mHealth

Use of mobile health tools in pharmacy practice

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fip International Pharmaceutical Federation

Colophon

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Executive summary

In a world of constant technological advances, it is important that healthcare professionals make use of technology to support patients and provide health care to ensure an optimal quality of life. Mobile health (mHealth) uses mobile technologies to assist healthcare professionals in providing efficient and adequate patient care. Mobile applications play an important role in mHealth, as they allow users to access information quickly, at the touch of a finger. This report discusses how mHealth assists pharmacists in providing patients with the best care possible.

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 smart phones 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. mHealth mobile applications have the ability to support pharmacy practice, as well as patients' lives.

Although mHealth is constantly advancing in global health care, patient confidentiality risks, variable IT literacy and internet access requirements are barriers that stand between patients/healthcare providers and the ability to fully take advantage of mHealth technologies. The goal of mHealth in the field of pharmacy should be to support and assist individuals in providing safe, effective and efficient patient-centred care.

Executive summary

1 Introduction

Technology is rapidly evolving. The evolution of technology has benefited healthcare providers worldwide, including pharmacists and patients. With these ongoing advances, pharmacists can improve patient care through more efficient availability and communication of information.

Many low- and middle- income countries are facing challenges to provide timely and effective health care due to economic limitations, geographic barriers, workforce shortages and governance issues.[1] One solution to these challenges is mobile health (mHealth). mHealth involves the application of mobile devices and other forms of wireless technology to provide health care. In developed countries, mHealth is providing a modified level of service, such as online treatments, wearables, monitoring of health status, and prescriptions.[2] However, with the rapid growth and innovation in mHealth, there is a large focus on the application of mHealth on a global scale, especially in developing countries.

In May 2018, the 71st World Health Assembly adopted a resolution on mHealth and the use of appropriate digital technologies for public health. The resolution paves the way for the World Health Organization (WHO) to establish a global strategy on digital health that identifies priority areas, including where the WHO should focus its efforts, and engages countries to optimise their health systems in sync with the global digital health agenda.

A major goal of mHealth is to provide quality health education and pharmaceutical care to all patients to meet their healthcare needs.

As populations change throughout the world, their needs are also evolving. Pharmacists are healthcare professionals whose professional responsibilities and accountabilities include seeking to ensure that people derive maximum therapeutic benefit from their treatments with medicines. This requires them to keep abreast of developments in pharmacy practice and the pharmaceutical sciences, as well as advances in knowledge and technology relating to use of medicines. mHealth has a potential to support pharmacists in their key roles as defined by good pharmacy practice (GPP).[3]

Pharmaceutical care is a patient-centred, outcomes-oriented pharmacy practice that requires the pharmacist to collaborate with the patient and the patient's other healthcare providers to promote health, to prevent disease, and to assess, monitor, initiate and modify medicines use to ensure that drug therapy regimens are safe and effective.[4] The goal of pharmaceutical care is to optimise the patient's health-related quality of life (HRQoL), and achieve positive clinical and humanistic outcomes, within realistic economic expenditures. The requirement of providing safe and effective personalised care is becoming increasingly more significant, more importantly, within populations with varying socioeconomic backgrounds and demographical needs. The uptake of mobile technology in pharmacy practice varies according to geographic conditions, practice settings, regulation and resource availability. Advancements in technology have played a major role in enabling healthcare professionals to develop and mould their clinical and pharmaceutical skills to provide safe and effective care.

To keep up with the progress and support of technology, pharmacists require skills to evaluate the benefits, limitations and value of different mHealth options before introducing them in their practice. To assist pharmacists to evaluate and use mHealth applications effectively, the International Pharmaceutical Federation (FIP) has prepared this guidance document, which describes:

- **Benefits** of mHealth to the practice of pharmacy;
- **Functionality** and **examples** of mHealth applications in pharmacy practice; and
- Potential of **future innovations** which will support the advancement of pharmacy practice.

Readers should remain aware that mHealth is rapidly evolving, and although this document aims to provide a guide to mHealth applications, it is not exhaustive.

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[1]MEASURE Evaluation, *Routine Health Information Systems: A Curriculum on Basic Concepts and Practice — Facilitators' Guide,* 2017 <https://www.measureevaluation.org/resources/publications/sr-16-135b> [accessed 15 April 2018]

[2]Official HT, *Healthcare Tech Terms: What is mHealth? Examples and Definitions,* 2017 <http://www.healthcaretechnologies.com/healthcare-tech-definitions-examples-of-mhealth-applications-healthcare> [accessed 15 April 2018]

[3]International Pharmaceutical Federation (FIP), *Joint FIP/WHO guidelines on good pharmacy practice: standards for quality of pharmacy services*, 2011 <https://www.fip.org/www/uploads/database_file.php?id=331&table_id=> [accessed 18 June 2018]

[4]American Pharmacists Association, *Principles of Practice for Pharmaceutical Care*, 2018 <https://www.pharmacist.com/principles-practice-pharmaceutical-care> [accessed 15 April 2018]

1.1 mHealth definition

The World Health Organization (WHO), in collaboration with the Global Observatory for eHealth, has defined mHealth as "medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices".[5] Furthermore, mHealth is considered to be a component of eHealth (Figure 1). eHealth is a broad, umbrella term referring to the "health services and information delivered or enhanced through the Internet and related technologies".[6]
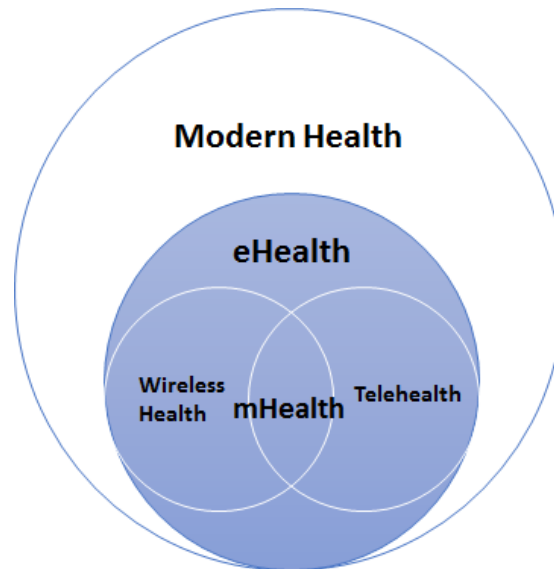

Figure 1. eHealth and mHealth Relationship [9]

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[5]World Health Organization (WHO), *mHealth: New Horizons for health through mobile technologies*. *Global Observatory for eHealth series, vol. 3,* 2011 <http://www.who.int/goe/publications/goe_mhealth_web.pdf> [accessed 14 April 2018]
[6]Eysenbach, G. 'What is e-health?' *Journal of medical Internet research* vol. 3.2 (2001): E20.

2 Current situation

2.1 Types of mHealth

There are different types of mHealth technologies available worldwide. These technologies appear in different devices and across a large spectrum. Some mHealth devices are mobile applications pre-loaded with information available at the touch of a fingertip, while others require additional devices to be "clipped" or "fitted" onto the mobile phone itself to become a diagnostic tool. These tools have the capability to support healthcare providers and provide real-time results.

For the purpose of this document, a selection of examples has been made based on criteria of being developed by pharmacy professional associations. Although there are many more examples of commercially available mHealth apps developed by industry and other stakeholders, those apps are not covered in this document. mHealth is a massive area. Examples of apps that are intended to be used by pharmacists to support their daily activities are explained in detail. There are many other mHealth apps for use by patients to facilitate them in their disease- and/or health-management; these will not be covered in this document.

2.1.1 Mobile applications

Currently, there are many mobile apps that aid healthcare providers. These range from reference apps, such as national formularies and literature databases, to more diagnostic or practical apps to support day-to-day practice, such as apps providing medical advice, or connecting to GPs. Reference apps are used by healthcare providers to provide quick, evidence-based medical information. These apps are updated regularly. Diagnostic apps allow healthcare providers to provide information to and gather data from their patients about their health, to formulate differential diagnoses, and to provide self-care solutions. Practical apps provide logistical support to healthcare providers. For example, Pro Delivery Manager provides pharmacies with the ability to track their deliveries and ensure their drivers are delivering medicines safely to their patients.

2.1.2 Other mobile device tools

Mobile devices also play a role within mHealth. These devices fit onto smartphones to convert them into a diagnostic tool. For example, a clip-on device converts a smartphone camera into an otoscope. Other devices include wireless blood pressure monitors and pulse oximeters. Mobile devices allow healthcare professionals to provide real-time results to their patients; for example, when the otoscope device is used, patients can view a photograph of their ear canal after the healthcare provider has examined them.

2.2 mHealth and pharmacists

Pharmacists should endeavour to engage with mHealth. There are various technologies available to enable and support pharmacists within their role. As described under 2.1.1, reference applications and diagnostic devices support the future model of the evolving role of the pharmacist. Through continual updates and "end-to-end" encryption, mHealth is increasingly safe for handling sensitive personal data, in a way that is comparable to face-to-face interaction.

2.3 Continual development of mHealth

2.3.1 Future of mHealth

mHealth is an evolving area. There are never-ending new developments within technology, therefore it is important to keep one up-to-date with the pace of the new technologies evolution. Figure 2 depicts an overview of the types of mHealth used today in different areas of health care.
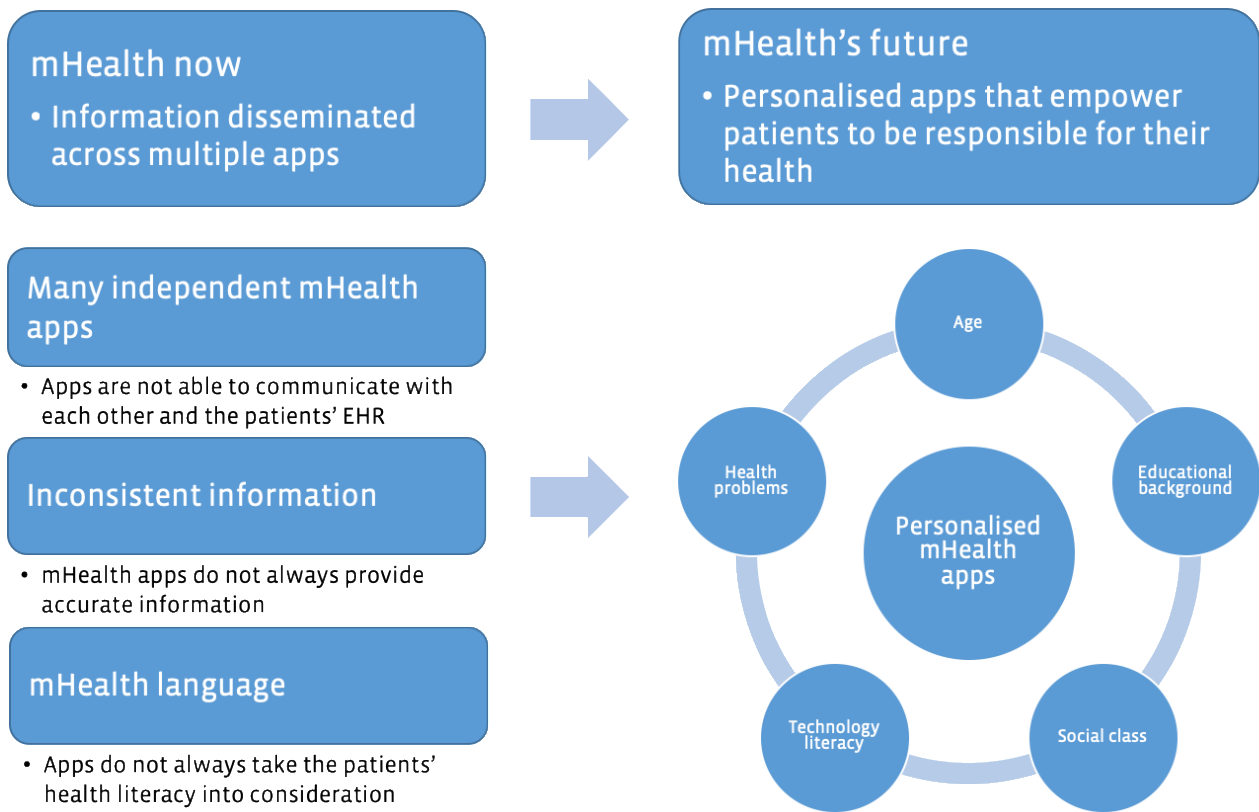
Figure 2. mHealth apps: Today and in the future[7]

Abbreviations: EHR (electronic health record), mHealth (mobile Health), apps (applications)

Figure 3 shows how each part of the continuum of mHealth tools is related. To start, measurement tools take a biological sample in real time. This leads into the diagnostic tools that allow for clinical decisions to be made. Once a diagnosis is made a treatment plan can be made using mHealth. Global mHealth tools use all of this information to provide healthcare in remote areas, information on health and prevention of diseases, and provide disease surveillance. Additionally, for every mHealth technology that is developed, each one must also be updated constantly. For example, recalibrations of devices and updates of information must be in accordance with current guidelines. Barriers and enablers of mHealth usage will be explored further later in this document.

Continuum of mHealth tools

Figure 3. Continuum of mHealth tools[8]

Although many mHealth apps currently exist, there is still a need for improvements. The utilisation of mHealth tools continues to increase. However, this can pose a problem for those who do not wish to download multiple apps. There

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[7]Direitos Reservados ao Governo da República Portuguesa - Ministério da Saúde, *Serviços Partilhados do Ministério da Saúde (SPMS), EPE,* 2017 <https://www.sns.gov.pt/entidades-de-saude/servicos-partilhados-do-ministerio-da-saude/> [accessed 22 October 2018]

[8] Kumar, Santosh et al. 'Mobile health technology evaluation: the mHealth evidence workshop' *American journal of preventive medicine* vol. 45,2 (2013): 228-36.

is a need for uniformity and ease of use for patients. With the proliferation of mHealth tools and apps comes a scattering of information, which may lead to gaps in care. Lastly, a comprehensive tool will be necessary to simplify the integration of mHealth into standard practice of care.

2.3.2 Current use of mHealth by pharmacists

To determine how mHealth is being used by pharmacists, a survey was sent to member organisations, and responses are summarised in Appendix 8.1. Based on responses received, it is evident that pharmacists are adopting new mHealth technologies in order to provide enhanced patient-centred care. Many are using mobile apps as drug information resources and tools to keep their pharmacy practice up to date with the most current disease state guidelines. Drug calculators are also utilised from various mobile apps. These data show that despite no formal training on how to use mobile apps, many pharmacists feel comfortable and quickly become experienced in using mobile apps to assist their practice.

To bring mHealth into the future within the field of pharmacy, more education must be implemented to inform pharmacists on how they can optimise their practice through use of mobile apps. For instance, the use of mobile devices as diagnostic tools could help pharmacists become even more accessible within communities. mHealth apps can assist pharmacists to keep up-to-date patient profiles, to receive patient specific adherence data, and to maintain adequate pharmacy stock for the needs of their patients. As mHealth expands, pharmacists should also expand their knowledge of mHealth and begin using these tools to support their various pharmacy roles. This will ensure that patients are receiving the best care possible.

3 mHealth and pharmacy practice

3.1 Considerations for developing or using mHealth in pharmacy practice

mHealth is important because it allows healthcare practices to be more accessible to the public through mobile communication technologies in a variety of ways (e.g., providing healthcare information, collecting health data, observing patients, etc.)[9]. However, there are multiple factors to consider when developing or utilising mHealth across the world within pharmacy practice.

The following factors should be considered before introducing mHealth into any pharmacy practice: proportion of people with a mobile phone in a population, internet access, data security and literacy level. In pharmacy practice specifically, mHealth awareness among pharmacists is paramount. Kayyali and colleagues conducted a study in England in 2017 examining the awareness of mHealth among pharmacists and general public. It revealed that 56% of the pharmacist respondents were aware of health apps, 60% of whom recommended them to patients. Additionally, a majority of the patients and pharmacists who used health apps found them to be beneficial, with the public agreeing that it helped them live a healthier lifestyle.[9]

During the stages of development for mHealth use in practice, mHealth tools should be evaluated for benefits to patients, pharmacists and other healthcare providers. This will provide the necessary evidence to inform investment decision and mass roll out.

Although Republic of Korea, a developed country, has internet access as high as 94%, in Uganda, a developing country, access is only 11%, according to the spring 2015 Global Attitude Survey.[10] In 2016, an estimated 62.9% of the population worldwide owned a mobile phone.[11] Mobile phone penetration is forecast to continue to grow, rising to 67% by 2019. Mobile health developers should focus on developing tools that can also be used by the world population without internet access.

The 2017 World Bank's State of Electricity Access Report (SEAR) highlighted that the world is not moving fast enough to reach its universal electricity access goal by 2030.[12] In addition, while nearly one billion people in Sub-Saharan Africa alone may gain electricity access by 2040, an estimated 530 million will still not have electricity access due to population growth. Because most mHealth tools require electricity to charge a device, making tools that use an alternative source of energy, such as solar energy, may further increase mHealth usage in remote areas of the world.

Another factor which needs to be considered is the security of the connection. The privacy of sensitive information might be compromised as it passes between patient and healthcare provider through mobile health apps. mHealth devices and apps need to be designed with security and privacy in mind. There is a need to identify software and hardware that enforces users' privacy preferences, protects the content of devices used, maintains the privacy of user context and clearly handles user authentication and data collection.[13]

3.2 Benefits of mHealth

As mHealth is an expanding and evolving field, population growth coupled with advancement in technology has provided a gateway to enable patients and healthcare providers alike to gather support through mobile technology. For years, pharmacists have been incorporating new technologies and tools into their daily work to support their various

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[9]Kayyali R, Peletidi A, Ismail M, Hashim Z, Bandeira P, Bonnah J., *Awareness and Use of mHealth Apps: A Study from England*, 2017 <http://www.mdpi.com/2226-4787/5/2/33/htm#B1-pharmacy-05-00033> [accessed 13 April 2018]

[10]Poushter J., *Smartphone Ownership and Internet Usage Continues to Climb in Emerging Economies*, 2016 <http://www.pewglobal.org/2016/02/22/internet-access-growing-worldwide-but-remains-higher-in-advanced-economies/> [accessed 13 April 2018]

[11]Statista, *Mobile phone penetration worldwide 2013-2019 | Statistic*, 2018 <https://www.statista.com/statistics/470018/mobile-phone-user-penetration-worldwide/> [accessed 13 April 2018]

[12]World Bank, *State of Electricity Access Report (SEAR)*, 2017 <http://www.worldbank.org/en/topic/energy/publication/sear> [accessed 13 April 2018]

[13]Kotz, David et al. 'Privacy and Security in Mobile Health: A Research Agenda' *Computer* vol. 49,6 (2016): 22-30.

roles in order to meet patients' needs and society's expectations. As patients are becoming more digitally dependent, the emerging technologies are enabling them to take a proactive role and make daily decisions about their health. Pharmacists should support their patients to make informed and educated decisions about their health in a safe manner. As healthcare providers with knowledge and expertise in health and medicines-related topics, pharmacists should also act as critical evaluators of different mHealth tools that are available to their patients.[14]

In pharmacy practice, pharmacists can use mHealth tools to provide high-quality services and patient care, with fitness for purpose and support available according to patients' specific needs in different parts of the world. Through its portability, mHealth enables pharmacists to access clinical patient information and clinical references more consistently and can provide more flexibility in their work. Incorporation of mHealth into standard practice of care supports more efficient, effective and safer pharmaceutical care to patients.[7]

3.3 Barriers to mHealth

It is possible that mHealth may be misused or misinterpreted by patients. As patients become empowered to be more proactive in their health care, pharmacists are presented with a perfect opportunity to step in and ensure the appropriate use of mHealth, which includes preventive care, treatments and self-management.[9]

mHealth also poses a privacy issue because patient health information is available on some mHealth apps. The General Data Protection Regulation in the European Union regulates data protection and privacy for all individuals in the EU. Despite this protection, a data breach could still occur. Data breaches are of huge concern in countries with lower incomes because mobile phones are shared between members of the community.[10] This is challenging because multiple people having access to the apps could lead to the leakage of potentially sensitive information.[10]

Overall, existing, emerging and future challenges, including demographics, scarcity of resources, and regulatory, payment and security issues, continue to inhibit the development of global mHealth policy. Countries around the world confront similar health challenges in terms of ageing, chronic and degenerative diseases, communicable diseases and provider shortages, all of which could be mitigated by deployment of mobile health technologies. However, there seems to be a lack of means, ability and finances to support the expansion and sustainability of mHealth.[15] Future areas of research should focus on identifying specific criteria to assess and evaluate the quality of different mobile apps, depending on their purpose and function.

3.3.1 Lack of interoperability of systems

"Interoperability" describes the extent to which systems and devices can exchange data and interpret that shared data. For two systems to be interoperable, they must be able to exchange data and subsequently present that data in a way that can be understood by a user.[16]

Achieving standards-based interoperability in mHealth projects faces unique challenges due to the constraints of using a mobile device. Many mobile-based initiatives use phone numbers as patient identifiers; however, phones are often shared among family members, so a phone number cannot serve as a unique identifier.[17] Additionally, users often switch phone numbers, or have more than one phone number with one or more mobile carriers, which makes using phone numbers for identification ineffective. For those mHealth projects that collect more than a phone number as identifying information, often only a subset of possible identifying information is collected, which may lead to challenges in matching information. For example, an mHealth project might collect a person's name and date of birth, but might not collect their address, identification number or gender.

The lack of a full set of identifying information for a patient will present challenges when trying to link the client with the rest of their shared health record, as a search of the patient master index might not produce a match. Matching

[14]Pwc, *Emerging mHealth: Paths for growth,* 2014 <https://www.pwc.com/gx/en/healthcare/mhealth/assets/pwc-emerging-mhealth-full.pdf> [accessed 18 June 2018]

[15]Malvey, Donna M and Donna J Slovensky. 'Global mHealth policy arena: status check and future directions' *mHealth* vol. 3 (2017):41.

[16]HIMSS, *What is Interoperability?*, 2018 <https://www.himss.org/library/interoperability-standards/what-is-interoperability> [accessed 22 October 2018]

[17]MEASURE Evaluation, *Interoperability Considerations in the Design, Development, and Implementation of mHealth Projects*, 2015 <https://www.measureevaluation.org/resources/publications/fs-15-152-en/at_download/document> [accessed 22 October 2018]

between mHealth initiatives and the national health information exchange might therefore need to include probabilistic methods, which look for approximate matches instead of exact matches. Probabilistic searches typically produce several possible matches, which would then need an extra step to verify the correct match.[18]

Progress is being made in some countries on interoperability. For example, Australia's "My health record" system allows third-party software and apps which meet technical and security criteria to integrate with the system.

3.3.2 Lack of coverage of and access to technologies

The most probable major limitation for implementation of mHealth projects is the coverage and accessibility of the technologies. mHealth is highly dependent on infrastructure availability in the area where the project is being deployed, hence a reliable network, and internet and electricity access are prerequisites. Access to mobile phones in Africa and developing countries is extensive, but not necessarily reliable. Moreover, the technical or expert knowledge for maintenance and development of platforms (software and hardware) may be limited or not available locally and, when these are available, the lack of expertise may slow down implementation, because technical training will normally be required.[18]

3.3.3 Limited technology literacy

The most frequent users of pharmacy services are not technology literate.[19] mHealth technologies have the potential to improve population health outcomes and delivery, but there is a need to use and develop mHealth apps with caution. The use of text messaging still requires a certain level of literacy. In addition, researching the use of apps to provide education and patient engagement in elderly populations may be hindered by the lower prevalence or use of certain technologies, such as smartphones, within this population. Although the mobile platform engages patients via written, spoken (text-to-speech technologies such as the iPhone's Siri), or even video interactions, there is a need to consider how the elderly or individuals without advanced technical skills will interact with the device or participate in the intervention.

3.3.4 Limited capacity to invest in technology (e.g., small businesses, governments, institutions)

Health care is one of the largest industries in the world, representing almost 10% of global gross domestic profit (GDP). Global healthcare spending is expected to grow at 5.4% annually between 2017-2022[20]. However, the percentage of GDP spent on global healthcare is expected to decrease from 10.6% in 2014 to 10.3% in 2018.[21] Because governments fund much of healthcare sector operations, challenging economic conditions make it difficult for governments in many of the world's regions to devote the necessary financial resources to handle expanding healthcare demands, especially when they are coupled with ever-rising costs. The Deloitte Report notes improvement in the US economy, but less gain in other countries, citing "sanctions and falling oil prices in Russia; a stagnating economy in Japan; significant growth slow-down, rising debt levels and currency devaluation in China; and recession and inflation in some Latin American countries" as examples.

3.4 Enablers of mHealth

Aamir and colleagues 2017 conducted a review to identify enabling and inhibiting factors for mHealth adoption. Key enabling factors for mHealth adoption in developing countries were found to be engagement of end users during the design phase, informed clinical decision making, utilisation of mHealth evidence, employers' tolerance of some personal use of devices, automation of tasks, and user-friendliness of the application.[22] Additional enablers of mHealth were found to be consumer demand and centralised health models to maintain patient records.

[18] Aranda-Jan, Clara B et al. 'Systematic review on what works, what does not work and why of implementation of mobile health (mHealth) projects in Africa' *BMC public health* vol. 14 (2014):188.

[19] Martin T. 'Assessing mHealth: Opportunities and Barriers to Patient Engagement' *Journal of Healthcare for the Poor and Underserved* vol. 23, 3 (2012): 935–41.

[20] Deloitte Touche Tohmatsu Limited, *2019 Global Health Care Outlook,* 2019 < https://www2.deloitte.com/global/en/pages/life-sciences-and-healthcare/articles/global-health-care-sector-outlook.html> [accessed 17 March 2019]

[21] Malvey DM, Slovensky DJ. 'Global mHealth policy arena: status check and future directions' *mHealth* vol. 3, 41 (2017).

[22] Aamir, Javariya, et al. 'Enablers and inhibitors: A review of the situation regarding mHealth adoption in low-and middle-income countries.' *Health policy and technology* vol. 7, 1 (2018): 88-97.

3.4.1 Engagement of end users during design phase

Involving healthcare professionals and community members in the design and development phase of mHealth interventions and revealing the findings from the interventions can facilitate mHealth adoption.

3.4.2 Informed clinical decision making

An example of how mHealth assists providers in clinical decision making is when mHealth apps provide disease-specific information. It is perceived that healthcare providers using mHealth are more knowledgeable, are informed by evidence and have increased confidence levels.

3.4.3 Utilisation of mHealth evidence

The scaleability and better utilisation of mHealth apps and interventions can result from alignment of mHealth initiatives with national health policies. A reliable estimation of the cost effectiveness of any mHealth pilot intervention is critical when introducing and implementing the intervention on a larger scale.

3.4.4 Employers' tolerance of some personal use of devices

Frontline health workers were able to complete work-related tasks more efficiently if they were allowed by their employers to use their mobile devices for personal use, and found they experienced a reduction in time and money consumption with the mHealth interventions. Frontline health workers' work performance improved because of the instant transfer of data and immediate feedback from their supervisors.

3.4.5 Automation of tasks

The automation of tasks powered by mHealth apps reduced the frequency of mistakes, decreased the burden of having to remember everything, and assisted less educated frontline health workers to perform tasks better.

3.4.6 User-friendliness of application

Less intricate mHealth apps offer more usability for those with low literacy levels. Having a user-friendly app can increase the user's motivation to continue its use.[11]

3.4.7 Consumer demand

Consumer demand for digital healthcare is growing, and not just for routine tasks like booking appointments. Consumers, as patients, also want to use digital healthcare, artificial intelligence and robots for more advanced care, such as for diagnosing an illness. The use of patient portals is on the rise with more than four in 10 respondents (44%) using a portal to access their electronic health records over the past year (2017) in the annual survey on digital healthcare trends from Accenture Consulting. Similarly, the use of wearable devices by consumers has nearly quadrupled, from just 9% in 2014 to 33% in 2017.[23]

3.4.8 Centralised health models (e.g., government- or health fund-initiated patient health records)

Centralised mHealth models can be used to keep patient records. Data generated from multiple tools can be centralised by governments and used for health-related budgets. For example, records of prescriptions can be used to evaluate the consumption of drugs and, hence, allocate adequate budget for it.

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[23] Brohan M, *Consumers want sophisticated digital health tools*, 2018 <https://www.digitalcommerce360.com/2018/03/07/consumers-want-sophisticated-digital-health-tools/> [accessed 13 April 2018]

4 Functions of mHealth tools in pharmacy practice

As the most accessible and trusted healthcare professionals, pharmacists play a key role in integrating mobile solutions to improve patient care. Combining the role of pharmacists with mHealth platforms can improve patient experience, by allowing them to interact remotely with the pharmacist. Pharmacists are increasingly using mHealth apps at the point of care to improve patient care. Many of these apps are not designed to replace the functionality of desktop resources, but rather to complement them and allow access to information at the time it is required.

4.1 Apps developed for community pharmacy: Patient interface with pharmacy

Community pharmacists can use mHealth platforms to improve the quality of pharmacy care they provide to their patients. Functionality is varied depending on the nature of the community pharmacy role and the services it provides.

4.1.1 Medicines management apps

Medicines management apps have been developed by organisations linked to community pharmacy to support quality use of medicines and business loyalty. These apps are usually developed by a third-party company and branded for the organisation paying for their use.

The functionality of apps varies significantly and is often tailored to the needs of the organisation paying for its use.

For example, since 2017, people in Finland have only been able to access prescriptions electronically via the internet. [24] Citizens can monitor their own health and wellbeing with the "My Kanta Pages Personal Health Record" (Kanta PHR). The services available by Kanta PHR are used alongside different wellbeing applications for recording personal measurement data, such as blood pressure, blood glucose or heart rate. Some examples of these apps include those developed with the purpose of using devices such as Fitbit, Polar and Withings.

Furthermore, pharmacy locator services in many countries, such as Finland, are accessible through Google Map services. When searching for a pharmacy, the nearest pharmacies are displayed with the help of other apps such as Foursquare and Yammer.

Despite some challenges, it is evident that in Finland, as well as all around the world, pharmacists are adopting new mHealth technologies in order to provide enhanced patient-centred care. The surroundings are constantly changing and the ways of practice are continuously developing.

4.1.1.1 Functionality of medicines management apps

4.1.1.1.1 Online ordering of prescription items
Patients are able to order prescriptions through medicines management apps. In locations where electronic prescriptions are available, such apps can allow these prescriptions to be dispensed and supplied, often through distance supply (e.g., mail order).

In locations where paper prescriptions are required, consumers may leave prescriptions at the pharmacy for online ordering and refill. Some apps have the capacity for patients to send details of their paper prescription to the pharmacy, either through a photo of the prescription or a prescription barcode linked to a prescription exchange server. The paper prescription must then be presented at the pharmacy when the medicine is collected, or sent via mail.

4.1.1.1.2 Access to dispensing history (automatic medicines list)

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[24] Kanta Services, *My Kanta Pages,* 2018 <https://www.kanta.fi/en/my-kanta-pages> [accessed 25 February 2019]

Traditionally patients have not had readily available access to their dispensing records. Synchronisation of pharmacy dispensing records with patients via mobile apps provides them with the opportunity to view important information about dispensed medicines via mobile devices, e.g., date of dispensing, medicine dispensed and dose of medicine.

4.1.1.1.3 Reminders to take medicines
Apps may provide reminders to patients to take medicines at prescribed times, often through links to the medicine profile or reminders set up by the pharmacy. They may also include functionality for the patient to denote that the medicine has been taken. This can provide a useful record of medicines use for consideration by pharmacists and prescribers.

4.1.1.1.4 Medicines information
In addition to dispensing records, additional medicines information can be made available to consumers in the app, e.g., images of medicine (tablet image) and consumer medicines information (how to take the medicines, indications, possible adverse effects, product description etc.).

4.1.1.1.5 Quality use of medicines advice
In addition to providing medicines information, mHealth can also include referral to consumer medicines information sources, such as medicines websites developed by government or non-government bodies.

4.1.1.1.6 Direct messaging
Pharmacists can send messages to patients via a secure app, either as an individual direct message or via a mailing list to a larger group. This functionality can be used for a variety of purposes such as:

- Communicating medicines safety information (e.g., a drug recall);
- Marketing of pharmacy products or services;
- Responding to patients' queries or concerns;
- Providing quality use of medicines messages, such as advice regarding media stories involving medicines; and
- Communication of opening hours during holiday periods.

4.1.1.1.7 Online chat with pharmacists
Mobile apps may provide functionality for consumers to communicate directly with pharmacists. Some apps have a "live chat" function. Other mechanisms for provision of advice could include a "submit question" function. Mobile apps often include contact details for pharmacies, such as phone numbers and email addresses.

4.1.1.1.8 Online commerce
Online commerce via mobile platforms lets consumers interact at a location outside the pharmacy or at a time outside of its hours of operation for a variety of services, including:

- Ordering prescription medicines and other products for purchase from the pharmacy for delivery or postage;
- "Click and collect" services (the purchase of medicines using an online platform for pick-up by the consumer at a nominated location, usually at a pharmacy); and
- Retail product ranges beyond what is available in the pharmacy.

Many apps, such as the CVS Pharmacy app, allow customers to access content in multiple languages. This increases the accessibility of the pharmacy services to more people.

4.2 Apps developed, used, recommended, and endorsed by professional pharmacy bodies

4.2.1 Pharmacy locator with geographical data

Geographical data allows patients to locate nearby community pharmacies based on their location. The app also contains personalised reminders of appointments or information about medication, vaccination or health diaries. The app also shows pharmacies on duty at night or during weekends [25]

> Example: Austrian Chamber of Pharmacists' Apo-App Pharmacies and Medicines

4.2.2 Recording patient consultations/care episodes

The ability to directly input a record of patient care at the point care is provided supports higher quality clinical notes and reduces the likelihood of omissions.

> Example: United States' Pharmacy Ambulatory Care Tracker

4.2.3 Patient symptoms history resources

Some apps allow patients to keep personal logs of disease-specific symptoms in order for physicians and pharmacists to help assess disease control or medication adherence.

> Example: Allergy Diary app allows allergic rhinitis patients to daily track their symptoms along with disease specific medication adherence [26]

4.2.4 Quality management systems

mHealth extends to activities which support the safe and effective operation of community and hospital pharmacies. Functionality can include reporting of incidents, and monitoring of business and quality indicators.

> Example: Sifarma Safety app integrates with the pharmacy software system to give the pharmacy manager better control of the performance and activity of the pharmacy. It includes a set of performance indicators, alarms and customisable events that allow the manager to monitor and react to business evolution, and to quickly detect any deviations from normalcy, as well as market variations.[27]

4.2.5 Access to membership services

Some apps enable pharmacists to view and track pharmacy licensing requirements and updates through their accrediting institution.

> Example: The Pharmacy Guild of Australia's membership app, "Victoria", is a mobile version of the member website. It allows members to log in and view membership details and request member services.

4.3 Apps developed by the pharmaceutical industry

Pharmaceutical industries globally have not only continued to advance in drug development and manufacturing processes, but also utilise the concept of mHealth. Through the invention of mobile apps, pharmaceutical companies can provide personalised health care by giving patients the ability to track and monitor their disease states. Examples of such mobile apps can be found in Appendix 8.2.

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[25]Österreichische Apothekerkammer, *Apo app nominated for World Summit Award 2018*, 2018 <https://www.apotheker.or.at/Internet/OEAK/newspresse.nsf/webPages/BC70993135EC2939C125833500346577!Opendocument> [accessed 19 March 2019]

[26]Bousquet J, Khaltaev N, Cruz AA, et al. 'Allergic rhinitis and its impact on asthma (ARIA) 2008 update (in collaboration with the World Health Organization, GA(2)LEN and AllerGen)' *Allergy* No. 63 Suppl 86 (2008):8-160.

[27]AppAdvice, *Farminveste-investimentos, participacoes e gestao*, 2018 <https://appadvice.com/app/sifarma-safety/1061204516> [accessed 22 October 2018]

4.4 Reference resources for pharmacists

Traditionally, pharmacopoeias, formularies and other clinical reference texts have existed primarily as printed resources. The availability of reference texts on mobile devices helps pharmacists have access to trusted and reliable references at the point of patient care. This supports productivity and sound clinical decision-making. Examples of reference categories and functionality on mobile devices are described below.

4.4.1 Drug information

Clinical reference texts and drug databases are increasingly available via mobile devices (e.g., smartphone, tablet computer, etc.). Many of these resources are also available on desktop computers and as printed reference texts. Functionality of the apps typically includes searches for drug indications, dosages, contraindications, interactions, adverse drug reactions, availability, etc.

> Examples: Micromedex, Lexicomp, Medscape, MIMS, BNF

4.4.2 Calculators

Clinical calculators are intended to guide clinical decision-making, such as for drug dosing of drugs with a narrow therapeutic index (e.g. vancomycin or phenytoin dosing), or clinical indicators (such as creatinine clearance).

> Examples: QxMD, Lexicomp, ClinCalc Medical Calculator

4.4.3 Guidelines

Guidelines provide evidence-based recommendations to pharmacists. These tools are used in a pharmacist's daily practice to provide the best patient care possible.

> Examples: International Society for Peritoneal Dialysis guidelines, oncology guidelines available through the US National Comprehensive Cancer Network and Epocrates, Sanford Guide for the Antimicrobial Therapy, American College of Cardiology/American Heart Association for hypertension guidelines

4.4.4 Literature databases

Mobile devices can often link to academic databases, including health journals, where internet access is possible. This functionality, through web-browsers or apps, can provide pharmacists with access to resources.

> Examples: *British Medical Journal*, *New England Journal of Medicine*, *The Lancet*, Pubmed, MEDline

4.4.5 Continuing education and professional development activities

Continuing education and professional development are a part of the duties of a practising pharmacist in order to stay up to date on the latest medical treatments and services. Mobile devices provide an accessible platform for pharmacists to perform these activities. Tools that support continuing education provide pharmacists with patient case studies, lessons on new treatment options, treatment reviews, and more.

> Examples: Medscape Education, *BMJ Best Practice*, *Pharmacy Times*, Online Academy

4.4.6 Diagnostic support tools/point-of-care diagnostics

Some point-of-care diagnostic therapeutic devices are now designed to be used with mobile devices, such as those that measure respiratory function or blood glucose levels. Although these are primarily intended for consumer use in the management of chronic health conditions (such as diabetes), their connectivity and convenience mean they can be used by pharmacists in screening or monitoring services.

> Examples: Dexcom Continuous Glucose Monitoring, Air Smart Spirometer, KardiaMobile

4.4.7 Medicines availability

There are mobile tools which provide information to pharmacists about medicines availability, shortages and alternative treatments. Drug shortages affect daily practice and it is important for pharmacists to be able to access this information easily and quickly.

Examples: Drug Shortages, Orange Book, Food Safety Alerts & Tips, FDA Recalls, Market Withdrawals & Safety Alerts

4.4.8 Patient information repository

Some apps provide pharmacists with patient health information and patient prescription histories. Many institutions have their own specific app which contains patient medical records. These apps allow pharmacists to have access to the patient's medical information when computers are not available or convenient to use.

Examples: Epic Haiku, MySNS Wallet, Patient Portal, Care360 Mobile

5 Pharmacists' roles and needs

Many emerging technologies might impact the future of a pharmacist's work. As such, pharmacists will need to:

- Contribute to scaling up mHealth projects according to their capacity
- Ensure that the technology being developed and used has the necessary oversight of healthcare professionals; automation is beneficial, but needs proper control
- Promote the use of mobile technologies to their patients and position themselves as points of contact for patients with medication-related issues
- Keep up-to-date with emerging technologies and recognise their potential impact
- Cement their central role in managing non-communicable diseases, especially as existing technology becomes more widely used
- Recognise the needs of their patients and the role pharmacist-patient interaction plays in disease management; patients may feel reluctant to adopt new technologies and will require guidance from their pharmacists and other healthcare professionals.

Accordingly, pharmacists will require:

- Support from governments and national professional associations to deliver this knowledge
- Continuing education for the new era of digital health and the patient-centred healthcare approach
- Open-minds towards the new technology and their roles within mHealth
- Wide recognition of their central role in preventive healthcare and patient interaction.

6 Future perspectives

6.1 Emerging mHealth developments

mHealth has been on the global health agenda for several years now.[28] The joint WHO-ITU (International Telecommunication Union) initiative "Be he@lthy, be mobile," which forged partnerships with the private sector as well, has existed since 2014. Select country programmes were framed within four-year-plans, with many milestones planned to be accomplished by 2018. Additionally, the 2030 Sustainable Development Goals agenda set by the United Nations includes mHealth as an integral component of reaching Universal Health Coverage by 2030. In addition, FIP has published its "Pharmacy vision: Board of Pharmaceutical Practice future trends" report, which includes a pillar on new technologies (mHealth and eHealth). This pillar focuses on pharmacists integrating mHealth into their daily practices to better facilitate patient care and improve patient outcomes.[29]

Many pilot access projects, such as those within the scope of the WHO-ITU initiative. have been launched in countries that often lack the infrastructure, a sufficient workforce and, on occasion, the technical knowledge to fully utilise mobile health technology to assist in patient care. The ability to reach patients at a distance via mHealth makes a significant difference in healthcare delivery.[30] Examples of mHealth pilot access programmes include mobile diabetes management in Senegal, and "JamboMama!", a mobile app used to assist expectant mothers in isolated or rural areas with limited access to medical care.[31, 32] More broadly, mobile technology has also proven effective in managing cardiovascular diseases.[33] Around the world, mHealth assists medical professionals in providing better care to patients in remote areas.

Although mHealth technology has improved access significantly, it has traditionally relied on using decades-old technology (SMS, voice messaging) or, more recently, well-established smartphone apps. The challenge that has been addressed most recently has been connecting healthcare professionals with patients at a distance and bridging access gaps through the use of mHealth. Some solutions currently exist, such as automated dosing systems, which allow patients to receive a temporary biodegradable implant that releases the formulation or active ingredient based on plasma concentrations. Such a system can be connected to an app which, in turn, allows the caring pharmacist to monitor the therapy at a distance. As with most other similar technologies, the question of privacy and data management will certainly need to be taken into account in the development and uptake of these technologies.

It will be necessary to continue developing new strategies, technologies and ideas to maximise and expand the utilisation of mHealth to provide optimal care for patients. mHealth can help provide more patient-centred care, thus empowering individuals with knowledge of their disease(s) and access to medical professionals as resources that can help improve their health outcomes and their overall quality of life.

6.2 New technological advancements

For the future, it is necessary to look beyond mHealth and to consider the broader term "digital health", because mobile technology is associated not only with smartphones and related applications, but also with technology that operates at a distance or is "cloud-based".

Utilising a blockchain infrastructure, which allows data from a variety of different healthcare records to be linked together in one integrated system, may be the best way to keep up with the ever-changing world of health care. Blockchain technology, being tamper-proof, potentially system-agnostic and interoperable within the ecosystem, is already a part of discussions on big data. In healthcare, increased digitalisation of patient records and hospitals' and pharmacies' data could make pharmacists' work more efficient, as there would be a single, secure database to rely on.

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[28]World Health Organization (WHO), *mHealth*, 2018 <http://www.who.int/reproductivehealth/publications/mhealth/en/> [accessed 13 April 2018]

[29]International Pharmaceutical Federation (FIP), *Pharmacy Vision: Board of Pharmaceutical Practice trends report* (The Hague: International Pharmaceutical Federation, 2017).

[30]World Health Organization (WHO), *Be he@lthy, be mobile*, 2017 <http://www.who.int/nmh/publications/be-healthy-be-mobile/en/> [accessed 13 April 2018]

[31]World Health Organization (WHO), *Treating diabetes take more than insulin: Senegal mobile phone project promoting public health*, 2017 <http://www.who.int/en/news-room/feature-stories/detail/treating-diabetes-takes-more-than-insulin-senegal-mobile-phone-project-promoting-public-health> [accessed 13 April 2018]

[32]Smart Access to Health For All, *JamboMama!*, 2018 <http://smartaccesstohealthforall.org/jambomama/> [accessed 13 April 2018]

[33]Kelli, Heval Mohamed et al. 'The Future of Mobile Health Applications and Devices in Cardiovascular Health' *European medical journal. Innovations* vol. 2017 (2017): 92-97.

Maintaining robust, interoperable, digital records has long been recognised as a major challenge in healthcare information technology.[34] With proper security in place, patient records cannot be accessed by unauthorised personnel, but only by treating healthcare professionals. Furthermore, such a database could provide invaluable aggregated or anonymised data on various therapies and patterns in patients' behaviour, allowing for informed decision-making in developing new approaches to patient management.[35]

The supply chain would also benefit in this case, especially in countries with generally weaker regulatory and legal frameworks. Pharmacies seeking to procure medicines would be able to do so with much less concern about the medicines' origin, as blockchain in supply chain management is even now presented as one of its main uses. This could, however, mean that pharmacists in future would need to acquire skills to fully harness the technology and even more so to be at the forefront of its development.[36,37]

[34]Bean R, Stephen G. 'How Blockchain is Impacting Healthcare and Life Sciences Today', *Forbes Magazine*, 2018 <https://www.forbes.com/sites/ciocentral/2018/04/02/how-blockchain-is-impacting-healthcare-and-life-sciences-today/#20db73df738f> [accessed 13 April 2018]

[35] Marr B. 'This Is Why Blockchains Will Transform Healthcare' *Forbes Magazine*, 2018 <https://www.forbes.com/sites/bernardmarr/2017/11/29/this-is-why-blockchains-will-transform-healthcare/#1606d8cd1ebe> [accessed 14 April 2018]

[36] Marr B. 'How Blockchain Will Transform The Supply Chain And Logistics Industry' *Forbes Magazine*, 2018 <https://www.forbes.com/sites/bernardmarr/2018/03/23/how-blockchain-will-transform-the-supply-chain-and-logistics-industry/#7cfdb0a35fec> [accessed 14 April 2018]

[37] Deloitte Consulting LLP, 'Using Blockchain to Drive Supply Chain Innovation', 2017 <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/process-and-operations/us-blockchain-to-drive-supply-chain-innovation.pdf> [accessed 13 April 2018]

7 Conclusions

The pace of uptake, development and utilisation of mHealth across the globe is and will continue to be varied. The implementation of access technologies will likely continue, but diagnostics and maintenance is only one part of health care — approaches to develop interventions or enact systematic change will still be necessary. As such, pharmacists have and will continue to have a pivotal role to play in this area of innovative health care.

8 Appendices

8.1 Current mobile health use around the world

A survey of FIP member organisations assessing their utilisation of mobile health technology in pharmacy practice settings was performed. Responding countries were: Armenia, Belgium, Croatia, Democratic Republic of Congo, Denmark, Ecuador, Finland, Great Britain, Iceland, Republic of North Macedonia, Mauritius, Netherlands, New Zealand, Norway, Pakistan, Spain, China Taiwan, Turkey, Ukraine, United States of America and Vietnam

8.1.1 Survey of current mobile health use around the world

An open-ended survey was sent to FIP member organisations enquiring how pharmacists utilise mobile health applications in their professional practice. Respondents were asked to provide information on:

- What mobile health applications are used by pharmacists
- What mobile health applications their organisation has developed
- What mobile health applications their organisation endorses
- How their organisation supports the development of patient and pharmacist mobile health applications
- Their awareness of mobile health applications used by pharmacists to interact with patients.

The responses are summarised in Tables 1 to 5.

Table 1: What mobile health applications are used by pharmacists?

Country	mHealth apps	Comments
Croatia	eTerapija, Unigluko, Lung Manager, Lexicomp, Bellabeat, Little Dot, Alergo, and Diavitas	These applications allow pharmacists to set medication reminders to improve patient medication adherence, collect information on blood sugar levels, make medication recommendations to patients with asthma and chronic obstructive pulmonary disease, and make recommendations to pregnant patients.
Ecuador	Vademecum	In Ecuador, pharmacists use the Vademecum mobile application to reference drug information for the drugs used by their patients.
Great Britain	BNFC, *The Pharmaceutical Journal*, RPharmS-iRx, MIMS, NICE Guidance, and NHS	These applications support pharmacists in developing their knowledge and understanding of the action and uses of medicines and assist them in giving advice to patients on how to take their medicines safely and effectively.
Mauritius	Diabetes Online Risk Assessment (DORA)	The DORA program is used at pharmacies to assess patient risk factors for developing diabetes. Patients who are deemed to be at moderate or high risk by a questionnaire on the application are given a complimentary blood glucose test at the pharmacy.
Netherlands	Apps are produced by Nictiz, Appotheek (App) or www.apotheek.nl, FK, NHG-standaard, and Kinderformularium	Nictiz is a national organisation focused on improving patient outcomes and aiding in new medical research to assist them in their practice. More information is available at this website: https://www.nictiz.nl/english/publications/ and https://www.nictiz.nl/wp-content/uploads/2016/06/Rapport_eHealth-de-apotheker-is-er-klaar-voor.pdf Appotheek (App) or www.apotheek.nl (including a web-app) is an app for a public website for medicines information for patients with barcode scanning, FK for public reference databank pharmacotherapy, NHG-standaard for guidelines of general practitioners, and Kinderformularium for guidelines for pharmacotherapy for children.

New Zealand	ZOOM	This is a patient app designed to improve adherence. The app holds all the patient's active medicines and a separate 12-month patient history for all medicines dispensed by a ZOOM pharmacy. ZOOM pharmacists can add other medicines manually to the app if the patient requests. The app holds simple-language, patient-oriented medicines information including a medicine photo for all ZOOM dispensed medicines. Simplicity of language was a criterion in developing this information. Links to a national healthcare information website are embedded along with emergency numbers, e.g., National Poisons Centre and after-hours pharmacies. For medicines with devices, "how to use videos", e.g., for MDIs for asthma, are embedded along with specific patient information, e.g., "where to inject for insulins", etc. Patients can use the automatic dose reminders set by ZOOM pharmacists, which can be altered within parameters by patients to provide reminders at dose times that suit the patient's lifestyle, e.g., moving a dose earlier or later in the morning, if the dose was intended for morning use. Patients cannot change to dose times outside a fixed range, e.g., a hypnotic may not be changed to a morning dose. The pharmacist can do this after discussion with the patient. The app sends patients reminders 10 days before their medicine is due to run out to reorder a new prescription or refill medicines. Patients can reorder medicines from the app. Currently, ZOOM pharmacists will then contact the prescriber. (Automation is planned for future iterations.) Payment can be made securely over the app. Patients can call or message ZOOM pharmacists in-app (video is planned).
Pakistan	Not available	In Pakistan, pharmacists use mobile applications to reference drug indexes, check for potential adverse drug reactions, record and report health data, and reference disease state specific information.
Spain	Bot Plus, Accessible Drug PLUS, Vademecum, and ExpertSalud	These applications allow pharmacists to look for information about drugs and active ingredients for human use authorised in Spain, including information related to their financing, dispensing, use conditions and interactions.
China Taiwan	Micromedex, UpToDate, Liverpool HEP ichart, Medscape, Sanford Guide Collection	These apps can be used to perform drug calculations, reference drug information, and stay up to date on the latest medical research and guideline information.
Turkey	Rx Media Pharm	These apps are used to reference drug guidelines, learn about drugs active pharmaceutical ingredient, and perform drug calculations.
United States of America	PharmacistLibrary, DrugInfoLine, Lexicomp, Epocrates, iPharmacy, Pharmacy Lab Values, MPR, Pharmacist's Letter, Pocket Pharmacist, Medscape	These apps are used to reference drug indexes, perform drug calculations, reference guidelines, check medication compatibilities, identify pills by their impression code, connect with other professionals for consultations, review insurance coverage plans for specific medications, and utilise the Health Insurance Portability and Accountability Act (HIPAA) (encryption requirements) compliant messaging.

Table 2: What mobile health applications have your organisation developed?

Country	Association	Application(s)	App(s) Summary
Belgium	Association of Pharmacists in Belgium	Apotheek.be	Supports and emphasises the role of the pharmacist as a full partner in health care by providing patients with different ways their pharmacist can have an impact on their health
Denmark	Association of Danish Pharmacies, Danish Health Authority and Danish Cancer Society	e-kvit (kvit = quit)	e-kvit is a health promotion app for smoking cessation. When using the app, the patient types personal data including the number of smoked cigarettes per day and the day of the smoking cessation. The app then informs the patient of the smoking cessation-duration and the number of cigarettes not smoked and money that has been saved, which will motivate the patient. Furthermore, the app gives the patient an opportunity to chat with other ex-smokers. The app helps the patient in weaning of nicotine-products and makes a tailored plan for the patient based on data of the patient.
Finland	Association of Finnish Pharmacies	Apteekin Neuvontatyökalu	In Finland wireless network services and mobile networks are so easily accessible that separate mobile health apps are not necessarily developed but internet pages are optimised to function in a scaled form suitable for mobile use. The high regulative demand of personal medicines information and General Data Protection Regulation (GDPR) set a certain limit for online pharmacies supply and distance drug delivery services. This mobile app does not necessarily need network connection for use. It is developed to help pharmacists at their work to provide OTC medicines information according to the latest Current Care Guidelines and, for example, encourage motivational interviews to help in smoking cessation and choosing the best possible product available according to customer need.
	Pharmaceutical Information Centre (Lääketietokeskus) for healthcare professionals	Pharmaca Fennica mobile app	This app includes medicines product pharmacovigilance information.
Great Britain	Royal Pharmaceutical Society	British National Formulary (BNF)	Evaluates clinical evidence to publish information which reflects current practice guidelines and serves as a guide for pharmacists regarding drug management.
		British National Formulary for Children (BNFC)	A standard paediatric reference for pharmacists in Britain
		Royal Pharmaceutical Society (RPharmS)-iRx	Includes information on the top 200 drugs in terms of indication, adverse effects, administration, etc.

Netherlands	Royal Dutch Pharmacists Association	App-otheek	Allows pharmacists to search by drug or disease state, allows patients to watch instructional videos on how to take or use their medicines, and summarises the roles of the pharmacist
		GnmVerkeer	Includes information on the top 200 drugs in terms of impact on driving abilities and possible safer alternatives
		IA Oncologie	Provides pharmacists with information about oncology medicines
		NierDosering	Helps pharmacists quickly find if a medication dosage needs to be adjusted based on a patient's kidney function.
Pakistan	Pakistan Pharmacy Graduates Association	Mobile Health Camp	Allows pharmacists to record data and report activities
Spain	General Pharmaceutical Council of Spain	Accessible Drug Plus	Allows users to access information about medicines and provides pharmacists with reading information directed to patients. In addition, it allows the patient to view personalised medication alerts based on their personal profile.
		Bot PLUS	Includes information on all marketed medicines in Spain for both human and veterinary use
Turkey	Turkish Pharmacists Association	EczanelBul	Allows patients to find a pharmacy near them and to contact the pharmacy
United States of America	American Pharmacists Association (APhA)	Drug Info Line	Provides pharmacists with a weekly publication about many healthcare topics such as cardiology and HIV.
		Pharmacist Library	A library featuring textbooks including Pharmacotherapy First, a NAPLEX exam review, and over 200 learning exercises such as case studies
		Pharmacy Today	An official APhA publication with top stories featuring important health topics.

Table 3: What mobile health applications does your organisation endorse?

Country	Organization	Mobile Applications
Croatia	Croatian Pharmaceutical Society	A mobile health application that promotes sexual health as part of the national public health campaign
Pakistan	Pakistan Pharmacy Graduates Association	All mobile applications in favour of the healthcare system and healthcare professionals
Spain	General Pharmaceutical Council of Spain	Accessible Drug Plus Bot PLUS
China Taiwan	Taiwan Society of Health-System Pharmacists	Micromedex National Health Insurance (NHI Mobile App UpToDate
United States of America	American Pharmacists Association	Lexicomp

Table 4: How does your organisation support the development of patient and pharmacist mobile health applications?

Country	Organization	Support
Croatia	Croatian Pharmaceutical Society	The society is included in digital healthcare events that occur in Croatia. They have been collaborating on a few recent projects that include pharmacists, including developing apps that aid in communication between patients and healthcare providers. At places such as the annual PharmIT! Conference on Digital Pharmacy in Croatia, topics including pharmacists as digital health coaches, drug serialisation, patient use of "smart" health devices, and digital literacy and innovation in the healthcare industry were discussed.
Mauritius	Not available	Mauritius supports the use of the DORA diabetes application to ensure early detection and management of diabetes.
Pakistan	Pakistan Pharmacy Graduates Association	The association has developed a team to focus on the support of mobile health applications. Currently, they are working on collecting patient data on this topic via a survey. Their hope is to create mobile health applications that keep in mind the needs of patients, doctors, and pharmacists alike.
Spain	General Pharmaceutical Council of Spain	The council works to support use of mobile health applications by pharmacists and patients through providing updated drug information on these applications, as well as information on the implementation of care services for the pharmacy. Accessible Drug PLUS is created "in collaboration with the ONCE Foundation (the national organisation for Spanish blind or visually impaired people) to provide information to patients, especially those with some degree of disability, who have difficulty accessing information leaflets.
United States of America	American Pharmacists Association	The association supports the use of mobile health applications for patients and pharmacists through literature published, either about newly developed applications or promoting the use of existing applications.

Table 5: Are you aware of mobile health applications used by pharmacists to interact with patients?

Country	Mobile Applications
Belgium	Apps include EASYPharm, Digiwellness, MyApoGuide
Ecuador	Mobile apps exist which can offer advice and patient education in order to help support the proper use of medicines.
Great Britain	Through the NHS, many apps to assist patients can be accessed, such as myCOPD, Cove, iPrescribe Exercise, Healthera, and Patients Know Best.
Norway	Many pharmacy chains within Norway have their own unique apps with information for patients and other possibilities to assist pharmacists in providing health care. Examples of pharmacy chains utilising mobile apps include Apotek1 and Vitusapotek.
Spain	PharApp and MediSafe are apps developed to help remind patients of when to take their medicines. The app Your Pharmacy Counter can be used by patients with medication questions and two experienced pharmacists are available to answer their questions. The General Pharmaceutical Council of Spain worked on a development of Bot PLUS, which will allow the pharmacist to share medicines advice with patients, strengthening the care work and the connection with them.
China Taiwan	The National Health Insurance Ministry has developed "NHI EZPass" . The most powerful function is that patients and healthcare providers can access medical records in the insurance system. Also, the estimated emergency room waiting time, the nearest medical service providers and the full medication along with medical device formulary can also be found in the app.

8.2 Examples of mHealth apps around the world

Below are some examples of mHealth apps around the world.

Name (English/local language)	Epocrates / Epocrates Plus
Link	http://www.epocrates.com/
Continent/region	**Mentioned in context of (country)**
☒Global ☒America	United States
For	**Developed/endorsed by**
☒Healthcare professionals	☒Industry
Keywords	**Price**
#interactions, #doses #serious ADRs #pharmacology	☒Free ☒Pay
Introduction	
Drug information application that allows review of drugs interactions, safety of brands, generics and OTC medicines as well as doses, Black Box Warnings, pharmacology and manufacturing.	
Other remarks	
https://www.youtube.com/watch?v=ePGWaC5VEG8	

Name (English/local language)	<800> HazRx™
Link	http://www.usp.org/hazrx-app
Continent/region	**Mentioned in context of (country)**
☒ Global ☒ America	United States
For	**Developed/endorsed by**
☒ Healthcare professionals	☒ Association ☒ Industry
Keywords	**Price**
#hazardous drugs #exposure #risk #safety handle	☒ Pay
Introduction	
<800> HazRx™ is a mobile app developed by the USP Convention for healthcare workers who might be exposed to hazardous drugs in any healthcare setting. This app helps to identify if the drug being handled is hazardous, provides information on how to safely handle hazardous drugs in accordance with establish standards, and keeps users up-to-date on the list of over 1,000 hazardous drugs with monthly updates.	

Name (English/local language)	Pharmacy Ambulatory Care Tracker (PACT)
Link	https://play.google.com/store/apps/details?id=com.glt.pact
Continent/region	**Mentioned in context of (country)**
☒ National ☒ America	United States
For	**Developed/endorsed by**
☒ Healthcare professionals	☒ Association
Keywords	**Price**
#ambulatory #reporting #dashboard	☒ Free ☒ Pay
Introduction	
This app allows practitioners to quickly and easily log the full details of patient encounters and interventions, maintaining a dynamic, ongoing record of care. The app tracks pharmacists' patient encounters across 37 different disease states and then aggregates the data into a subscription-based dashboard. Pharmacy directors and administrators can use the PACT dashboard data to track staff performance and determine which interventions and	

treatments improve patient outcomes.	
Other remarks	
http://www.pharmacytimes.com/association-news/ashp-releases-ambulatory-care-data-reporting-app-and-dashboard	

Name (English/local language)	BNF & BNFC app	
Link	https://www.bnf.org/products/bnfbnfcapp/	
Continent/region	**Mentioned in context of (country)**	
☒National ☒Europe	United Kingdom	
For	**Developed/endorsed by**	
☒ Healthcare professionals	☒ Association	
Keywords	**Price**	
#medicine formulary #treatment summaries #interactions #medical device #borderline substances #wound care	☒ Free	
Introduction		
This app is using the British National Formulary (BNF) and BNF for child for healthcare professionals who prescribe and administer medicines. It allows offline access to-up-to-date practical information on prescribing, dispensing and administering drugs.		
Other remarks		
https://www.nice.org.uk/news/article/new-improved-bnf-and-bnfc-app-launched https://www.youtube.com/watch?v=ZW3fAYRTJbs		

Name (English/local language)	BOT Plus App	
Link	http://www.portalfarma.com/inicio/botplus20/botplus20App/Paginas/que-es.aspx	
Continent/region	**Mentioned in context of (country)**	
☒National ☒Europe	Spain	
For	**Developed/endorsed by**	
☒ Healthcare professionals	☒ Association	
Keywords	**Price**	
#monograph #medicine safety #pictoram #medicine shortage	☒ Pay	
Introduction		
This app from the General Council of Provincial Pharmacy Chambers allows pharmaceutical and healthcare professionals to quickly and easily access a source of reference in Spain in the field of drugs information. Healthcare professionals can look at drug monographs, check interactions and save summaries of product characteristics as a pdf to their device. The app includes filters which can be used to verify a medicine's safety (in kidney or liver failure, or pregnancy and lactation) and contains features such as pictograms as a warning aid, quality alerts, administration recommendations and notifications of medicine shortages.		

Name (English/local language)	Medicine for Health	
Link	https://itunes.apple.com/us/app//id1112414659?mt=8	
Continent/region	**Mentioned in context of (country)**	
☒National ☒Asia	China Taiwan	
For	**Developed/endorsed by**	
☒ Healthcare professionals ☒ Patients	☒ Hospital	
Keywords	**Price**	
#personal medicine history #personal	Not available	

medication history #reminder service #medicine information	
Introduction	
The app provides patients with access to various medicines information and their medical history at National Cheng Kung University Hospital. They can also set up drug-taking alerts, record their medication history and make appointment through this app.	

Name (English/local language)	Medicine Search 의약품검색
Link	http://www.health.kr/resource/app.asp
Continent/region	**Mentioned in context of (country)**
☒National ☒Asia	Republic of Korea
For	**Developed/endorsed by**
☒ Healthcare professionals ☒ Patients	☒ Association
Keywords	**Price**
#medicine information #pill identifier #drug interaction #use in pregnancy #first aid by situation #disease and conditions	☒ Free
Introduction	
This app contains information on almost 50,000 drugs, which covers all medicines circulating in South Korea. Labelled information, pill identifiers (for all oral tablets and capsules), drug-food interactions, drug use in pregnancy, emergency first-aid and disease information are all available with the appl. It won the grand prize in medicines information section at App Award Korea 2015.	
Other remarks	
http://www.kmpnews.co.kr/news/articleView.html?idxno=16656	

Name (English/local language)	babyl health
Link	http://babyl.rw/
Continent/region	**Mentioned in context of (country)**
☒National ☒Africa	Rwanda
For	**Developed/endorsed by**
☒ Patients	☒ Industry
Keywords	**Price**
#medical records, #telehealth #make a doctor appointment #order prescriptions	Not available
Introduction	
Babyl is a digital healthcare provider that combines the latest technology with the knowledge and experience of doctors to make health care simpler, better, more accessible and affordable for people everywhere. Services include booking appointments, prescriptions and medical records.	
Other remarks	
https://www.youtube.com/watch?time_continue=115&v=JHUsFGSWa_Q	

Name (English/local language)	Matibabu
Link	http://matibabu.thinkitlimited.com/
Continent/region	**Mentioned in context of (country)**
☒Global ☒Africa	Uganda

For	Developed/endorsed by
☒ Healthcare professionals ☒ Patients	☒ Industry
Keywords	**Price**
#diagnose #malaria #share #personal record history #preventive information	Not available
Introduction	
This is a smartphone app meant for healthcare professionals which can help to diagnose malaria without a blood sample.	
Other remarks	
https://www.youtube.com/watch?time_continue=39&v=p31LN6IyIrY	

Name (English/local language)	SwipeRx
Link	http://swiperxapp.com/
Continent/region	**Mentioned in context of (country)**
☒ Global ☒ Asia	Indonesia, Philippines, Vietnam, Cambodia, Malaysia, Thailand
For	**Developed/endorsed by**
☒ Healthcare professionals	☒ Industry
Keywords	**Price**
#news from the pharma practice #drug information #jobs #continuing professional development (CPD) #networking	☒ Free
Introduction	
SwipeRx offers an easy and convenient way to connect pharmacy professionals. They can find job opportunities and connect with employers efficiently and intuitively and can receive updates on the latest government announcements, journal articles, and scientific discoveries.	

Name (English/local language)	ProDeliveryManager
Link	https://prodeliverymanager.com/
Continent/region	**Mentioned in context of (country)**
☒ Global ☒ Europe ☒ America ☒ Australia	United Kingdom, United States, Canada, Germany, Australia, New Zealand
For	**Developed/endorsed by**
☒ Healthcare professionals ☒ Patients	☒ Industry
Keywords	**Price**
#track the delivery process #real-time #prescription barcode scanning	☒ Pay
Introduction	
Pro Delivery Manager is a real-time delivery tracking service developed by an independent pharmacy. It also provides interactive maps, schedules deliveries in advance, printing out address labels including barcodes, configuring SMS/email customer notifications, thus enabling pharmacies to improve the efficiency of their local delivery services.	
Other remarks	
https://youtu.be/JNS7FrZNI_E	