharmacy
7. Clinical biology
8. Research and development
9. Digital health
10. Other __________

Process: Processes for digital health in pharmacy education

7. Did you receive any education related to digital health at your pharmacy school? (Digital health is the field of knowledge and practice associated with the development and use of digital technologies to improve health. Digital health expands the concept of e-Health to include digital consumers, with a wider range of smart devices and connected equipment. It also encompasses other uses of digital technologies for health such as the internet of things, artificial intelligence, big data and robotics.)
1. Yes, I received it at undergraduate level
2. Yes, I received it at postgraduate level
3. Yes, I attended a certification course
4. No

8. Was the course mandatory?
1. Yes, it was mandatory
2. No, it was voluntary/elective

9. Have you received any training/certificate programmes related to digital health during your practice as part of your continuing professional development?
1. Yes
2. No

10. Was the training course or certificate programme mandatory for your work?
1. Yes, it was mandatory as part of the job training
2. Yes, it was mandatory for other reasons
3. No, it was voluntary

Needs-based education: Locally determined, socially accountable, globally-connected, and quality assured education

11. Which of the following tools were covered in your pharmacy school/continuous professional development course? Please select those which apply.
1. Mobile applications
2. Big data/data science
3. Other Artificial Intelligence (AI) powered tools/services
4. Telemedicine/telehealth/virtual care
5. Online/remote (patient) counselling
6. Remote patient monitoring
7. Digital therapeutics
8. Digital medicine
9. Bots (e.g., chatbots, symptom checker bots)
10. Consumer/medical wearable technology
11. Online pharmacy
12. Blockchain technology
13. e-Dispensing
14. e-Prescribing
15. Electronic health record: information systems/patient-generated health data
16. Other ______________________________

12. How confident are you in using these tools/services to deliver digital health services in your practice?

	Not confident at all	Not confident	Somewhat confident	Confident	Very confident
Mobile applications	❑	❑	❑	❑	❑
Big data/data science	❑	❑	❑	❑	❑
Other Artificial Intelligence (AI) powered tools/services	❑	❑	❑	❑	❑
Telemedicine/telehealth/virtual care	❑	❑	❑	❑	❑
Online/remote (patient) counselling	❑	❑	❑	❑	❑
Remote patient monitoring	❑	❑	❑	❑	❑
Digital therapeutics	❑	❑	❑	❑	❑
Digital medicine	❑	❑	❑	❑	❑

Bots (e.g., chatbots, symptom checker bots)	❑	❑	❑	❑	❑
Consumer/medical wearable technology	❑	❑	❑	❑	❑
Online pharmacy	❑	❑	❑	❑	❑
Blockchain technology	❑	❑	❑	❑	❑
e-Dispensing	❑	❑	❑	❑	❑
e-Prescribing	❑	❑	❑	❑	❑
Electronic health record: information systems/patient-generated health data	❑	❑	❑	❑	❑
Other	❑	❑	❑	❑	❑

13. What are the expected outcome(s) of using digital health tools/services in your practice? Please select those which apply

	Improved pharmaceutical care	Improved access to care	Improved patient experience	Improved health and well-being	Efficient use of resources (workforce, time, finance)	Other
Mobile applications	❑	❑	❑	❑	❑	❑
Big data/data science	❑	❑	❑	❑	❑	❑
Other Artificial Intelligence (AI) powered tools/services	❑	❑	❑	❑	❑	❑
Telemedicine/telehealth/virtual care	❑	❑	❑	❑	❑	❑
Online/remote (patient) counselling	❑	❑	❑	❑	❑	❑
Remote patient monitoring	❑	❑	❑	❑	❑	❑
Digital therapeutics	❑	❑	❑	❑	❑	❑
Digital medicine	❑	❑	❑	❑	❑	❑
Bots (e.g., chatbots, symptom checker bots)	❑	❑	❑	❑	❑	❑
Consumer/medical wearable technology	❑	❑	❑	❑	❑	❑
Online pharmacy	❑	❑	❑	❑	❑	❑
Blockchain technology	❑	❑	❑	❑	❑	❑
e-Dispensing	❑	❑	❑	❑	❑	❑
e-Prescribing	❑	❑	❑	❑	❑	❑
Electronic health record: information systems/patient-generated health data	❑	❑	❑	❑	❑	❑
Other	❑	❑	❑	❑	❑	❑

14. In your pharmacy school or continuous professional development training, which of the following concepts were covered in the context of digital health? Please select those which apply

1. Ethics and compliance
2. Innovation and creativity
3. Data privacy and security
4. Management and leadership
5. Entrepreneurship
6. Digital accessibility
7. Patient empowerment
8. Reimbursement/remuneration for providing digital health services, such as virtual care
9. Digital health literacy
10. Clinical reasoning and decision making
11. Evidence-based digital medicine
12. Cyber security
13. Other ___________

15. Which of the following competencies have you gained after taking the digital health courses or lectures? Please select those which apply.

1. Technology literacy
2. Design thinking
3. Service design
4. Entrepreneurship
5. Patient-centred digital health
6. Knowledge of digital health tools
7. Technology confidence
8. Quality assurance and improvement
9. Compliance/ethics
10. Intraprofessional and interprofessional collaboration
11. Familiarity with health systems and healthcare

12. Familiarity in interpreting and working with different types of health data
13. e-Professionalism
14. Other __________

16. How confident are you in the competencies that you have gained after taking the digital health courses or lectures?

	Not confident at all	Not confident	Somewhat confident	Confident	Very confident
Technology literacy	❑	❑	❑	❑	❑
Design thinking	❑	❑	❑	❑	❑
Service design	❑	❑	❑	❑	❑
Entrepreneurship	❑	❑	❑	❑	❑
Patient-centred digital health	❑	❑	❑	❑	❑
Knowledge of digital health tools	❑	❑	❑	❑	❑
Technology confidence	❑	❑	❑	❑	❑
Quality assurance and improvement	❑	❑	❑	❑	❑
Compliance/ethics	❑	❑	❑	❑	❑
Intraprofessional and interprofessional collaboration	❑	❑	❑	❑	❑
Familiarity with health systems and healthcare	❑	❑	❑	❑	❑
Familiarity in interpreting and working with different types of health data	❑	❑	❑	❑	❑
e-Professionalism	❑	❑	❑	❑	❑
Other	❑	❑	❑	❑	❑

17. How often do you use digital health technologies in your practice?
1. Daily
2. Weekly
3. Monthly
4. A few times in a year
5. Not at all
6. Not applicable

18. In your opinion, what are the challenges of digital health according to your experience in your practice? Please select those which apply.
1. Data privacy issues
2. Security issues
3. Lack of familiarity/low acceptance at patient level
4. Lack of enabling policies and cooperation due to health system
5. Lack of enabling regulation, both of the technology and pharmacy services
6. Technical limitations such as lack of interoperability or access to necessary data
7. Lack of resources/reimbursement
8. Misinformation
9. Increase of health inequality due to inability of patients to afford technical devices
10. Less personal contact with healthcare professionals/patients
11. Other __________

19. To what extent do you agree or disagree that the content of the digital health education you received is relevant to pharmacy practice?
1. Strongly disagree
2. Disagree
3. Neither disagree nor agree
4. Agree
5. Strongly agree
6. Not applicable

20. What would you like to learn more about in order to use digital health effectively in your practice (e.g., tools/services, concepts, competencies, etc.)?

Infrastructures to support digital health in pharmacy education

This section asks you to provide information relating to support in delivering digital health activity.

21. Is digital health education/training included in the general strategic plan of your national pharmacy association(s)?

1. Yes
2. No
3. I don't know

22. Is any support, policy or guidance Available at your national/regional pharmacy organisations for the development of digital health skills?
    1. Yes
    2. No
    3. I don't know

23. Are there any long-term strategies defined by your national/regional pharmacy organisations to increase the scope and quality of digital health in practice?
    1. Yes
    2. No
    3. I don't know

24. Would you like to receive further support from pharmacy organisations or public agencies for the development of your digital health skills?
    1. Yes
    2. No

Outcomes & Impact: Impact of digital health in practice

This section asks you to provide information relating to the impact of digital health in practice.

25. How would you rate the impactfulness of digital health on collaboration with other healthcare providers?
    1. Not impactful
    2. Slightly impactful
    3. Moderately impactful
    4. Impactful
    5. Very impactful
    6. Not applicable

26. How would you rate the impactfulness of digital health on improving engagement with patients?
    1. Not impactful
    2. Slightly impactful
    3. Moderately impactful
    4. Impactful
    5. Very impactful
    6. Not applicable

27. How would you rate the usefulness of digital health tools/services in pharmacy practice?
    1. Not useful
    2. Slightly useful
    3. Moderately useful
    4. Useful
    5. Very useful
    6. Not applicable

28. What kind of support would you like to receive from FIP to improve your skills in digital health?

Thank you very much for completing this survey. FIP will publish the results of this survey in a Global Report on Digital Health in Pharmacy Education. Would you like to receive a copy of the report?
    1. I would like to receive a copy of the FIP Global Report on Digital Health in Pharmacy Education.
    2. No, I don't like to receive a copy of the report.

D. Survey for faculty members

This section asks you to provide information relating to you.

1. Currently, in which country do you live?

2. Name of your university:

3. City/Town:

4. Website of your university:

5. Your position/job title:

6. Type of your university:

1. Public
2. Private
3. Other ______________________________

Process: Processes for digital health in pharmacy education

This section asks you to provide information related to processes in your pharmacy school which involve delivering digital health in pharmacy education.

7. Is digital health being taught in your pharmacy school? (Digital health is the field of knowledge and practice associated with the development and use of digital technologies to improve health. Digital health expands the concept of e-Health to include digital consumers, with a wider range of smart devices and connected equipment. It also encompasses other uses of digital technologies for health such as the internet of things, artificial intelligence, big data and robotics.)

1. Yes, it is a standalone course
2. Yes, it is integrated in already existing courses
3. No
4. I don't know

8. Is digital health being taught in a mandatory or elective course in your pharmacy school? Please select those which apply.

1. Mandatory
2. Elective
3. Through an optional certificate programme
4. I don't know

9. In which of the following degrees does your pharmacy school provide courses on digital health to your students?

1. B.Pharm
2. M.Pharm
3. Pharm.D
4. Other __________

10. In which year does your pharmacy school provide courses on digital health to your students?Please select those which apply.

1. First year
2. Second year
3. Third year
4. Fourth year
5. Fifth year
6. Other __________

11. How many lectures are allocated to digital health in your pharmacy school?

1. 1–2 lectures over an academic year
2. 3 or more lectures over an academic year
3. An entire module or course within the curriculum
4. I don't know

12. How does your pharmacy school provide the courses on digital health to your students? Please select those which apply.

1. In a classroom setting
2. In a practice setting, e.g., hospital

3. In a virtual setting
4. I don't know

13. Who is delivering the digital health courses or lectures offered in your pharmacy school?Please select those which apply.
1. Lecturer(s) from pharmacy department
2. Lecturer(s) from other departments
3. Guest speaker(s) from digital health industry
4. Visiting faculty
5. I don't know
6. Other __________

14. Is digital health taught to pharmacy students separately or as part of interprofessional education together with other students? Please select those which apply.
1. Only to pharmacy students
2. With other healthcare students (e.g., medicine, nursing, etc)
3. With other disciplines (e.g., engineering, etc)
4. I don't know

Needs-based education: Locally determined, socially accountable, globally connected, and quality assured education

This section asks you to provide information relating to programmes which have been prepared for your students on digital health in pharmacy education.

15. Do you agree or disagree with the following statement?

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
My students are equipped with the competencies to deliver digital health services after graduation.	❑	❑	❑	❑	❑
In the ever-changing landscape of digital health, my school is able to readily identify and include new digital health skills/competencies in the curriculum as they emerge in practice.	❑	❑	❑	❑	❑

16. Which of these tools/services are covered in digital health education in your pharmacy school? Please select those which apply.
1. Mobile applications
2. Big data/data science
3. Other Artificial Intelligence (AI) powered tools/services
4. Telemedicine/telehealth/virtual care
5. Online/remote (patient) counselling
6. Remote patient monitoring
7. Digital therapeutics
8. Digital medicine
9. Bots (e.g., chatbots, symptom checker bots)
10. Consumer/medical wearable technology
11. Online pharmacy
12. Blockchain technology
13. e-Dispensing
14. e-Prescribing
15. Electronic health record: information systems/patient-generated health data
16. Other ______________________________

17. Which of the following concepts are covered in digital health education in your pharmacy school? Please select those which apply.
1. Ethics and compliance
2. Innovation and creativity
3. Data privacy and security
4. Management and leadership
5. Entrepreneurship
6. Digital accessibility
7. Patient empowerment
8. Reimbursement/remuneration for providing digital health services, such as virtual care
9. Digital health literacy
10. Clinical reasoning and decision making
11. Evidence-based digital medicine
12. Cyber security
13. Other ______________________________

18. Which of the following infrastructures are provided to support digital health education in your pharmacy school? Please select those which apply.
1. Laboratory to test digital health concepts and tools

2. Access to clinical care digital platforms or software
3. Analytics/statistical software or other relevant data management tools
4. Active learning sessions
5. Capstone
6. e-Learning
7. Hackathon
8. Living lab
9. Masterclass
10. Product/idea pitch presentation to a panel
11. Testing devices
12. I don't know
13. Other

19. What are the competencies that are linked to the learning outcomes of your digital health courses or lectures in your pharmacy school? Please select those which apply.
1. Technology literacy
2. Design thinking
3. Service design
4. Entrepreneurship
5. Patient-centred digital health
6. Knowledge of digital health tools
7. Technology confidence
8. Quality assurance and improvement
9. Compliance/ethics
10. Intraprofessional and interprofessional collaboration
11. Familiarity with health systems and healthcare
12. Familiarity in interpreting and working with different types of health data
13. e-Professionalism
14. I don't know
15. Other ________________________________

20. Does your pharmacy school provide any postgraduate courses on digital health in pharmacy education?
1. Yes
2. No
3. I don't know _________

21. Does your pharmacy school provide any certificate programmes on digital health to practising pharmacists as part of continuous education or continuous professional development (not linked to a degree)?
1. Yes
2. No
3. I don't know

Structure: Academic infrastructures to support digital health in pharmacy education

This section asks you to provide information related to infrastructures at your pharmacy school for delivering digital health education.

22. Is digital health education included in the general strategic plan of your university or pharmacy school?
1. Yes
2. No
3. I don't know

23. Is any support, policy or guidance Available at your national/regional pharmacy organisations for the development of digital health courses or lectures in your pharmacy school?
1. Yes
2. No
3. I don't know

24. Are there any challenges faced by your pharmacy school in providing education on digital health? Please select those which apply.
1. Lack of guidance
2. Lack of resources
3. Lack of experts to facilitate learning experience
4. Lack of time
5. Lack of interest among faculty members
6. Lack of interest among school leadership
7. Lack of interest among students
8. I don't know
9. Other __________

Outcomes & Impact: Impact of digital health in practice

This section asks you to provide information relating to the impact of digital health in practice.

25. What are the desired outcomes of including digital health in the curriculum? Please select those which apply.
   1. Digital health applied in practice settings
   2. Advancing pharmacy practice
   3. Outreach activities carried out by the school to disseminate awareness of digital health
   4. Increase the value of the pharmacy programme for prospective students
   5. Expanding employment options for graduates
   6. Students to gain transferable skills
   7. I don't know

26. What kind of support would you like to receive from your school to teach/deliver digital health education effectively in your pharmacy school?

27. What kind of support would you like to receive from FIP to deliver digital health in your pharmacy school?

Thank you very much for completing this survey. FIP will publish the results of this survey in a Global Report on Digital Health in Pharmacy Education. Would you like to receive a copy?
   1. I would like to receive a copy of the FIP Global Report on Digital Health in Pharmacy Education.
   2. No, I don't like to receive a copy of the report.

Are you interested in teaching and training digital health courses or lectures?
   1. Yes
   2. No

Are you interested in learning about digital health?
   1. Yes
   2. No

Are you interested in learning about digital health?
   1. Yes
   2. No

8. What are the top three tools/services you would be interested to teach on digital health education in your pharmacy school?
   1. Mobile applications
   2. Big data/data science
   3. Other Artificial Intelligence (AI) powered tools/services
   4. Telemedicine/telehealth/virtual care
   5. Online/remote (patient) counselling
   6. Remote patient monitoring
   7. Digital therapeutics
   8. Digital medicine
   9. Bots (e.g., chatbots, symptom checker bots)
   10. Consumer/medical wearable technology
   11. Online pharmacy
   12. Blockchain technology
   13. e-Dispensing
   14. e-Prescribing
   15. Electronic health record: information systems/patient-generated health data
   16. Other ________________________________

9. What are the top three concepts you would be interested to teach in digital health education in your pharmacy school?
   1. Ethics and compliance
   2. Innovation and creativity
   3. Data privacy and security
   4. Management and leadership
   5. Entrepreneurship
   6. Digital accessibility
   7. Patient empowerment
   8. Reimbursement/remuneration for providing digital health services, such as virtual care
   9. Digital health literacy
   10. Clinical reasoning and decision making
   11. Evidence-based digital medicine

12. Cyber security
13. Other ______________________________

10. What are the top three infrastructures would you wish to provide in your pharmacy school to support digital health education

1. Laboratory to test digital health concepts and tools
2. Access to clinical care digital platforms or software
3. Analytics/statistical software or other relevant data management tools
4. Active learning sessions
5. Capstone
6. e-Learning
7. Hackathon
8. Living lab
9. Masterclass
10. Product/idea pitch presentation to a panel
11. Testing devices
12. Other _________

11. What are the top three competencies that you perceive as essential linked to the learning outcomes of digital health courses in your pharmacy school?

1. Technology literacy
2. Design thinking
3. Service design
4. Entrepreneurship
5. Patient-centred digital health
6. Knowledge of digital health tools
7. Technology confidence
8. Quality assurance and improvement
9. Compliance/ethics
10. Intraprofessional and interprofessional collaboration
11. Familiarity with health systems and healthcare
12. Familiarity in interpreting and working with different types of health data
13. e-Professionalism
14. Other ______________________________

12. Is digital health education included in the general strategic plan of your university or pharmacy school?

1. Yes
2. No
3. I don't know

13. Has your university or pharmacy school made a decision to incorporate digital health education/training into the pharmacy curriculum in the future?

1. Yes
2. No
3. I don't know

14. Is any support, policy or guidance Available at your national/regional pharmacy organisations to start digital health courses in your pharmacy school?

1. Yes
2. No
3. I don't know

15. What are the top three key challenges faced by your pharmacy school resulting in not providing digital health education?

1. Lack of guidance
2. Lack of resources
3. Lack of experts to facilitate learning experience
4. Lack of time
5. Lack of interest among faculty
6. Lack of interest among school leadership
7. Lack of interest among students
8. Other _________
9. Not applicable

16. What are the top three desired outcomes of including digital health in the curriculum of your pharmacy school?

1. Digital health applied in practice settings
2. Advancing pharmacy practice
3. Outreach activities carried out by school to disseminate awareness of digital health
4. Increase value of the pharmacy program for prospective students
5. Expanding employment options for graduates
6. Students to gain transferable skills
7. Other _________
8. Not applicable

17. What kind of support would you like to receive from FIP to support the delivery of digital health in your pharmacy school?

Thank you very much for completing this survey. FIP will publish the results of this survey in a Global Report on Digital Health in Pharmacy Education. Would you like to receive a copy of the report?

1. I would like to receive a copy of the FIP Global Report on Digital Health in Pharmacy Education.
2. No, I don't like to receive a copy of the report.

8. How do you rate your knowledge of the use of digital health tools/services?

1. None
2. Some
3. Reasonable
4. Good
5. Very good
6. Not applicable

9. Give your own definition of digital health in few words.

10. What are the top three tools/services you would be interested to learn about in digital health education in your pharmacy school?

1. Mobile applications
2. Big data/data science
3. Other Artificial Intelligence (AI) powered tools/services
4. Telemedicine/telehealth/virtual care
5. Online/remote (patient) counselling
6. Remote patient monitoring
7. Digital therapeutics
8. Digital medicine
9. Bots (e.g., chatbots, symptom checker bots)
10. Consumer/medical wearable technology
11. Online pharmacy
12. Blockchain technology
13. e-Dispensing
14. e-Prescribing
15. Electronic health record: information systems/patient-generated health data
16. Other ______________________________

11. What are the top three infrastructures you would wish to have in your pharmacy school in order to learn about digital health?

1. Laboratory to test digital health concepts and tools
2. Access to clinical care digital platforms or software
3. Analytics/statistical software or other relevant data management tools
4. Active learning sessions
5. Capstone
6. e-Learning
7. Hackathon
8. Living lab
9. Masterclass
10. Product/idea pitch presentation to a panel
11. Testing devices

12. What are the top three skills that you would like to gain in digital health?

1. Technology literacy
2. Design thinking
3. Service design
4. Entrepreneurship
5. Patient-centred digital health
6. Knowledge of digital health tools
7. Technology confidence
8. Quality assurance and improvement
9. Compliance/ethics
10. Intraprofessional and interprofessional collaboration

11. Familiarity with health systems and healthcare
12. Familiarity in interpreting and working with different types of health data
13. e-Professionalism
14. Other ______________________________

13. Is any support or guidance Available at your school about employment opportunities in digital health?
   1. Yes
   2. No
   3. I don't know

14. After you graduate, do you have any career plans to focus on digital health in pharmacy practice?
   1. Yes
   2. No
   3. I am not sure

15. Is any support or guidance Available at your national/regional pharmacy students association for digital health education/skills?
   1. Yes
   2. No
   3. I don't know

16. What kind of support would you like to receive from FIP to improve your skills in digital health?

Thank you very much for completing this survey. FIP will publish the results of this survey in a Global Report on Digital Health in Pharmacy Education. Would you like to receive a copy of the report?
   1. I would like to receive a copy of the FIP Global Report on Digital Health in Pharmacy Education.
   2. No, I don't like to receive a copy of the report.

Needs-based education: Locally determined, socially accountable, globally connected, and quality assured education

10. What are the top three tools/services you would be interested to learn about in digital health education?
   1. Mobile applications
   2. Big data/data science
   3. Other Artificial Intelligence (AI) powered tools/services
   4. Telemedicine/telehealth/virtual care
   5. Online/remote (patient) counselling
   6. Remote patient monitoring
   7. Digital therapeutics
   8. Digital medicine
   9. Bot (e.g. chatbots, symptom checker bots)
   10. Consumer/medical wearable technology
   11. Online pharmacy
   12. Blockchain Technology
   13. E-dispensing
   14. E-prescribing
   15. Electronic health record: information systems/patient-generated health data
   16. Other __________

11. Which of the following digital health tools/services do you use in your practice? Please select those which apply.
   1. Mobile applications
   2. Big data/data science
   3. Other Artificial Intelligence (AI) powered tools/services
   4. Telemedicine/telehealth/virtual care
   5. Online/remote (patient) counselling
   6. Remote patient monitoring
   7. Digital therapeutics
   8. Digital medicine
   9. Bots (e.g., chatbots, symptom checker bots)
   10. Consumer/medical wearable technology
   11. Online pharmacy
   12. Blockchain technology
   13. e-Dispensing
   14. e-Prescribing
   15. Electronic health record: information systems/patient-generated health data
   16. Other __________

12. How often do you use digital health technologies in your practice?
   1. Daily

2. Weekly
3. Monthly
4. A few times in a year
5. Not at all
6. Not applicable

13. In your opinion, what are the benefits of digital health according to your experience in your practice? Please select those which apply.

1. Time saving
2. User friendly
3. Reliable
4. Improved access to healthcare and improved health outcome
5. Patient safety and empowerment
6. Decreased cost
7. Improved outcomes of medicines use
8. Other __________

14. In your opinion, what are the challenges of digital health according to your experience in your practice? Please select those which apply.

1. Data privacy issues
2. Security issues
3. Lack of familiarity/low acceptance at patient level
4. Lack of enabling policies and cooperation due to health system
5. Lack of enabling regulation, both of the technology and pharmacy services
6. Technical limitations such as lack of interoperability or access to necessary data
7. Lack of resources/reimbursement
8. Misinformation
9. Increase of health inequality due to inability of patients to afford technical devices
10. Less personal contact with healthcare professionals/patients
11. Other __________

15. What would you like to learn more about in order to use digital health effectively in your practice (e.g., tools/services, concepts, competencies etc.)?

Infrastructures to support digital health in pharmacy education

This section asks you to provide information relating to support in delivering digital health activity.

16. Is digital health education/training included in the general strategic plan of your national pharmacy association(s)?

1. Yes
2. No
3. I don't know

17. Is any support, policy or guidance Available at your national/regional pharmacy organisations for the development of digital health skills?

1. Yes
2. No
3. I don't know

18. Are there any long-term strategies defined by your national/regional pharmacy organisations to increase the scope and quality of digital health in practice?

1. Yes
2. No
3. I don't know

19. Would you like to receive further support from pharmacy organisations or public agencies for the development of your digital health skills?

1. Yes
2. No

Outcomes & Impact: Impact of digital health in practice

This section asks you to provide information relating to the impact of digital health in your practice

20. How would you rate the impactfulness of digital health on collaboration with other healthcare providers?

1. Not impactful
2. Slightly impactful
3. Moderately impactful
4. Impactful

5. Very impactful
6. Not applicable

21. How would you rate the impactfulness of digital health on improving engagement with patients?
    1. Not impactful
    2. Slightly impactful
    3. Moderately impactful
    4. Impactful
    5. Very impactful
    6. Not applicable

22. How would you rate the usefulness of digital health tools/services in pharmacy practice?
    1. Not useful
    2. Slightly useful
    3. Moderately useful
    4. Useful
    5. Very useful
    6. Not applicable

23. What kind of support would you like to receive from FIP to improve your skills in digital health?

Thank you very much for completing this survey. FIP will publish the results of this survey in a Global Report on Digital Health in Pharmacy Education. Would you like to receive a copy of the report?
1. I would like to receive a copy of the FIP Global Report on Digital Health in Pharmacy Education.
2. No, I don't like to receive a copy of the report.

Annex 3 — Glossary developed to accompany the FIP digital health in pharmacy education survey

The purpose of this glossary is to support FIP digital health in pharmacy education survey respondents with an understanding of digital health terminology.

Definitions

Active learning — Instructional techniques that allow learners to participate in learning and teaching activities, to take the responsibility for their own learning, and to establish connections between ideas by analysing, synthesising, and evaluating. See https://link.springer.com/referenceworkentry/10.1007%2F978-1-4419-1428-6_489

Analytics/statistical software — Analytics is the extensive use of data, statistical and quantitative analysis, exploratory and predictive models, and fact-based management to drive decisions and actions. Many statistical software programs such as SAS, Stata, SPSS, Microsoft Excel are commonly used for statistical analysis. See https://bmchealthservres.biomedcentral.com/articles/10.1186/1472-6963-11-252 and https://www.tandfonline.com/doi/full/10.1080/2573234X.2018.1507605

Artificial intelligence — Simulation of human intelligence processes by machines, especially computer systems that work and react like human beings. Specific applications of AI include expert systems, natural language processing (NLP), speech recognition and machine vision. See https://www.who.int/docs/defaultsource/documents/gs4dhoc510c483a9a42b1834a8f4d276c6352.pdf and https://searchenterpriseai.techtarget.com/definition/AI-Artificial-Intelligence

Big data — Datasets that are not only big, but also high in variety and velocity, which makes them difficult to handle using traditional tools and techniques. See https://link.springer.com/chapter/10.1007/978-3-319-08976-8_16

Blockchain — An immutable ledger or database, shared by peers in a network, in which records of events or transactions are appended in a chronological order. One important feature of blockchain that is clearly beneficial to healthcare applications is decentralisation, which makes it possible to implement distributed healthcare applications that do not rely on a centralised authority. See https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6627742/

Bots — The word "bot" is a reduction of "robot". These software automations undertake tasks online, acting as surrogates for humans and performing some repetitive informational task. (e.g., chat bots, symptom checker bots). See https://www.tandfonline.com/doi/full/10.1080/19331681.2018.1448735

Capstone — Many graduate programmes have a capstone, thesis or practicum as one of their last courses. These programme-terminating courses enable schools to assess the effectiveness of their programme, provide opportunities for experiential learning, and provide closure for students as they complete the programme. See https://dl.acm.org/doi/10.1145/2047456.2047467

Certification courses — Highly specialised programmes intended to help a person delve deeply into one specific area of study. Some of these programmes can also prepare students to gain an official certification and can be a quick way to gain experience to supplement work or college qualifications. See https://www.griffith.ie/admissions/postgraduate/which-course-right-me

Cyber security — The application of technologies, processes and controls to protect systems, networks, programs, devices and data from cyber-attacks. It aims to reduce the risk of cyber-attacks and protect against the unauthorised exploitation of systems, networks and technologies. See https://www.itgovernance.co.uk/what-is-cybersecurity

Data privacy and security — Data privacy is focused on the use and governance of individual data: things like putting policies in place to ensure that consumers' personal information is being collected, shared and utilised in appropriate ways. Security concentrates more on protecting data from malicious attacks and the misuse of stolen data for profit. While security is fundamental for protecting data, it is not sufficient for addressing privacy. See https://link.springer.com/article/10.1186/s40537-016-0059-y

Data science — Coupling of scientific discovery and practice which involves the collection, management, processing, analysis, visualisation and interpretation of vast amounts of heterogeneous data associated with a diverse array of scientific, translational and inter-disciplinary applications. See https://amstat.tandfonline.com/doi/full/10.1080/10618600.2017.1384734

Design thinking — An analytic and creative process that engages a person in opportunities to experiment, create and prototype models, gather feedback, and redesign. See https://journals.sagepub.com/doi/10.3102/0034654312457429

Digital accessibility — Access to technology products, resources, and services across hardware and software. See https://www.sciencedirect.com/science/article/pii/S0970389617301131

Digital health — The field of knowledge and practice associated with the development and use of digital technologies to improve health. Digital health expands the concept of e-health to include digital consumers, with a wider range of smart devices and connected equipment. It also encompasses other uses of digital technologies for health such as the Internet of things, artificial intelligence, big data and robotics. See https://www.who.int/docs/default-source/documents/gs4dhdaa2a9f352b0445bafbc79ca799dce4d.pdf

Digital medicine — The use of digital tools to upgrade the practice of medicine to one that is high-definition and far more individualised. It encompasses our ability to digitise human beings using biosensors that track our complex physiologic systems, but also the means to process the vast data generated via algorithms, cloud computing, and artificial intelligence. See https://www.nature.com/articles/s41746-017-0005-1

Digital therapeutics — A concept that encompasses the therapeutic approaches that are used to change a patient's behaviour using a variety of digital technologies and ultimately to treat diseases or promote health. See https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6393746

e-Dispensing — The act of electronically retrieving a prescription and reporting on giving out the medicine to the patient as indicated in the corresponding e-prescription. See https://usecase-repository.ihe-europe.net/content/e-prescription-and-e-dispensing-cross-border-scale

e-Health — The use of information and communication technologies for health. See https://www.who.int/ehealth

Electronic health records — Digital forms of patient records that include patient information such as personal contact information, patient's medical history, allergies, test results, and treatment plan. Some benefits of EHRs include improving efficiency, increasing positive patient outcomes and improving population health. See https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6182727/

Entrepreneurship — An individual's ability to turn ideas into action. It includes creativity, innovation and risk taking, as well as the ability to plan and manage projects in order to achieve objectives. See https://ec.europa.eu/growth/smes/promoting-entrepreneurship_en

e-Prescribing — Prescribing method in which the prescriber generates the prescription electronically. See https://www.hiqa.ie/sites/default/files/2018-06/EPrescribing.pdf

e-Professionalism — The attitudes and behaviours reflecting traditional professionalism paradigms but manifested through digital media. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5289725/

Hackathons — Techno-creative events during which participants get together in a physical location or virtually, work individually or in teams, usually for several days, and develop projects such as hardware or software prototypes. See https://journals.sagepub.com/doi/10.1177/1354856517709405 and https://www.beyondhealthhack.com/

Health applications (apps) — Any commercially available health or fitness application with capacity for self-monitoring. See https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4876999/

Health literacy — Refers to how people obtain, understand, use, and communicate about health information to make informed decisions. See https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5069402/

Living labs — Methodology of innovation that enables collaborative learning by users, producers and researchers in a real-life environment, in which user-needs are central. Aside from innovation methodology, the term "living labs" often also refers to the (temporary) organisational structure in which the methodology is implemented. See https://journals.sagepub.com/doi/full/10.1177/2399654417753623

Masterclass — A session of tuition by an expert for exceptional students. See https://www.mskscienceandpractice.com/article/S1356-689X(14)00048-4/fulltext

m-Health (mobile health) — Medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants and other wireless devices. See https://www.who.int/goe/publications/goe_mhealth_web.pdf

Mobile applications — Software applications that are designed to run on phones, tablets, and other mobile electronic devices. See https://www.sciencedirect.com/science/article/pii/S2095756416302690

National pharmacy associations — National organisations which advance the pharmacy profession, including pharmacists, pharmaceutical scientists, student pharmacists and pharmacy technicians. They are involved in carrying out various collaborative professional activities that include organising training programmes for professionals from industry, academia, regulatory affairs and practice. See https://www.pharmacist.com/about-apha and https://ipapharma.org/

Online pharmacy — An internet-based legal vendor, which sells medicine and may operate as an independent internet-only site, an online branch of a "brick-and-mortar" pharmacy, or sites representing a partnership among pharmacies. See https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6125612/

Online/remote (patient) counselling — Professional counselling help in which the counsellor and the person being counselled communicate with each other via electronic devices. See https://files.eric.ed.gov/fulltext/EJ1250423.pdf

Patient-generated health data — Health-related data, which includes health history, symptoms, biometric data, treatment history, lifestyle choices, and other information-created, recorded, gathered, or inferred by or from patients or their carers or those who assist them to help address a health concern. See https://pubmed.ncbi.nlm.nih.gov/25248998

Postgraduate programme — Programme after completing an undergraduate degree. Postgraduate courses include graduate diploma, master and PhD. See https://gotovu.custhelp.com/app/answers/detail/a_id/957

Remote patient monitoring — Use of digital technologies to collect health data from individuals in one location, such as a patient's home, and electronically transmit the information to healthcare providers in a different location for assessment and recommendations (e.g., home laboratory testing). See https://www.cchpca.org/about/about-telehealth/remote-patient-monitoring-rpm

Service design — A particular domain within design that deals with how exchanges between service providers and users (e.g., between healthcare providers, patients, and their significant others) can be improved upon, by proposing changes. See https://www.tandfonline.com/doi/full/10.1080/24735132.2017.1386944

Technological literacy — The ability to use, manage, assess and understand technology. See https://link.springer.com/article/10.1007/s10798-009-9108-6

Telehealth — Telehealth involves the use of telecommunications and virtual technology to deliver healthcare outside traditional healthcare facilities. Telehealth, which requires access only to telecommunications, is the most basic element of e-health, which uses a wider range of information and communications technologies. See https://www.who.int/docs/default-source/documents/gs4dhoc510c483a9a42b1834a8f4d276c6352.pdf

Telemedicine — The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communications technologies for the exchange of valid information for diagnosis, treatment and prevention of disease, research and evaluation, and the continuing education of healthcare workers, with the aim of advancing the health of individuals and communities. See https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6334286

Virtual care — A broad term meant to capture all clinical interactions in healthcare that do not involve the patient and provider being in the same room at the same time. See https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5479398

Wearable technology — Item (often with electronic capabilities) worn with acceptable function and aesthetic properties, consisting of a simple interface to perform set tasks to satisfy needs of a specific group. These may be worn as an accessory, incorporated in clothing, or as an implant (more permanent and invasive). See https://www.researchgate.net/publication/327542210_Wearable_Technology_Present_and_Future

Annex 4 — Country distributions of responses

ISO Code	Country	WHO region	World Bank income level	Academics	Students	Practitioners	Total
ALB	Albania	Europe	Upper middle	1			1
DZA	Algeria	Africa	Lower middle		2		2
AND	Andorra	Europe	High			1	1
ARG	Argentina	Americas	Upper middle	2	1	13	16
ARM	Armenia	Europe	Upper middle	1		1	2
AUS	Australia	Western Pacific	High	13	1	7	21
BGD	Bangladesh	South East Asia	Lower middle	1	1		2
BEL	Belgium	Europe	High			1	1
BEN	Benin	Africa	Lower middle		1	3	4
BOL	Bolivia	Americas	Lower middle	1			1
BRA	Brazil	Americas	Upper middle	14	21	41	76
BGR	Bulgaria	Europe	Upper middle	1		3	4
CMR	Cameroon	Africa	Lower middle			5	5
CAN	Canada	Americas	High			1	1
CHL	Chile	Americas	High			3	3
CHN	China	Western Pacific	Upper middle			1	1
TWN	China Taiwan	Western Pacific	High	2		5	7
COL	Colombia	Americas	Upper			4	4
CRI	Costa Rica	Americas	Upper	1		1	2
HRV	Croatia	Europe	High			3	3
CYP	Cyprus	Europe	High	2		1	3
DNK	Denmark	Europe	High			1	1
DOM	Dominican Republic	Americas	Upper middle	1		1	2
ECU	Equador	Americas	Upper middle		1	3	4
EGY	Egypt	Eastern Mediterranean	Lower middle	1			1
EST	Estonia	Europe	High	1			1
FIN	Finland	Europe	High	2	1	1	4
FRA	France	Europe	High	1	2	2	5
DEU	Germany	Europe	High			3	3
GHA	Ghana	Africa	Lower middle	5	2	7	14
GRC	Greece	Europe	High	2			2
HTI	Haiti	Americas	Low			1	1
HND	Honduras	Americas	Lower middle			1	1
HKG	Hong Kong, China	Western Pacific	High	2			2
IND	India	South East Asia	Lower middle	31	18	8	57
IDN	Indonesia	South East Asia	Upper middle	6	4	9	19
IRQ	Iraq	Eastern Mediterranean	Upper middle	4	1		5
IRL	Ireland	Europe	High			2	2

ISO Code	Country	WHO region	World Bank income level	Academics	Students	Practitioners	Total
ITA	Italy	Europe	High	1			1
JPN	Japan	Western Pacific	High	1		2	3
JOR	Jordan	Eastern Mediterranean	Upper middle	6		6	12
KEN	Kenya	Africa	Lower middle	3	1	11	15
KOR	Korea, Republic of	Western Pacific	High		1	1	2
KWT	Kuwait	Eastern Mediterranean	High	2			2
LVA	Latvia	Europe	High	1			1
LBN	Lebanon	Eastern Mediterranean	Upper middle	4	2	8	14
MAC	Macao SAR, China	Western Pacific	High			1	1
MWI	Malawi	Africa	Low	1		1	2
MYS	Malaysia	Western Pacific	Upper middle	5	2	1	8
MLT	Malta	Europe	High	2	1		3
MEX	Mexico	Americas	Upper middle	5	1	4	10
MAR	Morocco	Eastern Mediterranean	Lower middle			1	1
NAM	Namibia	Africa	Upper middle			1	1
NPL	Nepal	South East Asia	Lower middle	3	5	2	10
NLD	Netherlands	Europe	High	2		5	7
NZL	New Zealand	Western Pacific	High	2		2	4
NGA	Nigeria	Africa	Lower middle	12	17	30	59
NOR	Norway	Europe	High	4	6	3	13
OMN	Oman	Eastern Mediterranean	High			1	1
PAK	Pakistan	Eastern Mediterranean	Lower middle	7	8	2	17
PRY	Paraguay	Americas	Upper middle	1			1
PER	Peru	Americas	Upper middle	1	1	1	3
PHL	Philippines	Western Pacific	Lower middle	10	3	21	34
POL	Poland	Europe	High		1		1
PRT	Portugal	Europe	High	5	4	7	16
ROU	Romania	Europe	High	1		1	2
RUS	Russian Federation	Europe	Upper middle	7	1		8
RWA	Rwanda	Africa	Low		7	1	8
SAU	Saudi Arabia	Eastern Mediterranean	High	1		1	2
SRB	Serbia	Europe	Upper middle		3		3
SLE	Sierra Leone	Africa	Low	1			1
SGP	Singapore	Western Pacific	High		11	1	12
SOM	Somalia	Africa	Low			1	1
ZAF	South Africa	Africa	Upper middle	5	3	3	11
ESP	Spain	Europe	High	26	119	207	352
LKA	Sri Lanka	South East Asia	Lower middle	1			1
LCA	St Lucia	Americas	Upper middle			1	1

ISO Code	Country	WHO region	World Bank income level	Academics	Students	Practitioners	Total
VCT	St Vincent and the Grenadines	Americas	Upper middle			4	4
SWE	Sweden	Europe	High	3		3	6
CHE	Switzerland	Europe	High		1	1	2
TZA	Tanzania	Africa	Lower middle	3		29	32
THA	Thailand	South East Asia	Upper middle	1		1	2
TUR	Turkey	Europe	Upper middle	15	10	6	31
UGA	Uganda	Africa	Low		3	1	4
UKR	Ukraine	Europe	Lower middle	2			2
ARE	United Arab Emirates	Eastern Mediterranean	High	1		3	4
GBR	United Kingdom	Europe	High	4		4	8
USA	United States of America	Americas	High	13	3	9	25
VEN	Venezuela	Americas	Upper middle	2			2
ZMB	Zambia	Africa	Lower middle	1	3	2	6
ZWE	Zimbabwe	Africa	Lower middle		1	3	4
Total				**260**	**274**	**526**	**1,060**

Annex 5 — FIP digital health in pharmacy education case study template

Using the format below, we invite you to contribute a 700-1500-word CASE STUDY on digital health in pharmacy education. You may find it easier to write your case study using the below TEMPLATE and then copy & paste your text directly into the sections in the web-platform to submit your case study.

Once you complete the template - please copy and paste directly into the web-platform at: *https://fipdigitalhealthcasestudies.questionpro.com*

The DEADLINE for submissions is 19 October 23:59 CEST. You may refer to a similar FIP case studies on higher education from this link to support you as an example. If you have any questions, please do not hesitate to contact us at education@fip.org

Do not send this form to FIP – only submissions made via the web-platform will be accepted.

Guidance for developing your case study	The case study you are submitting will provide a snapshot of good practices to pharmacy schools, educators and students from around the world and encourage them to roll out similar practice in their countries. As digital health in pharmacy (undergraduate & postgraduate & continuous) education is a relatively new area, we would like to provide guidance about areas that you may consider for your case studies. These areas could be, but are not limited to, approaches in: 1. Curriculum development 2. Teaching delivery and learning technology 3. Learning assessment 4. Experiential learning/placements Through this area we would like to explore many unknowns such as: Drivers for including digital health in curriculum; Setting up the vision for digital health education; Processes and stakeholders involved to ensure curriculum content is emerging, forward thinking; Processes and stakeholders involved in development & delivery of the digital health course; Multi-disciplinary learning strategies; Competency development and assessment in digital literacy and utilisation of technology; Advanced & specialist frameworks; and Employment opportunities in the digital health sector.
Title: *Case study title:*	
Author list: *Full first name followed by full surname/family name. Separation by comma ‘, ‘* *Example:* Nilhan Uzman, Xiao Yu Wang, Aukje Mantel	
Affiliations of authors: *One University affiliation (mailing address); include country.*	

Example: *University College, 29-39 Brunswick Square, London, UK.*	
Email address for corresponding author:	Corresponding author:
Keywords (maximum 4): *List in order, separated by commas.* *Example:* Curriculum, teaching methods, technology, assessment	Key words:
Abstract of work: A brief summary of the case study. Maximum 150 words. *As an example, this should be a brief overview of the case study, allowing readers to gain a rapid insight into the educational innovation being described below.*	Summary:
Background and context: Background, context, objectives, drivers. Maximum 250 words. *A brief introduction about the context of the case study, including the reasons and drivers for the case study.*	Background and context:
Educational description: Describe what you developed, how it was rolled out and what diverse resources you used. Maximum 500 words.	Educational description:
Outcomes, lessons learned and recommendations: Describe your outcomes and recommendations for others who might choose to adopt your approach(es) at their institution. What lessons have you learned and what conclusions can you draw from your work? Maximum 300 words.	Outcomes, lessons learned and recommendations:
Reference list (include DOIs where available): *Up to 5 references can be included, using numbers placed in the main text above – such as (1), (4), etc.* *Use this citation style:* *1. Name AA, Name BB, Name CC et al. Title of paper. Title of journal in full Year; Volume (Issue):000–000.* *2. International Pharmaceutical Federation. Nanjing Statements: Statements on pharmacy and pharmaceutical sciences education. The Hague: FIP, 2017.* *3. International Pharmaceutical Federation. Nanjing Statements: Statements on pharmacy and pharmaceutical sciences education. The Hague: FIP, 2017. Available at: https://www.fip.org/files/content/priority-areas/workforce/nanjing-statements.pdf (accessed 23 August 2020).*	References:

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