

DIGITAL JOURNEY IN PRIMARY HEALTH CARE: EMPOWERING PATIENTS WITH NONCOMMUNICABLE DISEASES IN VIETNAM

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Digital Journey in Primary Health Care: Empowering Patients with Noncommunicable Diseases in Vietnam

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Abstract: The study reviewed available patient-facing digital applications for people with noncommunicable diseases along their journey in primary health care settings and proposed strategic action areas to advance the digital health journey at the primary health care level. It brought together rich qualitative and quantitative information from primary sources (online surveys, interviews, focus group discussions) as well as secondary sources (literature review). Despite recent growth in digital health investment, there are not many digital applications for patients with noncommunicable diseases in Vietnam. At the primary health care level, 15 types of digital health applications are available. Online health information and social networks are the most common applications for patients with noncommunicable diseases to manage their health. Numerous smartphone apps enable patients to update information, evaluate symptoms, look for services, book appointments, consult with health professionals, and purchase over-the-counter medications, but there are not many dedicated to noncommunicable diseases. Digital applications tied to monitoring and wearable technology are limited, mostly in the testing period on a small scale with little proof of their efficacy or impact. Even short message service intervention for noncommunicable diseases is uncommon and lacks strong evidence of efficacy and sustainability. Particularly, there is a scarcity of digital applications for patients with noncommunicable diseases to self-manage their chronic conditions. This study also provided a greater understanding of the challenges facing innovators, patients, and primary health care providers that have hampered the successful adoption of digital health applications to address the burden of noncommunicable diseases. The authors made a call for action to advance the digital journey in primary health care by fostering digital health innovations, enhancing user engagement, and sustaining digital health applications for patients with noncommunicable diseases.

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Executive Summary

The burden of disease in Vietnam has shifted rapidly toward noncommunicable diseases; however, the health care system is not well prepared for this epidemiological transition. A weak primary health care network is an important contributor to the persistent overuse of hospital care for noncommunicable diseases, which is the major source of inefficiency. The Ministry of Health has been implementing a plan for advancing information communication technology applications at the primary health care level, but domains relating to patients with noncommunicable diseases lag behind schedule. Highlighting the importance of a people-centric approach to digital transformation, this study reviewed available patient-facing digital applications for people with noncommunicable diseases along their journey in primary health care settings and proposed strategic action areas to advance the digital health journey at the primary health care level.

The digital health journey presents touch points where a person with noncommunicable diseases in Vietnam can experience digital interactions with a primary health care (PHC) provider. Most people with noncommunicable diseases start their journey long before they access a health care setting as they may not even be aware of risks or symptoms. Therefore, the health journey comprises four sequential stages, as follows: (1) staying through being aware of risk factors and adjusting lifestyles to prevent diseases; (2) seeking care when recognizing a symptom; (3) using services in health care settings; and (4) managing chronic conditions at home including adherence, self-monitoring, and self-care with decision support.

Along this journey, 15 types of digital health applications are available in Vietnam. To stay healthy, people can receive text messaging for health promotion or use social media and networks, health and fitness apps, and consumer health wearables. When recognizing a health problem, patients with noncommunicable diseases can seek care through online health information sources, online symptom checkers or health assessment tools, online health service directories, and online appointment booking. Teleconsultation, tele-pharmacy, and digital patient feedback are made available for those patients who want to receive primary health care services from a distance. To manage chronic conditions at home, patients with noncommunicable diseases often join online health communities, while a minority of them are piloting other applications including text messaging for reminders, electronic health records or personal health records, mobile apps, and wearable medical devices.

Despite recent growth in digital health investment, there are not many digital applications for patients with noncommunicable diseases in Vietnam. Online health information and social networks are the most common applications for patients with noncommunicable diseases to manage their health. Numerous smartphone apps enable patients to update information, evaluate symptoms, look for services, book appointments, consult with health professionals, and purchase over-the-counter medications, but there are not many dedicated to noncommunicable diseases. Digital applications tied to monitoring and wearable technology are limited, mostly in the testing period on a small scale with little proof of their efficacy or impact. Even short message service intervention for noncommunicable diseases is uncommon and lacks strong evidence of efficacy and sustainability. Particularly, there is a scarcity of digital applications for patients with noncommunicable diseases to self-manage their chronic conditions.

This report provides a greater understanding of the challenges facing innovators, patients, and primary health care providers that have hampered the successful adoption of digital health applications to address the burden of noncommunicable diseases. Digital health innovators are working in a challenging environment that constrains research and development of digital applications for noncommunicable disease works. Many digital health applications for people with noncommunicable diseases are struggling to scale. The uptake of official electronic/digital health services remains low, attributed to a lack of trust, limited digital capacity among primary health care professionals, and low digital literacy in the general population. Sustainability remains a concern as many digital applications are operating as a siloed technology in the public health system and a reimbursement model for digital health services are not in place.

This report makes a call for action to advance the digital journey in primary health care for patients with noncommunicable diseases. The first strategic action area is fostering digital health innovations for patients with noncommunicable diseases. The central and provincial authorities should utilize existing resources to strengthen health innovation exchange and support health care entrepreneurship. Policy makers should prioritize establishing a regulatory framework that supports innovations in health care without compromising privacy, security, and intellectual property.

The second strategic action area is enhancing user engagement and the uptake of digital health applications for patients with noncommunicable diseases. The uptake of digital health applications for patients with noncommunicable diseases requires both professional and organizational behavior changes. Establishing trust in digital health applications is essential for user engagement and adoption. It is critical to build digital capability in the health workforce to facilitate the adoption of digital applications for patients with noncommunicable diseases. Simultaneously, the government of Vietnam should make an effort to address low digital literacy and the digital divide across population groups.

Sustaining digital health applications for patients with noncommunicable diseases is another strategic action area. A priority action is advancing integration and interoperability across digital systems deployed at the grassroots level, which was a shared desire among the players in a digital health ecosystem. Establishing a national reimbursement system for digital health applications would ensure financial accessibility in the long run, but also requires tremendous efforts to accomplish this goal. A starting point for government agencies is to review financing mechanisms and consider business models applicable to the Vietnam context. It is also important for the Vietnam Ministry of Health to undertake monitoring and evaluation to ensure that digital health applications for patients with noncommunicable diseases are adopted in a safe, ethical, and cost-effective manner.

Abbreviations

| | |
|-------|---|
| AI | Artificial Intelligence |
| CHS | Commune Health Station |
| DOH | Department of Health |
| EHR | Electronic Health Record |
| GDP | Gross Domestic Product |
| HICs | High-Income Countries |
| HIS | Hospital Information System |
| HL7 | Health Level 7 |
| ICT | Information Communication Technology |
| IFC | International Finance Corporation |
| ITU | International Telecommunication Union |
| LMICs | Lower- and Middle-Income Countries |
| MIC | Ministry of Information and Communication |
| MOH | Ministry of Health |
| NCD | Noncommunicable Disease |
| OHCs | Online health communities |
| OOP | Out-of-Pocket |
| PACS | Picture Archive and Communication System |
| PHC | Primary Health Care |
| PHR | Personal Health Record |
| SMS | Short Message Service |
| UHC | Universal Health Coverage |
| UNDP | United Nations Development Programme |
| US | United States |
| VAN | Vietnam Autism Network |
| VSS | Vietnam Social Security |
| VOV | Voice of Vietnam |
| WB | World Bank |
| WHO | World Health Organization |

PART 1: INTRODUCTION

1.1 Primary health care for patients with noncommunicable diseases

Vietnam has made remarkable progress in economic development, poverty reduction, and social welfare for its people over the past decades. Between 2002 and 2018, gross domestic product (GDP) per capita increased by 2.7 times, reaching over US\$2,700 in 2019. Poverty rates declined sharply from nearly 60 percent in 1993 to below 5 percent (Vietnam GSO 2018). Poverty reduction has also been accompanied by improved living standards and broader welfare gains. By 2019, 99.4 percent of households used national grid electricity for lighting, 97.4 percent used clean water, and 88.9 percent used hygienic toilets. The net enrollment rate for primary schools increased from 78 percent in 1993 to 98 percent in 2019, for lower secondary schools from 36.01 percent to 89.2 percent, and for upper secondary schools from 11.39 percent to 68.3 percent (Vietnam Central Steering Committee for the 2019 Population and Housing Census 2020). Vietnam’s Human Capital Index¹ value increased from 0.66 to 0.69 between 2010 and 2020, exceeding the global, regional, and lower-middle-income country averages (World Bank 2020b).

The population health outcomes have been improved remarkably, and the burden of disease has shifted rapidly toward noncommunicable diseases (NCDs). The under-five mortality rate fell from 51.0 to 20.8 per 1,000 live births, while the maternal mortality ratio reduced from 139 to 43 per 100,000 live births between 1990 and 2017 (World Bank 2020a). The life expectancy at birth was 73.5 in 2018, representing an increase of 5.5 years since 1999 (Vietnam MOH 2019). Aging and lifestyle factors are contributing to a rapid shift in Vietnam’s burden of disease toward NCDs. In Vietnam, 95 percent of aged people live with chronic conditions, which are mostly NCDs (Dam Huu Dac et al. 2010). In 2017, NCDs occupied seven spots in the top ten causes of death and share 74 percent of Vietnam’s disease burden, up from 46 percent in 1990 as measured in disability-adjusted life years (IHME 2018).

However, the health care network in Vietnam is not well prepared for the increasing burden of NCDs despite expanded coverage. The country has 1,400 hospitals, nearly 12,000 public commune health stations (CHSs), and more than 35,000 private clinics (Le, Govindaraj, and Bredenkamp 2020). More than 90 percent of the population is covered by health insurance, marking significant progress toward the achievement of the universal health coverage (UHC) goal. However, the health care network is struggling to manage NCDs. In the “cascade of care” for hypertension and diabetes, many patients are “lost” at both the diagnosis and treatment stages. Among hypertensive survey respondents, only 43 percent had been previously diagnosed by doctors, and just 14 percent reported that their condition was currently being managed at a health facility. Among those assessed as being diabetics, 31 percent had previously been diagnosed, and only 29 percent were receiving treatment or being managed for their raised blood glucose (Vietnam MOH 2016).

A weak PHC network is an important contributor to the persistent overuse of hospital care for NCDs, which is the major source of inefficiency. Many doctors in Vietnam are not properly trained to manage NCDs (World Bank 2016). NCD service availability is particularly limited at the commune level. More than a quarter of commune health stations (CHSs) do not provide even the most basic level of screening for hypertension (28.5 percent) and diabetes (29.7 percent). The proportion of CHSs providing complete management of hypertension and diabetes was only 9.8 percent and 24.4 percent, respectively (Vu, Bales, and Bredenkamp 2019). A weak

PHC network is an important contributor to the persistent overuse of hospital care for NCDs, which is the major source of inefficiency. Treating NCDs at the hospital level is very expensive: for example, the average costs of hospital care for hypertension and diabetes vary from VND357,961 to VND1,102,983, four to ten times higher than an average cost of VND92,619 at the commune level (Hanoi Social Security 2020).

1.2 Digital transformation in the health sector

Over the past three decades, Vietnam’s health sector has been adopting information communication technologies (ICTs) through three main periods: experimental, developing, and scaling-up periods. The experimental period took place in 10 years from 1993 to 2003, when several hospitals started using computers and software for statistic reports. The developing periods from 2004 to 2011 were characterized by rapid growth of the ICT market and developers but slower adoption of ICTs in the health sector. The establishment of an electronic health agency (EHA) within the Ministry of Health (MOH) in 2012 marked the beginning of scale-up periods, where the health sector strengthened the policy and institutional environment, developed action plans, and mobilized resources for ICT adoption and digital transformation.

The policy environment for the adoption of ICTs in the health sector has been improved significantly. The legal framework for the development and deployment of ICTs in health institutions has been established with regulations on operational requirements for health care in the online environment, categories of ICTs in the health sector, electronic health information security, telehealth, electronic medical records, and the criteria on ICT adoption in health care settings, etc. There are regulations and standards for health data administration including health identification management, medical coding classification for common use by the health insurance agency, data sharing in health insurance reimbursement, pharmaceutical data exchange and interoperability standard, Health Level 7 (HL7) standard for hospitals, etc. In consecutive years 2017–2018, the MOH was first-ranked among 19 ministries for the development of policies and regulations on ICT adoption (Vietnam MIC 2019).

The MOH is taking the lead in the provision of online public services (e-government services). The MOH’s e-Government Architecture² was developed, providing reference models and a general description of main components such as user layers, communication channels, database, and data analysis layers, local government service platform, infrastructure, supervision, and management. By June 2020, all administrative procedures have been provided online by the MOH through the public health service portal <https://dichvucong.moh.gov.vn/> at the highest level.³ The MOH has remarkable achievements in the adoption of ICT for public health system administration such as the national immunization information management system (<http://tiemchung.gov.vn/>), and pharmaceutical databank (<https://drugbank.vn/>) with connection with 60 percent of drug supply facilities nationwide. The MOH was fourth-ranked among 17 ministries for their intensive adoption of ICT (Vietnam MIC 2019).⁴

Medical and pharmaceutical institutions have adopted ICTs widely to improve operational efficiency. By 2019, 100 percent of public hospitals in Vietnam had installed and operated a hospital information system (HIS). Almost all (99.5 percent) health care facilities nationwide have submitted electronic health insurance claims to the Vietnam Social Security (Tran 2020). Nearly 60,000 drug supply facilities have management software, 60 of which can exchange data with the pharmaceutical data bank (Government newspaper 2020).

FIGURE 1.1: Remarkable ICT Interventions in Vietnam’s Public Health System by 2020

| Interventions for patients and population | Interventions for health professionals | Interventions for health system managers |
|---|---|--|
| <ul style="list-style-type: none"> • Communicable disease notification to mobile users • COVID-19-prevention messaging campaign to mobile users • COVID-19 contact tracing mobile app • Electronic health records • Electronic immunization records • Cashless payment by patients in hospitals • Quality-of-care feedback by patients in hospitals | <ul style="list-style-type: none"> • Telemedicine system at 1,000 points of care • Prescription order systems in all hospitals • Diagnostic order systems in 60% of hospitals • Picture archiving and communication systems in 23 hospitals • Electronic medical records in 8 hospitals • E-learning systems in all medical schools | <ul style="list-style-type: none"> • Communicable disease surveillance system • Electronic health declaration at all points of entry • National immunization information system in all vaccination facilities • Hospital management information systems in all hospitals • NCDs’ management information system at CHSs • Pharmacy management systems in almost all pharmacies • Population and family planning management information system • Health practitioners’ and providers’ registration and licensing management system • National electronic health reporting system • MOH’s portal for online public services to businesses, citizens • VSS’s portal for insurance claim submission by all health facilities • Smart health governance centers in cities, provinces |
| <p style="text-align: center;">Interventions for data services</p> <ul style="list-style-type: none"> • Adoption of HL7 Standards on Clinical Document Architecture • Medical coding classification systems for common use in health care and health insurance payment • Standards on data exchange and interoperability across pharmacy information systems and online drug bank • E-Government Architecture for Ministry of Health including Data Reference Model, Security Reference Model, Local Government Services Platform, Database • V20 Platform for data exchange and interoperability across information systems at CHSs • Data storage and aggregation at MOH, VSS, and hospitals • Regulations on health data security in healthcare facilities | | |

Source: Original figure for this study report.

Notes: ICTs = Information and communication technologies; HL7 = Health level seven; NCDs = Noncommunicable diseases; CHSs = Commune health stations; MOH = Ministry of Health; VSS = Vietnam Social Security.

Despite such efforts in ICT application, health facilities in Vietnam are still at the early stage of digitalization and going smart. By 2019, 40.4 percent of hospitals could meet level 1, which is the lowest level in the MOH’s seven-level hierarchy of information technology

advancement;⁵ 32.2 percent met level 2; 21.4 percent met level 3; 4.8 percent met level 4; 1.1 percent met level 5; only 1 hospital met level 6—smart hospital; and none met level 7, the highest level. Digitalization in Vietnam's hospitals is currently fragmented and mainly implemented in central-level public and private hospitals in large cities (YCP Solidiance 2020). While the deployment of digital interventions is hospital-centric, the connection and integration of digital systems among different providers remain limited. No Client/Patient Registry exists, while a unique citizen identifier (ID) system has just been established. Although the Health Facility Registry is in place, only 20 percent of 48,000 health care facilities nationwide are registered for interoperability.

1.3 The Need for a study on a digital journey in PHC for patients with NCDs

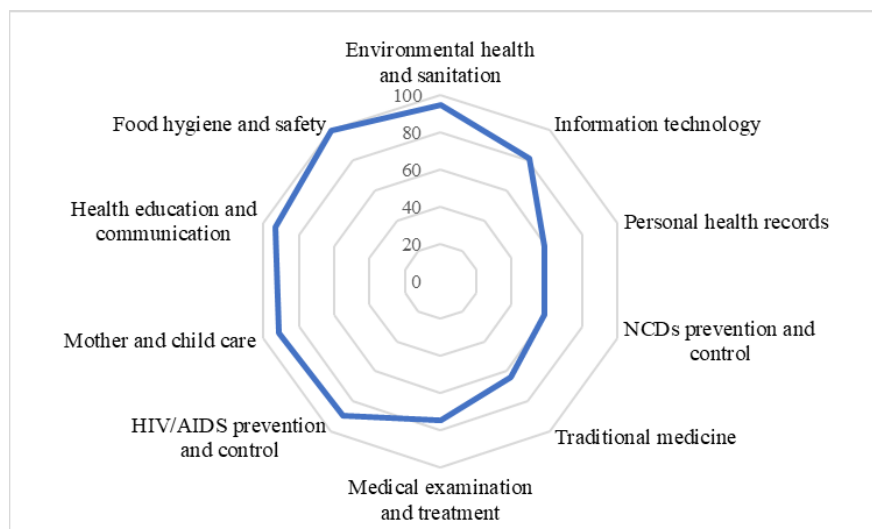
There had been various ICT interventions at the grassroots level, but sustainability remained a concern. In the mobile health (mHealth) domain, only 20 mHealth initiatives had been implemented by 2018, of which a majority targeted vulnerable and hard-to-reach populations, aimed to prevent the occurrence of disease, and used text messaging (short message service, SMS) as part of their intervention. The largest threats to the popularity of mHealth initiatives are the absence of government policy, heavy dependence on foreign funding, and lack of technological infrastructure (Lam et al. 2018). In addition, CHSs are using various software to manage health care activities and public health programs, raising concerns about interoperability across applications.

Since 2018, the MOH has been implementing a plan for advancing ICT applications at the PHC level⁶ but domains relating to patients with NCDs lags behind schedule. To date, almost all CHSs have installed and operated management software and electronic health statistic software, enabling them to submit health insurance claims and update statistic reports online. While the adoption of ICTs in the management domain has made good progress at the grassroots level, the deployment of electronic health records (EHR) for patients in the CHSs lags behind schedule, failing to achieve the respective targets set forth in the national master plan for building and developing the grassroots health care network. Other digital applications and services for the primary care of patients with NCDs are also limited at CHSs. Even at 26 new model CHSs, where the MOH and provincial departments of health (DOH) have invested intensively, the professional performance indicators associated with deployment of EHRs and NCDs prevention and control still need to be improved further (see Figure 1.2). Due to a lack of digital capability, PHC providers were struggling to deliver essential services to patients with NCDs during lockdown and the restrictions amidst the COVID-19 pandemic.

The potentially transformative role of digital technologies in reducing the burden of NCDs and strengthening PHC systems has been recognized by governments, donors, and multilateral institutions. The Declaration of Astana on PHC advocated the use of digital technologies to enable individuals and communities to identify their health needs, participate in the planning and delivery of services and play an active role in maintaining their health and well-being (WHO and UNICEF 2018). Recognizing that digital health interventions will be increasingly important, the World Bank signed the Principles of Donor Alignment for Digital Health, launched at the World Health Summit in Berlin in October 2018. The World Bank is developing a digital health implementation strategy, as part of its wider efforts to support countries with reimaging their PHC systems and elevating disruptive technology as a key feature of service

delivery (Cafagna, and Secci 2020). The World Health Organization (WHO) urged member states to assess their use of digital technologies for health to identify areas of improvement and to prioritize the development, evaluation, implementation, scale-up, and greater utilization of digital technologies, as a means of promoting equitable, affordable and universal access to health for all (WHO 2018a).

FIGURE 1.2: Professional Performance Indicators at 26 New Model CHSs in 2019



Source: Vietnam MOH 2020.

Notes: CHSs = Commune health stations; NCDs = Noncommunicable diseases; HIV/AIDS = Human immunodeficiency virus/Acquired immunodeficiency syndrome.

Recent national strategies, master plans, and policies reflect an emphasis on strengthening ICT capacity at the grassroots health network. The master plan for building and developing the grassroots health care network⁷ includes computerization of primary health care activities and connected information systems between the commune and district levels to improve CHSs' performance in NCDs management. The ruling Communist Party's Resolution on Health Care for People in the New Situation,⁸ while reaffirming targets associated with NCD prevention and treatment, emphasizes the comprehensive adoption of ICTs to manage CHSs' activities and population health. The National Plan for Preventing and Controlling NCDs and Mental Disorders⁹ requested all CHSs to adopt ICTs in managing these illnesses by 2025.

Though several assessments of digital health have recently been conducted in Vietnam, the digital patient journey remains a knowledge gap. The assessments have generally focused on three broad analytic domains: the digital transformation landscape in the health sector, the enabling environment for digital health entrepreneurship in the country, and digital health projects in selected health systems' building blocks. However, only limited research and analysis of digital interventions in health care service delivery have been conducted. The digital journey in primary health care for people with NCDs remains a major knowledge gap.

1.4 Study objectives, scope, and methodological approach

Study objectives. The study on digital health services for people with NCDs in Vietnam has the following objectives:

- To review available patient-facing digital applications for people with NCDs along their journey in PHC settings
- To propose strategic action areas to advance the digital journey of people with NCDs at the PHC level

Definition of digital health application. The World Health Organization considered digital health applications as “ICT systems and communication channels that facilitate delivery of digital interventions and health content” (WHO 2019). In practice, a digital application often offers multiple interventions (or functions) and contents for targeted user groups. This study focused on patient-facing digital applications that can be used by patients with NCDs along their journey in PHC.

Study scope. Aligned with the objectives, the study entails two main parts as follows:

- (1) *Digital health journey of people with NCDs in Vietnam.* This part (Chapter 2) encompasses a review of the availability, accessibility, and acceptability of digital health interventions along the health journey of people with NCDs in PHC settings.
- (2) *Strategic action areas to advance the digital journey of people with NCDs at the PHC level.* This part (Chapter 3) identifies major issues in the digital transformation at the PHC level and proposes strategic action areas to be taken by government agencies and relevant stakeholders to harness digital technologies to serve people with NCDs, based on findings of the current study and international experience.

Data collection methods:

The study brings together rich qualitative and quantitative information from primary sources (online surveys, interviews, focus group discussions) as well as secondary sources (literature review). In addition, information was sourced from the websites of PHC providers and digital developers in Vietnam and other countries. The data collection methods used in different parts of the study are summarized as follows:

- The literature review entailed an examination of published and grey international literature (studies, reports, guidelines, etc.), as well as published and grey literature from Vietnam.
- Twenty semi-structured interviews with digital health innovators and providers were undertaken in both the public and private sectors.
- A focus group discussion was organized to solicit information from relevant stakeholders (digital health innovators, providers, development partners, and researchers) about barriers to the development and adoption of digital applications and strategic priorities for digitalizing PHC toward achieving UHC for people with NCDs.

PART 2: DIGITAL APPLICATIONS IN PHC FOR PATIENTS WITH NCDs

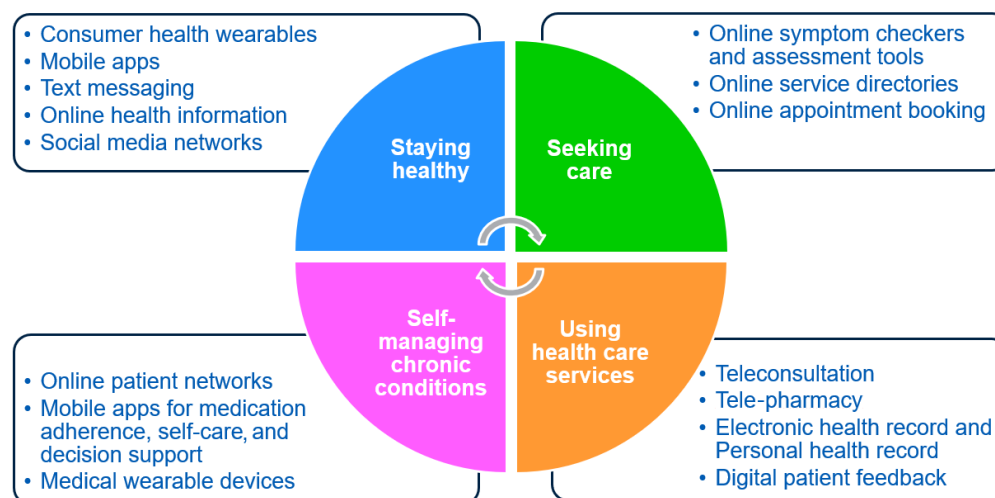
This chapter provides a review of digital health applications for people with NCDs in Vietnam. It starts by providing an overview of the digital health journey of people with NCDs in PHC settings and then examines available digital interventions in terms of features and functions, usage and acceptance, impacts and lessons learned, and current adoption in Vietnam. Case studies on digital health providers and applications are introduced to highlight major achievements.

2.1 Overview of the digital journey in PHC for patients with NCDs in Vietnam

This study highlights the importance of a people-centric approach to digital transformation in health care. Those who live with NCDs are often multimorbid and may interact with a variety of health care workers for each morbidity, prompting their unique journey. The patient thus becomes the constant among variables in the health system. A people-centric approach shifts the focus from how health workers deal with a disease to what a person needs along his/her health journey. Patient journey mapping is a form of clinical audit that breaks down the health journey into consecutive steps and then analyzes the process using the patient's perspective. This approach can help identify "pain points" in people with NCDs and propose appropriate digital interventions to solve problems.

The digital health journey shown in Figure 2.1 presents touch points where a person with NCDs in Vietnam can experience digital interactions with a primary health provider. It is worth noting that most people with NCDs start their journey long before they access a health care setting as they may not even be aware of risks or symptoms. Therefore, the health journey comprises four sequential stages: (1) being aware of risk factors and adjusting lifestyles to prevent diseases; (2) seeking care when recognizing a symptom; (3) using services in health care settings; and (4) managing chronic conditions at home including adherence, self-monitoring, and self-care with decision support. Along this journey, 15 types of digital health applications are reviewed in this study.

FIGURE 2.1: Digital Health Journey in PHC for Patients with NCDs in Vietnam



Source: Original figure for this study report.

2.2 Digital applications for people to stay healthy

❖ Text messaging for health promotion

Around the world, text messaging is successfully used to increase awareness and encourage health behavior change. Text messaging (or short message service, SMS) for health promotion is a process of using telecommunication technologies to convey a text message on health and promote healthy behaviors among the targeted population. The use of text messaging has proven to be effective in changing harmful behaviors, reducing calorie intake, and increasing physical activity: significant reductions in waist circumference; a significant increase in the number of steps taken per day; and changing food intake and daily weight monitoring, which eventually leads to weight loss in the short (3 months) and longer-term (12 months). Among NCD interventions, the global initiative “Be He@lthy, Be Mobile,” led by WHO and the International Telecommunication Union (ITU), is using text messaging and mobile apps to help combat diabetes, cervical cancer, hypertension, dementia, and chronic respiratory diseases in lower- and middle-income countries (LMICs). Evaluations indicated that text messaging is feasible, acceptable, and effective in a large population to disseminate knowledge about NCDs, promote healthy lifestyles, and improve health-seeking behaviors (Free et al. 2013; Ramachandran et al. 2018; WHO and ITU 2016a, 2016b, 2016c, 2017, 2018, 2020, 2021).

In Vietnam, health promotion messaging has been adopted for a decade and recently boomed to protect the general population from coronavirus disease. In the first quarter of 2020, the government sent 3 billion text messages to all mobile phone users to alert them of health risks, update the pandemic situation, promote personal protective behaviors, and reinforce social distancing. Clear and consistent health promotion messaging contributed to the national success in containing the SARS-COV-2 virus in the early phase of the COVID-19 pandemic (Todd et al. 2020).

However, text messaging interventions addressing NCDs remain scarce in Vietnam. A review of SMS interventions in Vietnam before 2018 found that none targeted people with NCDs and only one covered smoking behavior in health education for the ethnic minority population (Lam et al. 2018). Recently, two more SMS interventions for cessation of tobacco use have been implemented in Vietnam (Jiang et al. 2021; Larkin et al. 2021; see Box 2.1), where 15.6 million people are smokers and 72 percent of smokers intending to quit were willing to use and pay for smoking cessation support via text message (Ngan et al. 2017). Other than these interventions, there are not any publications on text messaging for NCD awareness.

BOX 2.1: Text Messaging to Reduce Tobacco Use

The Vietnam Ministry of Health (MOH) established telephone Quitlines and an automated cessation texting system to engage and motivate smokers to quit smoking cigarettes. Smokers receive one-way motivational text messages written by former smokers. This system has proven effective in the United States and is being adapted to the Vietnam context. A pilot randomized controlled trial, which was conducted to test a six-week SMS program, supported the feasibility and acceptability of an SMS program adapted for Vietnamese smokers. Another community-based randomized controlled trial is being carried out to examine the effectiveness of a six-month SMS program.

Source: Jiang et al. 2021 and Larkin et al. 2021.

Note: SMS = Short message service.

❖ Social media and networks

Social media has a great influence on individual perceptions and behaviors. Social media platforms are promising instruments to improve population health (Mendoza-Herrera 2020), but criticism about their impact remains. Interventions involving social media can improve lifestyles and metabolic indicators of NCDs (Balatsoukas et al. 2015; Jane et al. 2017; Gabarron, Årsand, and Wynn 2018). Social media interventions can help people increase their physical activity levels and reduce their sugar and fat consumption, enhance motivation among online health program users, and deliver nutritional or diabetes education (Richardson 2010; Tapper et al. 2014; Williams et al. 2014; Johns, Langley, and Lewis 2017).

Vietnam has been among the countries with the highest number of social media users worldwide in recent years. With 72 million users, the social network penetration in Vietnam reached nearly 74 percent in 2021 (We are Social and Hootsuite 2021). Among internet users, 96 percent are using Facebook, followed by YouTube, Zalo (a local platform), and TikTok. Using social networks has become the most popular online activity in rural Vietnam (Statista 2021b).

Vietnamese people are more health-conscious on the internet and social media platforms. In 2020, Google reported a surge in search interest over the past year for air purifiers (200 percent), diet and healthy eating (80 percent), health wearables (55 percent), and fitness app downloads (38 percent) in Vietnam (Google 2020). Healthy living has become a trending topic on social media. Healthy lifestyle topics such as gymnastics, running, yoga, eating, etc. triggered about 200,000 discussions per month on social media platforms, which were inspired mainly by health-related groups and fan pages of gym fitness influencers, health coaches, and celebrities (YouNet Media 2019).

Nevertheless, there is increasing concern about health misinformation and risky perceptions on social media, particularly impacting youths and adolescents. Half of Vietnamese youths found health information on Facebook reliable, and one-tenth of youths reported following health advice from Facebook (Zhang et al. 2020). The influence of online peers on the development of risk behaviors, such as the occurrence of shisha smoking among youths, has been highlighted (Huong 2018; Tran et al. 2019; Zhang et al. 2020). Evidence suggested an association between cyberbullying self-harm and suicidal behaviors among adolescents (Nguyen H. T. L. et al. 2020). Although the code of conduct on social networks has been issued, questions about monitoring and enforcement of individual behavior in online environments remain.

The power of social media has been leveraged for the COVID-19 pandemic response and to improve well-being during lockdown periods. In early 2020, the Institute of Occupational and Environmental Health released the music video “Ghen Co Vy” (meaning “Jealous Coronavirus”) to communicate coronavirus risk and protective measures. The music video has gone viral on social media and reached over 100 million views on YouTube to date. Another dance move on handwashing spearheaded a dance challenge on TikTok worldwide, which quickly attracted more than 11 billion views. Additionally, TikTok initiated campaigns calling people to share funny, active moments to promote well-being and mental health during lockdown periods (See Box 2.2). The central and local governments transferred 1.4 billion notifications on COVID-19 through the Zalo platform. Since the MOH recognized the contribution of social media such as Zalo and TikTok in

the pandemic response, it would be interesting to see how the public health sector harnesses social media platforms for NCD awareness and prevention in the post-COVID-19 time.

BOX 2.2: Well-Being and Mental Health Promotion on TikTok

The prolonged pandemic and lockdowns affected well-being and triggered mental health disorders among the general population. TikTok initiated a series of well-being promotion campaigns, which attracted millions of Vietnamese users to share funny, active videos on housework while staying home. In 2020, the [#StayHomeIsFun](#) campaign had 1.6 million videos and 11 billion views. In September 2021, another challenge of [“Stay optimistic over the pandemic—happy@home”](#) was initiated to spread an optimistic spirit and reached more than 28 billion views within a week. Recently, TikTok has introduced mental health resources for its users. These initiatives signal a promising shift in well-being and mental health promotion through social media platforms.

Source: TikTok 2021.

❖ Health and Fitness apps

Mobile apps have become popular in promoting health and fitness. There are over 350,000 health and fitness or medical apps now available to consumers worldwide from the Apple Store and Google Play (IQVIA 2021). Mobile apps for staying healthy are categorized into five key healthy living categories: encouraging physical activity, promoting healthy eating, improving mental well-being, preventing tobacco use, and reducing alcohol consumption (McKay et al. 2019). They have the ability to motivate users to change behavior for better health by using behavior-change techniques such as goal-setting, instruction, self-monitoring, tracking activities, push notifications, and reminders.

Engagement with a health app can improve diet, physical activity, and sedentary behaviors. Apps are widely considered satisfactory, easy to use, and helpful in the pursuit of weight loss goals (Dounavi and Tsoumani 2019). Systematic reviews found that the use of mobile health applications has a positive impact on health behaviors such as physical activity and dietary habits (Han and Lee 2018; Milne-Ives et al. 2020; Schoeppe et al. 2016). However, there remains little evidence on the effectiveness of mobile health apps to improve health outcomes (Milne-Ives et al. 2020).

Mobile apps are playing an increasing role in supporting a healthy lifestyle among Vietnamese people. Although population-based data are not available, recent market surveys revealed that fitness app downloads increased significantly (Google 2020), and about one-third of consumers are using either a nutrition app or a fitness app (VIR 2021b). In addition to global health and fitness apps, various Vietnamese apps have been developed for the local people (see Figure 2.2). Noteworthy ones include a heart rate plus app PVDApps, a tobacco cessation app Cai Thuốc Lá, a weight loss app Eatsy, and a sports activity tracker UpRace. Vietnamese smartphone users might have lower uptake but have a higher acceptance of health apps than those in other countries (Do et al. 2018); however, the effects of app use on their behavior and health outcomes are not studied.

FIGURE 2.2: An Overview of the Health and Fitness Apps Landscape in Vietnam



Source: Original figure for this study report.

❖ Consumer health wearables

Consumer health wearables enable users to track their activity and health indicators to stay healthy, but long-term engagement poses a challenge. Most consumer wearables sync wirelessly with a sensor and an app to automatically provide users with access to data, notifications, and reminders. The growing demand for wearables has generated a booming market with a global market value of US\$14.41 billion by 2022 (Marketsandmarkets 2020). Consumer health wearables facilitate behavior change and improve weight loss. Wearables have proven positive impacts on physical activity, even among old persons (Mercer et al. 2016; Ehn et al. 2018). Devices focusing on healthy habits can be programmed to help their wearers track their healthy decisions and set goals, providing just-in-time coaching for habit forming (HIMSS 2021). Studies have also found that wearables improve weight loss (Shuger et al. 2011, Pellegrini et al. 2012); however, over 24 months, such devices may not offer an advantage over standard behavioral weight loss approaches (Jakicic et al. 2016). Engagement with consumer wearables also decreases over time from the initial purchase (Ledger and McCaffery 2014; Paré et al. 2018).

Supply and demand for wearables have been increasing in Vietnam, though scientific evidence on health benefits among Vietnamese consumers is lacking. Global technology giants

such as Samsung, and Apple are manufacturing smartwatches in Vietnam. The local wearable market is predominantly supplied with smartwatches and wristbands from Apple, Xiaomi, and Samsung. Prices of such wearables vary from US\$30 to US\$300, representing a luxury for most Vietnamese people whose monthly income is just approximately US\$265 on average. About 2.3 percent of the general population own a form of wearable technology (KPMG 2020) mainly for health and fitness tracking (Statista 2021c). Recently, several start-up companies have joined the consumer wearable market with innovative products such as Earable sleep aid devices (see Box 2.3). However, there are no scientific publications on the impacts of such wearables on physical activity and health behavior among Vietnamese consumers.

BOX 2.3: Earable Sleep Aid Device

The start-up company Earable Inc., led by a Vietnamese American scientist, has been developing a sleep aid device to track and improve sleep using personalized sleep therapy. With seven sensors, the headband can collect and analyze data on brain activity, eye movement, muscle activity, heart rate, SpO2, breathing rhythm, and head motion. Machine learning and AI applications help inform and guide sleep therapy. In the United States, the prototype has undergone clinical trials on 1,250 participants and proved to significantly improve sleep onset latency. It has been preordered and produced by batch to improve continuously based on consumer feedback. In Vietnam, the Earable development project is being financed by the VinTech Fund to scale up clinical trials and optimize the product for Vietnamese consumers.

Source: <https://www.earable.ai/>.

Note: AI = Artificial Intelligence; SpO2 = Oxygen saturation.

2.3 Digital applications for patients with NCDs to seek care

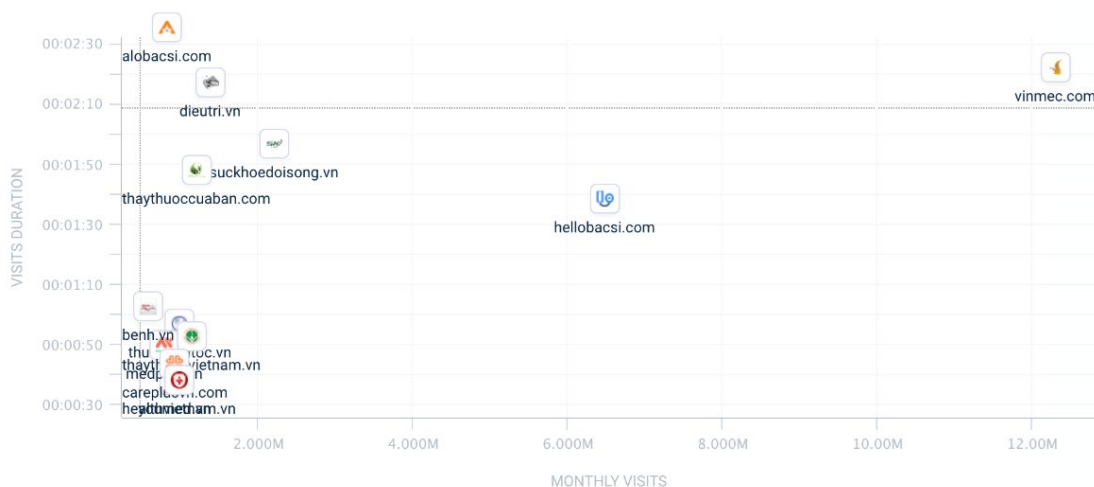
❖ Online health information sources

Over the past decades, the internet has become the most popular health information source. Most people use the internet to search for information on health issues for themselves, but they also look for information for family or friends or just out of curiosity. A health website is likely to provide more accurate information substantiated by research and written by experts, while forums allow users to engage with peers who have the same experience. Social media sites are also becoming increasingly prominent sources of health information among adolescents (Castle-Clarke and Imison 2016).

People with chronic conditions use online health information sources to help manage their condition more effectively. They can understand their conditions, clarify and check the information given by a health care professional, and seek alternative or additional treatments (Castle-Clarke and Imison 2016). Young adults who access health information online report having more productive visits with doctors and saving time by getting information quickly without needing to make an appointment with doctors (Briones 2015). However, it is worth noting that Google searches can return inaccurate diagnostic results (Black 2008), and patients may follow harmful advice on the internet.

Vietnamese people have good access to reliable online health information sources. The MOH and public institutions have developed the “health & life” website (<https://suckhoedoisong.vn/>) and disease-specific websites on hypertension (<https://huyetap.vn/>), diabetes (<http://daithaoduong.kcb.vn/>), etc. Recently, private health care providers have been playing a critical role in health information with their websites becoming more popular (see Figure 2.3). In general, Vietnamese health information websites are reliable. For instance, a study found that the information concerning breast cancer in online Vietnamese newspapers is largely accurate (Jenkins et al. 2020). However, health websites often lack stories about personal experiences, for which people seek peer support from social network sites.

FIGURE 2.3: Leading Health Information Websites in Vietnam in 2021



Source: Original figure for this study report.

❖ Online symptom checkers and health assessment tools

Online symptom checkers and assessment tools are increasingly used by people seeking care and are adopted in health care worldwide. These services provide users with possible alternative diagnoses based on reported symptoms and/or suggest a course of action (Chambers et al. 2019), help users self-triage and manage minor conditions at home, and direct users to appropriate services (Castle-Clarke and Imison 2016). In the United Kingdom, 50 percent of the population uses the internet for self-diagnosis (UK Trade and Investment 2015). The National Health Service (NHS) England has recently introduced a digital platform to make triage services accessible via a website or smartphone app (Chambers et al. 2019). It should be noted that online or digital symptom checkers and triage tools have not achieved a high level of diagnostic and triage capabilities, although performance varied widely between checkers and conditions (Chambers et al. 2019; Semigran et al. 2015).

Online or digital symptom checkers and assessment tools concerning NCDs are available for free use in Vietnam; however, questions about user interest remain. <https://helloworld.com>, one of the most popular health information websites, introduces assessment tools for stroke, chronic obstructive pulmonary disease (COPD), asthma, osteoporosis, glaucoma, etc. Several health care providers offer health assessment tools on their websites as a service promotion. The MOH has launched the “Vietnam Cardiovascular Health” mobile app for estimating the 10-year risk of cardiovascular disease but received little public response since 2019.

Recently, insurance buyers had more opportunities to experience symptom checkers and assessment tools as insurers are moving toward digital risk profiling. Thousands of people in Vietnam downloaded and used the Prudential Insurance Company’s mobile app, which includes a health assessment tool and a symptom checker. Bao Viet Insurance Corporation, Vietnam’s largest nonlife insurer, has just introduced a new feature on its mobile app that allows one million health insurance policyholders to measure their risk of developing NCDs (see Box 2.4). It is anticipated that more and more insurers in Vietnam will introduce symptom checkers and health assessment tools on the path toward digital risk profiling.

BOX 2.4: Risk Simulator for Insurance

Bao Viet Insurance in partnership with Hitachi has been integrating the Risk Simulator for Insurance solution into Bao Viet Direct mobile app. The solution uses artificial intelligence (AI) and medical big data to predict an individual’s risk of contracting one or eight main NCDs including diabetes, hypertension, cerebrovascular accidents, renal diseases, cardiovascular diseases, pancreatic disease, hepatic disease, and malignant neoplasm. Medical insurance policyholders can check their risks easily by entering their health checkup results and past medical history into the mobile app. The app also displays risk factors and offers advice for improving behaviors and habits. This is an important benchmark in the adoption of digital risk profiles among health insurance companies in Vietnam.

Source: Bao Viet Insurance 2021.

Notes: AI = Artificial intelligence; NCDs = Noncommunicable diseases.

❖ Online health service directories

More and more people around the world use an online health service directory when seeking care. Online service directories provide a list of health providers and related information, as well as map out locations. They help people search for health care services online by various criteria such as name, location, medical specialty, distance, availability, quality of care, etc. In the United States, most health consumers use online provider reviews before making an appointment (Rock Health and Stanford CDH 2021), and the online health care directory Vitals (<https://www.vitals.com/>) gets more than 3.4 million visitors every month. In the United Kingdom, the NHS's Directory of Services is a national central directory (<https://digital.nhs.uk/services/directory-of-services-dos>) that provides real-time information about available services and clinicians across all care settings.

Vietnamese people can access online service directories in various ways. At the minimum level, a citizen can find a list of health care providers eligible for the social health insurance scheme on the provincial DOHs' websites. Ho Chi Minh City (HCMC) DOH even offers a mobile app for seeking health care services in the city (see Box 2.5). Above all, the largest and most popular online health service directory is ViCare, which has a database of 20,000 health care providers countrywide and enables users to find appropriate care via the website and mobile app (see Box 2.6).

BOX 2.5: ViCare Health Service Directory

Launched in 2015, Vietnam-based ViCare is a listing and discovery platform for health care providers as well as testing laboratories in Vietnam. Users can select a location from a drop-down list and search for health facilities as well as for doctors from various disciplines. ViCare currently has data on over 19,000 health care providers and 20,000 doctors throughout the country, and these figures keep on increasing. ViCare's website receives 200,000 visitors, with 3,000 leaving comments and 6,000 asking questions each month. The mobile app is available in Google Play.

Source: <https://vicare.vn/>.

BOX 2.6: Health Service Directory in Ho Chi Minh City

Ho Chi Minh City Department of Health (DOH) developed a mobile app to help citizens seek appropriate care in the city. The mobile app provides users with sufficient and reliable information about health care providers, both public and private, who are licensed by the DOH. A person can search for a suitable provider, based on symptoms, the distance from home to the facility, regular clinic hours or out-of-hours services, etc. He or she can also check service prices and waiting time via the app. The app is available in Google Play Store with more than 10,000 installs with a rating of 4.4/5 stars.

Source: <https://play.google.com/store/apps/details?id=vn.gov.hochiminhcity.medianet.tracuu&hl=en&gl=US>.

❖ Online appointment booking

Online appointment booking is a tool that allows patients to book, change, or cancel appointments with their health care providers. These sites and apps often empower patients to review providers before booking an appointment with the selected one. In high-income countries (HICs), most patients found online appointment booking important and had booked appointments online. An appointment booking platform can also help providers remind patients about upcoming appointments via emails or text messages and keep patients engaged with regular check-ins and updates. The development of appointment booking apps is expanding globally. Doctor booking start-ups have now raised nearly US\$800 million from investors globally (Medicalstartups.org 2021), but only a minority of funding is oriented to LMICs.

In Vietnam’s public health system, both providers and patients have little acquaintance with appointment booking. Almost all health care providers, both public and private, have yet to implement an online appointment platform, except for hospitals and clinics in big cities. The average person does not usually book health care in public systems. As a result, patients struggle to navigate health care networks with long waiting times in outpatient clinics and encounter difficulty in finding an appropriate doctor (Lopez, Viet, and Le 2021).

Health care technology start-ups are offering strong potential for transforming the way city dwellers access primary care providers. Over the past five years, many health care apps have been developed, enabling Vietnamese users to select and book appointments with a physician. Doctor booking-focused apps like Medpro (see Box 2.7), Docosan, VOVdoctor 24, etc., can help people access health care far more conveniently and help health care providers expand their client base (Lopez, Viet, and Le 2021). Other apps extend their functions beyond appointment booking to provide users with health information (Hellobacsi) and health service directory (ViCare), or empower patients to choose an appropriate kind of care including in-person visits, teleconsultations (Jio Heath, Med247, e-Doctor, etc.), nursing home care (BlueCare), laboratory tests (MedOn or Mymedlatec, see Box 2.8), etc. Figure 2.4 provides an overview of the health care app landscape in Vietnam.

BOX 2.7: Appointment Booking App Medpro

PHK company is a health technology start-up founded in early 2018 and headquartered in Ho Chi Minh City. PHK offers health care providers the Medpro platform that makes online transactions easier for their customers. The Medpro platform enables patients to book appointments with registered providers, order clinical and testing services, take teleconsultations with doctors, receive and view medical records, and make online payments for health care services. Medpro solutions also include a call center (hotline number 19002115) empowered by AI. To date, more than 70 hospitals and clinics in Ho Chi Minh City have been using Medpro, either the mono version or the white-label app. The company reported 3 million users and 10,000 booking per day via the Medpro platform. It is worth noting that 3 percent of bookings are from Cambodian users who seek cross-border health care.

Source: Medpro 2023.

Note: AI = Artificial intelligence.

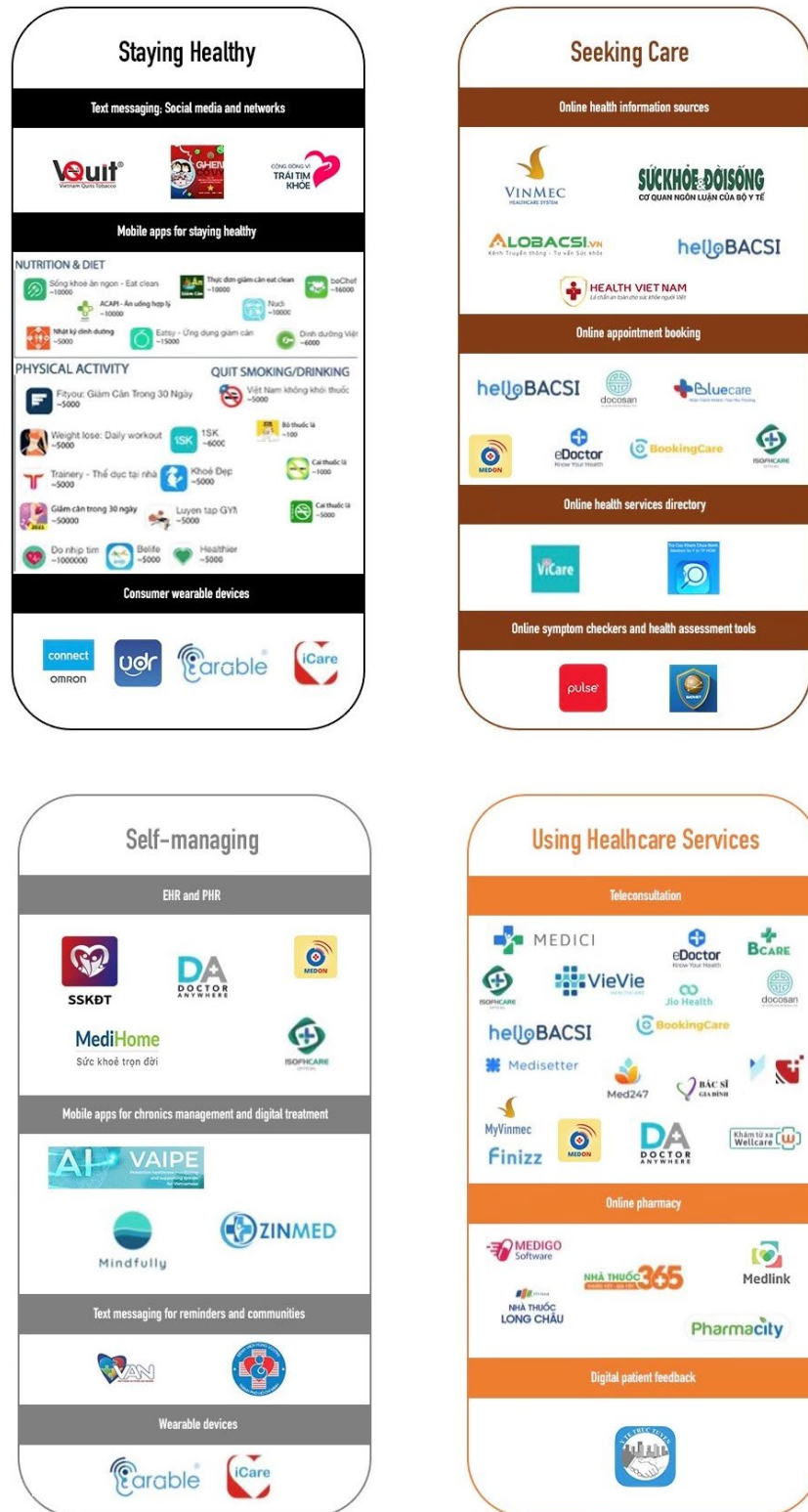
Digital appointment booking has also been inspired by well-established health care systems. Since 2016, the private health care chain MEDLATEC has used an appointment booking app for laboratory sampling and testing and recently upgraded it with new features for improving the patient experience (see Box 2.8). In the public sector domain, hospitals in Ho Chi Minh City pioneer to deploy a mobile app allowing patients to book appointments with doctors.

BOX 2.8: Adoption of Appointment Booking App in a Private Health Care Chain

MEDLATEC, one of the largest health care chains in Vietnam, has a network of laboratory testing facilities and health checkups in 50 cities and provinces, and serves 2 million clients per year. Since 2016, its clients have been able to book an appointment for health checkups at hospitals or for laboratory samplings at home via the iCNM app. Through this app, the company received 1,000–2,000 requests per month. In November 2020, MEDLATEC introduced a new app—MedOn—for its clients and health care professionals. The MedOn app empowered clients to book appointments, select services, and make video calls with health professionals, etc. Within a year after its launch, the MedOn app had more than 250,000 users and 30,000 monthly active users and had facilitated about 4,000 online consultation sessions per month during the pandemic. Recently, Medlatec has upgraded the MedOn app to a newer version, Mymedlatec app, to further improve users’ digital experience through useful features such as an online appointment book, real-time monitoring of service delivery, personal health records, online health service directory, online payments, etc.

Source: MEDLATEC 2020, 2022.

Figure 2.4: An Overview of the Health Care App Landscape in Vietnam



Source: Original figure for this study report.

2.4 Digital applications for patients with NCDs to use health care services

❖ Teleconsultation

Teleconsultation or remote consultation refers to interactions through ICT between clinicians and patients to provide diagnostic or therapeutic advice at a distance (PAHO and WHO 2020). Teleconsultation can function among health workers based in different locations, as well as between patients and clinicians who are separated by distance (WHO 2019) for different purposes of first consult, follow-up consult, or emergency consult (India MOHFW 2020). It can occur via various modes of communication (video link, phone, text messaging, email, or fax), on condition that patient safety, privacy, traceability, accountability, and security can be monitored (WHO 2019). Teleconsultation has long been recognized as a potential means of overcoming geographical barriers and health workforce shortages but has encountered long-standing challenges. The COVID-19 pandemic acted as a stimulus to make substantial progress in the implementation of teleconsultations in HICs and LMICs (Richardson et al. 2020; Nachiket et al. 2021; Lok et al. 2021).

Not only did teleconsultation play a vital role in maintaining continuous care during the COVID-19 pandemic, but it has also proved effective in chronic disease management. The use of video technology typically enables effective consultations between patients and clinicians in diabetes, cancer, and heart failure services (Shaw et al. 2020). Patients with long-term conditions are satisfied with videoconferencing as it offers convenience, flexibility, and cost savings (Armfield, Bradford, and Bradford 2015; Fatehi et al. 2015; Kitamura Zurawel-Balaura, and Wong 2010; Ignatowicz et al. 2019; Stain et al. 2011). There is growing evidence that consultations delivered through telephone and videoconferencing were as effective as face-to-face communication in improving clinical outcomes for patients with mental health and those attending PHC services (Downes et al. 2017; Ignatowicz et al. 2019; Carrillo de Albornoz, Siao, and Harris 2021). Linking PHC providers with specialists through videoconferencing could improve survival for patients with liver disease (Su et al. 2018). However, further research is needed around cost, ethics, and safety, and the practical challenges when implementing videoconferencing (Ignatowicz et al. 2019). High discontinuation rates among patients receiving teleconsultations in the PHC settings indicate this may not be a suitable modality of health care delivery for all patients (Carrillo de Albornoz, Siao, and Harris 2021).

Teleconsultation was introduced in Vietnam two decades ago, but it was not until the COVID-19 pandemic that provider-to-provider videoconferencing was expanded throughout the hospital network. Since the 2000s, several hospitals have adopted telemedicine to provide remote training and consultations but encountered numerous challenges in mainstreaming it into routine operations (Lam et al. 2018; Tran, B. X. et al. 2020). The COVID-19 pandemic, while causing serious disruptions in service delivery, has been a key driver for scaling up teleconsultation in the hospital network. In June 2020, the MOH, in association with the state-owned enterprise Viettel Corporation, launched the “remote health care” project, which supports provider-to-provider teleconsultations between health facilities at various levels. By the end of 2021, the remote health care project had expanded to 1,500 health care facilities from the central to the provincial and district levels, involving 4,000 health professionals at the upper level and 15,000 health professionals at the lower levels in a thousand teleconsultation sessions (Vietnam Communist Party 2021). Such a provider-to-provider teleconsultation model, however, remains hospital-centric and has yet to reach the PHC network.

At the grassroots level, public health facilities are struggling to scale up teleconsultation, although pilot models have proved effective. Primary health checks for patients at home or at CHSs and connecting them to doctors at a higher level through videoconferencing have been practiced in various settings. During the COVID-19 pandemic, CHSs in the epicenter intensively adopted client-to-provider teleconsultation, which has proven feasibility and effectiveness in caring for patients at a distance (see Box 2.9). Technology-wise, it is feasible to run a teleconsultation as most Vietnamese people have an internet connection and a computer or smartphone with audio and video capabilities. Operation-wise, lack of practical guidelines and insufficient reimbursement for client-to-provider teleconsultation hinder public health facilities from maintaining or scaling up remote consultation services in normal situations (HCMC DOH 2020).

BOX 2.9: Client-to-Provider Consultations through a Virtual Call Center during the COVID-19 Pandemic

Despite the initial success in COVID-19 pandemic control in 2020, southern cities in Vietnam had been ravaged by the SARS-COV2 virus since mid-2021. In response to this crisis, the “Accompanying Health Professional Network—AHPN” was established to provide teleconsultation services to COVID-19 patients in the epicenters. In collaboration with local ICT companies, the AHPN deployed a cloud-based (virtual) call center to facilitate inbound and outbound calling in multiple, distributed locations. Using this platform, thousands of health professionals countrywide could connect with COVID-19 patients in the epicenters via computers or smartphones through their internet connection. With integration of AI for translating speech to text and customer relationship management (CRM) functions, the platform enables the AHPN to manage patients’ information and teleconsultation service delivery. During the pandemic peak time from August to October 2021, the virtual call center facilitated 3.5 million minutes of teleconsultations by 10,000 health professionals for 388,000 COVID-19 patients in the epicenters, equivalent to 42 percent of total COVID-19 patients countrywide.

Source: Accompanying Health Professional Network 2021.

Notes: ICT = Information and communication technology; AI = Artificial intelligence.

In the private health care market, client-to-provider teleconsultation has quickly become a preferred mode of PHC service delivery to patients who are willing to pay. Since 2017, the Voice of Vietnam (VOV) in collaboration with the MOH has launched the first online doctor listing platform in Vietnam—VOV doctor24—which allows patients to make video calls with 1,500 doctors working in public hospitals. Following VOV doctor24, various health tech start-ups such as Doctor Anywhere, Docosan, e-Doctor, Jio Health, MedOn, and so on offered video-consultation services to their clients. All have seen remarkable growth in the number of users during the COVID-19 pandemic. For instance, the number of teleconsultation appointments booked on Docosan doubled in July, since its launching in June 2020, while Doctor Anywhere delivered 350 teleconsultations per day, a six-fold increase compared to 60 sessions per day before the pandemic (KMPG 2020).

Table 2.1: Main Features of Selected Teleconsultation Systems in Vietnam

| Provider | Digital applications and services | Customer segment and coverage |
|------------------------|--|---|
| Docosan | A marketplace platform connects patients with more than 300 individual health care providers. It currently has a 5-star rating. Clients can compare providers across 29 specialties, view pricing information, read reviews of doctors, book appointments, chat with PHC assistants, receive teleconsultations and compliant reminder messages from doctors, and order home delivery of self-test kits and medications. | It serves 400–500 clients per day. The largest number of clients are from Ho Chi Minh City, although the system has reached people in 24 provinces, mainly in the North and the South. A customer segment that Docosan targets is women and men in need of reproductive health services, including the stigmatized and vulnerable populations. Building a good and reliable platform with tags for patient feedback enhances the relationship with clients. |
| Doctor anywhere | A telemedicine platform connects patients with 400 networked doctors, clinics, and pharmacies. Patients can use mobile apps to schedule appointments, receive teleconsultations, purchase medications, manage health records, and receive 3-day follow-up via SMS. Online and home-based services are delivered. | The system receives 300–400 bookings per day. Most clients living in Ho Chi Minh City and Da Nang City, and can pay for services either out-of-pocket or by private health insurance. Customer coverage is expanded through partnering with enterprises, using social media, and offering free health education. |
| e-Doctor | A marketplace platform connects patients with about 600 doctors and 50 clinics. Patients can use mobile apps to chat with doctors, schedule appointments, receive teleconsultation and prescriptions, purchase medications, order home-based testing services, and manage health records. Online and home-based services are delivered. | The system serves 400,000 patients per year. Most patients are in the 35–45 age range, residing in large cities (Ho Chi Minh City, Hanoi, Can Tho), and of middle- or high-income status. Social media, apps, websites, hotlines, health education events, and direct sales are channels to expand customer coverage. The app has 450,000 downloads and 60,000 active users per month. |
| HelloBacsi | A health information platform offers blogs and content pieces via two websites (http://helloworldbacs.com and http://marrybaby.vn), which have 20 million viewers per month in Vietnam. Driving people to its two main websites, the platform connects patients with over 10,000 doctors across the country, who currently offer teleconsultations for a fee. Most revenue comes from advertisement and delivery of products and services on websites. | Two websites attract 10 million monthly visitors, of whom 5 million are active users. While clients are from all over the country, a large number are from urban settings where the internet and technology are more advanced. The young and middle-aged are a majority of customers. Ensuring the quality of health content on websites and ensuring the quality of services help expand and maintain customer coverage. |

| Provider | Digital applications and services | Customer segment and coverage |
|---------------------|---|---|
| JioHealth | A telemedicine platform connects patients with five smart clinics and 150 networked doctors. It offers a website and mobile app for patients to book services, receive teleconsultations, purchase medications, and store and share health records confidentially according to HIPAA guidelines. Both online, clinic-based, and home-based services are delivered. | The system serves up to 400–500 patients per day. Most clients are residing in urban Ho Chi Minh City and can pay for premium services and membership, either out-of-pocket or by private health insurance. Smart clinics, apps, websites, hotlines, and health education events are used to enhance customer coverage and experience. The app has about 300,000 active users. |
| Medlatec | A telemedicine platform offers a call center and an app for patients to book and monitor services, have teleconsultations with doctors, and manage health records. Doctors have access to a mobile app to perform teleconsultation, a PACS for teleradiology and teleultrasound, and a teleconferencing system for clinical seminars. The service model is a mixture of inpatient, outpatient, home-based, and online services. | The health system serves 2 million clients per year. Most patients are living in urban settings who want to use home-based services and are willing to pay out-of-pocket or be covered by private health insurance. Customer coverage is expanded/maintained through networked clinics and health workers, point accumulation, social media, hotlines, and events. |
| VOV doctor24 | A marketplace platform connects patients with highly qualified doctors in public hospitals. It offers a website and mobile app for patients to find, book appointments, and consult with a doctor; and a website and mobile app for doctors to provide teleconsultations and prescriptions from a distance. All services are online. | The system served 200 clients per day during the COVID-19 pandemic. Clients are Vietnamese patients who want and can pay out-of-pocket for teleconsultations with good doctors in public hospitals. Among patients 30 percent are from Ho Chi Minh City, the rest are from other part of the country, especially the North. The VOV radio channel is a strong tool for VOVdoctor 24 to reach customer coverage, in addition to the hotline, and social media. |

Source: Original compilation for this study report.

Notes: PHC = Primary health care; SMS = Short message service; HIPAA = Health Insurance Portability and Accountability Act; PACS = Picture Archive and Communication System; VOV = Voice of Vietnam.

❖ Tele-pharmacy

Tele-pharmacy refers to the provision of pharmaceutical care by registered pharmacists and pharmacies through the use of telecommunications or other technologies to patients at a distance (Casey et al. 2010). Tele-pharmacy services include medication selection, order review, dispensing, patient counseling and monitoring, provision of clinical service, and so on (Baldoni et al. 2019; Le, Toscani, and Colaizzi 2018; Win 2017). Pharmacists can deliver remote services through telephone, videoconferencing, chat, novel software, and automated dispensing machines or devices (Baldoni et al. 2019; Ho et al. 2015; Poudel and Nissen 2016). Tele-pharmacy models have been implemented in various countries despite variations in health care systems (Hedima and Oroko 2021).

Tele-pharmacy brings many benefits to patients. The primary advantage is the easy access to pharmacist counseling and prescription medication, which are fundamental aspects to the delivery of patient-centered health care, in remote and rural communities (Poudel and Nissen 2016). Tele-pharmacy saves travel time and cost, which are the major problems encountered by old and disabled people and those living in rural areas (Gordon, Hoeber, and Schneider 2012; Traynor 2013). Patients in different settings were satisfied with online counseling and videoconferencing interactions with pharmacists, as well as the time required to obtain medications (Clifton et al. 2003; Ho et al. 2015; Rothwell and Hogan 2015; Traynor 2013). Literature suggests that tele-pharmacies perform similarly to traditional pharmacies in terms of medication safety and adherence, although evidence remains limited to draw definitive conclusions about patient safety and quality-related outcomes (Pathak et al. 2021).

Thousands of pharmacies in Vietnam's cities have adopted e-commerce, offering patients a convenient way to purchase medications. About 15 percent of 65,000 wholesale and retail pharmacies and drug outlets countrywide are run by modern pharmacy retailers (Phu Hung Securities 2022), which mostly integrate e-commerce into operations. The current legal framework allows licensed pharmacies to operate an online platform selling nonprescription drugs, prescription medications, medical devices, food supplements, and cosmetics. To address the COVID-19 pandemic, pharmacy chains have harnessed ICTs and ramped up their e-commerce business on the internet (see Box 2.10). Nowadays, online pharmacies are creating a new pharmaceutical distribution marketplace where patients in urban settings can search, compare, select, order, buy, and receive drugs from their own homes. Health tech start-ups further improved patients' digital experience. Medio features its pharmacy directory and offers home delivery of medicines around the clock. Omicare develops a personal health record (PHR) for users to record their drug use histories and side effects.

As the pharmaceutical e-commerce business is booming in Vietnam, there remain questions about the interaction between pharmacists and patients at a distance. In a country with only 3.39 pharmacists per 10,000 population (WHO 2022), drug counseling through face-to-face communication between pharmacists and patients at community pharmacies remains limited in terms of quantity and quality of interactions (Quynh et al. 2018; Tran, V.D. et al. 2020). Online pharmacies facilitate communications with customers via chat and telephone (hotline), through which customers receive remote counseling but which seldom verify the counselor's qualifications. Although online pharmacy apps often show high ratings from users, there remains limited scientific evidence on the quality of patient counseling services through pharmaceutical e-commerce systems. Recently, the two largest pharmacy chains, Long Chau and Pharmacity, have

reported intensive investment in ICTs and training of pharmacists to improve service quality and patient satisfaction (see Box 2.10).

BOX 2.10: Use of ICTs to Deliver Pharmaceutical Services by a Pharmacy Chain

Long Chau pharmacy chain is the largest pharmacy retailer in Vietnam with more than 1,000 drugstores nationwide. As a member of FPT digital retail company, the pharmacy chain has harnessed the power of ICTs to optimize supply chain operation, improve pharmacists' competencies, and enhance customer experience. Deployment of the material requirement planning system and real-time location system automated workflow and increased operational efficiency in the supply chain. Application of virtual simulation in continuous training improved pharmacists' professional skills in pharmacy practice. Amid the COVID-19 pandemic, the retailer launched a website and a mobile app to offer online pharmacy services. Pharmacists from a contact center provide customers with remote drug counseling via chat and telephone, and review and verify electronic orders of prescription medicines. Achieving a high customer satisfaction level, the Long Chau pharmacy network has recently captured the largest share of the retail market for pharmaceuticals and medical devices. The effective adoption of ICTs is considered a key contributor to this success.

Source: FPT 2021.

Note: ICTs = Information and communication technology.

Despite recent developments, tele-pharmacy in Vietnam has yet to realize its full potential for delivering pharmaceutical care to patients, particularly those who live in rural and remote areas. Pharmacist- and patient-oriented digital interventions mostly reside in the pharmaceutical retail industry with a focus on medication selection, counseling, purchase, and dispensing. Several telemedicine providers such as AiHealth, Doctor Anywhere, Jio Health, and MedOn developed their online pharmacies or linked their electronic prescriptions to established pharmaceutical e-commerce platforms. Other than pharmaceutical transactions, there is not any report on the use of ICTs by pharmacists to provide patient monitoring and clinical care. Tele-pharmacy services, mainly delivered by the private sector, are targeting urban consumers who are willing to pay a premium. Adopting tele-pharmacy by public health care providers remains limited, particularly at the grassroots level, due to a lack of policy and a shortage of resources. Those who live in rural and remote areas, therefore, have very little experience with tele-pharmacy services.

❖ Digital patient feedback

Digital patient feedback is a tool that supports reporting of health system issues by patients to health care providers and health system managers. It offers the advantage of timeliness and reduced costs and may be perceived as disruptive to organizational and clinical routines (Ong et al. 2020). Digital patient satisfaction surveys are often automatically scheduled to be sent to patients as soon as they leave a clinical site. Increasingly, health care settings are installing digital devices to collect patient feedback on the experience of care (Ong and Sanders

2021). While health care staff recognize the potential of digital feedback, patients might have a range of views depending on their familiarity with the technologies and implementation of digital patient feedback systems in specific contexts (Ong et al. 2020). People with long-term physical and mental health conditions might encounter barriers to engagement with digital screens for collecting patient feedback (Ong and Sanders 2021). Additionally, a lack of emphasis on digital maturity may lead to ineffective real-time feedback, thwarting improvement efforts (Khanbhai et al. 2019).

Patient feedback in the Vietnam health system is now widespread and digital interventions are increasingly used by patients. Almost all telemedicine mobile apps for patients integrate a user feedback function, enabling patients to rate service providers after each visit. However, the adoption of digital patient feedback in the public sector remains slow. Several hospitals developed their digital patient feedback tool but these cannot be scaled to other facilities. There is one solution from the Ho Chi Minh City Department of Health, which was developed in 2019. No evidence has been found regarding the adoption or the sustainability of this solution.

BOX 2.11: App Y tế trực tuyến

Y tế trực tuyến is an interactive channel between the people and the Ho Chi Minh City Department of Health, which allows the public to participate in monitoring and reporting to state management agencies about violations of the law while participating in the health care sector at both individual and organizational levels. Users can easily report the illegal acts of practitioners to the Medical Inspector of the Department of Health with pictures or video clips as evidence. After 12 months, the Ho Chi Minh City Department of Health received 530 reports, which helped to stop 24 illegal health care facilities in the city. The app has 10,000+ installs with positive feedback and is rated 4.2/5 in the Google Play Store.

Source:

<https://play.google.com/store/apps/details?id=vn.gov.hochiminhcity.medinet.ytetructuyen&hl=en&gl=US&pli=1>

2.5 Digital solutions for patients with NCDs to manage a chronic condition

❖ Online health communities

Online health communities (OHCs) provide an internet-based platform to support self-management of chronic conditions. Through social network sites, patients and family members can connect with others in similar circumstances, exchange information about an illness, and seek and offer peer support. By belonging to online communities, patients with chronic conditions become more knowledgeable; feel more socially supported and empowered; and have improved behavioral and clinical outcomes (Bartolome and Yuan 2018; Johansson et al. 2021; Van der Eijk et al. 2013). Social media sites are also becoming increasingly prominent sources of health information among adolescents (Castle-Clarke and Imison 2016). Nevertheless, there remain concerns about health misinformation and risky perceptions generated by online social networks.

OHCs have been burgeoning in Vietnam, where social network penetration reached nearly 74 percent. Facebook is the most popular platform for Vietnamese patients, health professionals, and informal caregivers to create their health communities. Among Facebook groups with 1,000 members and above, there are more than 70 groups related to cancer, 50 groups for musculoskeletal diseases, 40 groups for diabetes, 30 groups for depression, 20 groups for hypertension, etc. While noting concerns about social media information credibility, this study acknowledges that several well-established OHCs in Vietnam are providing great support to patients with chronic conditions. For example, the Breast Cancer Network Vietnam has a good reputation for its social and emotional assistance to women with breast cancer through online and offline activities. The Vietnam Autism Network (VAN) is well-known for its capacity to provide self-management education and facilitate collaboration between parents who have a child with autism and interdisciplinary professionals, which does not happen spontaneously in the formal mental health care systems (see Box 2.12).

Box 2.12: Vietnam Autism Network

Approximately 0.75 percent of Vietnamese children suffer from autism spectrum disorders (ASD); unfortunately, there remains a critical shortage of mental health and education professionals to support parents of a child with ASD. In 2013, affected parents created the Vietnam Autism Network to connect with each other and share information, experience, and resources for the care, treatment, and education of a child with ASD. The network administrators, in collaboration with ASD experts, also organize online events for affected parents including knowledge exchanges, competitions, etc. With nearly 36,000 members, the Facebook group of parents of a child with ASD has become the largest and most well-established online social network for ASD in Vietnam. Online ASD communities are providing informational and social support, and facilitating interdisciplinary collaboration across professions and institutions toward patient-centered care.

Source: VAN 2021.

❖ Text messaging for reminders

Text message reminders in health care involve the use of SMS to deliver reminders to patients for enhancing appointment attendance and treatment adherence. These interventions have proved effective in increasing medication adherence and improving some clinical outcomes among patients with diabetes, hypertension, coronary heart disease, and COPD (Frank, Schwebel, and Larimer 2018; Nepper, McAtee, Wheeler and Chai 2019; Tam, Wong, Cheung and Chung 2021; Vargas, Cajita, Whitehouse and Han 2017; Zhao et al. 2019). Studies also support the use of text message reminders in managing other chronic conditions such as asthma, stroke, mental disorders, musculoskeletal pain, etc., although further evidence is required (D'Arcey et al. 2020; Dong et al. 2018; Fritsch et al. 2020; Kamal et al. 2015; Rathbone and Prescott 2017). A combination of SMS reminders with other interventions was generally more effective (Ogungbe et al. 2021).

However, there remains limited evidence supporting the use of text message reminders for chronic condition management in Vietnam. Using weekly SMS reminders of medical appointment retention and medication adherence for a large population group with hypertension in Ho Chi Minh City did not show higher efficacy than usual behavior change approaches (Tran et al. 2019). Several small-scale community-based projects demonstrated the feasibility of text messaging in NCD management but could not prove an advantage of SMS reminders over usual care due to a lack of a control group (UNESCAP 2019). These interventions revealed challenges in technical design, patient engagement, and interrelationships with the clinical and organizational context (Tran et al. 2019 UNESCAP 2019). Recently, the leading obstetrics and gynecology specialized hospital in Ho Chi Minh City has launched an SMS application to remind pregnant women with gestational diabetes to test blood glucose regularly. Despite early successful deployment, it is still too early to evaluate the effectiveness and sustainability of this hospital-based system.

❖ Electronic health record and personal health record

Electronic health records (EHRs) and personal health records (PHRs) are real-time, patient-centered records that enable authorized users to manage patients' electronic health information. EHRs allow authorized providers to create, update, and access information at any point of care, thereby improving the timeliness of care and streamlining workflow. PHC providers in some countries are required to give patients online access to EHRs as an effective way to improve patient engagement. With PHRs, patients fill in health information, store data on their computers or the internet, and share information with health care providers. When PHRs are connected to an EHR system, patients access health information through a secure portal.

Online access to EHRs and PHRs can improve patient engagement and operational efficiency. Evidence shows that patient access to EHRs is highly valued, leading to improved patient satisfaction, reduced medical errors, and perceived cost savings (Alanazi, Butler-Henderson, and Alanazi 2020; Hoover 2016; Shah et al. 2015; Fisher 2013; Delbanco et al. 2012; Schnipper et al. 2012; Menachemi and Collum 2011). Patients can use EHRs as a starting point to search for further information online, resulting in more productive health care consultations (Briones 2015; Shah et al. 2015). Online access to EHRs can improve patient understanding,

confidence, communication, adherence to lifestyle advice, and a sense of involvement in their own care (Bhavnani et al. 2011; Fonda et al. 2010). Professionals also found that it facilitates shared decision-making (Pagliari, Shand and Fisher 2012). PHRs can coordinate and combine information from multiple providers, enhance provider–patient communication, encourage family health management, and reduce administrative costs (ONC 2016). Additionally, PHRs can provide patients with the ability to utilize transactional services (e.g., appointment booking, requesting repeat prescriptions). People with long-term conditions, who require regular monitoring and contact with health care services, benefit the most from having access to their PHRs (Gabriel et al. 2016; RCP 2016).

While countries benefited from EHRs, the government of Vietnam has recently embarked on EHR implementation at the PHC level. By 2015, over 50 percent of upper-middle- and high-income countries had adopted national EHR systems, but adoption rates are much lower in the lower-middle and low-income countries (WHO 2016). Not until 2016 did the government of Vietnam approve the grassroots health network strengthening strategy, proposing the adoption of EHRs to manage and monitor health information for the entire population. The MOH realized this strategic direction by standardizing the health record template in 2017, piloting EHRs in 26 model CHSs in 2018, issuing an EHR implementation plan in 2019, and establishing the national health database (<http://www.hososuckhoe.gov.vn>) in 2020.

Many public health institutions in Vietnam have piloted EHRs over the past three years, but meaningful use of EHRs by health professionals and patients remains a concern. Following the decentralized approach, provincial DOHs are responsible for deploying EHRs at the grassroots level in line with the MOH’s plan. By 2021, more than 50 out of 63 provinces had adopted EHR software at various stages. However, most CHSs have yet to gather individual health data in EHRs, and PHC professionals remain unable to share health information with other health care providers. Electronic referral of patient information from a primary- to a secondary-level practitioner remains a challenge due to a lack of unique patient ID and non-interoperability between software applications. Besides, the local EHR market is predominantly supplied with three applications from the VNPT corporation, the Viettel corporation, and the Vietsens Technology Group, which provides neither patient online access to health records nor staff access to clinical decision support. Therefore, public health service providers hardly ever demonstrate meaningful use of an EHR to advance clinical processes and patient experience.

The COVID-19 pandemic, while it interrupted the implementation of EHRs at the grassroots level, accelerated the introduction of PHRs for Vietnamese citizens. In the framework of the national COVID-19 vaccination campaign, the MOH launched the “Sổ sức khỏe điện tử” digital platform, which is the PHR for citizens to replace other COVID-19–related apps. Using this application, people in Vietnam can perform health declarations, register for COVID-19 vaccinations, check vaccination history, report postinjection complications, and receive a certification of COVID-19 vaccination with a QR code. Not only does the mobile app address the COVID-19 pandemic, it also allows users to manage their health information through a PHR and to utilize other telehealth functions, which have potential for tackling NCDs (see Box 2.13). Thanks to the government’s endorsement, this PHR app has become the fastest-growing app ever in the national health care industry with more than 10 million installs and a 2.4/5 review rating within six months of operation. Despite an impressive take-up, there remain questions about public interest and government effort in maintaining this PHR app for managing NCDs in the post pandemic era.

BOX 2.13: Features of “Sổ sức khỏe điện tử” Platform favorable for tackling NCDs

- **PHR services:** The app enables users with NCDs to record their biomedical data (height, weight, temperature, heart rate, blood pressure, blood sugar, SpO₂, BMI index, blood group, medical histories) and to view previous vaccinations, consultations, testing results, medications, etc. Additionally, users can manage health information for other family members having NCDs in the same accounts.
- **Telehealth services:** The app allows users with NCDs to search health service providers, book an appointment, and take a teleconsultation.
- **Interoperability:** Data are stored on the MOH’s EHR database and can be shared with other MOH-managed applications. Using the QR code on the citizen identity card, the app can share data across the government’s digital platforms.

Source: Original box for this study report

Notes: PHR = Primary health care; NCDs = Noncommunicable diseases; BMI = Body mass index; MOH = Ministry of Health; EHR = Electronic health record; SpO₂ = Oxygen saturation.

Contrary to public institutions, few private PHC providers can afford an EHR or PHR application. At least three PHC providers (MEDLATEC, Doctoranywhere, and MEDIHOME) are operating an EHR system, which allows patients to access health information through a patient portal. Additionally, several digital health innovators in Vietnam such as AiHealth, iSofH, Jio Health, e-Doctor, and VTRC/MEDIHOME introduced PHR apps for their clients. There is little information available on how many and how frequently Vietnamese people use such PHRs, and what they use them for. However, it is obvious that when users switch to another app, their health data in the previous one are not shared with the new one due to non-interoperability.

❖ Mobile apps for chronic condition management

The use of mobile apps by patients with chronic conditions can increase medication adherence, enhance symptom self-management, and improve some health outcomes (Lee et al. 2018; Pérez-Jover et al. 2019; Whitehead and Seaton 2016). The most common features of mobile apps for managing chronic conditions are real-time or regular symptom assessments, preprogrammed reminders, or feedback tailored specifically to the data provided by participants via mHealth devices (Lee et al. 2018). These applications enable greater engagement of patients and allow them to self-diagnose their acute symptoms, and enhance monitoring, tracking, and communication of different biometric information (e.g., blood pressure, glucose levels, spirometry values, oxygen saturation, lung function) (Steinhubl, Muse, and Topol 2013). Among the chronic condition management apps, the largest categories focus on mental disorders, diabetes, and the cardiovascular system, while applications for digestive, respiratory, musculoskeletal, nervous systems, and cancer also account for a significant proportion (IQVIA 2021). The applications that use behavior change strategies reported significant effects on mental disorders including depression, anxiety, and stress (Kai, Varma, and Prospero 2018; Khademian, Aslani, and Bastani 2021). Apps tended to increase medication adherence in cardiovascular disease (Alessa et al.

2018), lower systolic blood pressure in patients with hypertension, and reduce the rate of hospitalizations in patients with heart failure (Indraratna et al. 2020). The use of apps by patients with diabetes could help improve the control of Hemoglobin A1c (HbA1c) (Bonoto et al. 2017). Mobile apps have also shown promising results in patients with asthma, cancer, Parkinson's disease, and rehabilitation (Alquran et al. 2018; Jongerius et al. 2019; Linares-del Rey, Vela-Desojo, and Cano-de la Cuerda 2019; Magalhães et al. 2021; Ryan et al. 2019).

In Vietnam, the adoption of self-management mobile apps remains a nascent tendency among digital health stakeholders. The authors recorded very few mobile apps developed or customized for Vietnamese patients managing chronic conditions. Two of them are a companion app to wearable medical devices that enable customers to automatically synchronize and transfer measurement data, track biometric data (blood pressure, heart rate, blood glucose, etc.), and receive reminders or alerts (FaCare 2023; Omron Healthcare 2023a). The manufacturers have been promoting the uptake of wearable medical devices and mobile apps for a health measurement rewards program (Omron Healthcare 2023b) or occupational health telemonitoring initiative (FaCare 2023b); however, no evidence of impact on Vietnamese customers' health outcomes are published. Another mobile app accompanied by a commercial platform for diabetes management was piloted in selected hospitals and demonstrated effectiveness and acceptability; however, it requires further study on cost-effectiveness and scalability (see Box 2.15). The final mobile app is being developed as part of an artificial intelligence–assisted Internet of Things (IoT)–enabled system with proven potential to improve medication safety and quality of care (see Box 2.14).

People living in Vietnam can access global mobile apps for self-monitoring, although the appropriate use and health impact of these apps remains a question. Among the top 50 health and medical apps ranking on Google Play Store for Vietnam, there are six apps for blood pressure tracking imported from other countries (Similarweb 2023). A study provided evidence that the use of mobile self-monitoring applications could potentially aid in self-managing high blood pressure among overseas Koreans living in Vietnam.

Box 2.14: AI-Assisted IoT-Enabled Smart, Optimal, and Protective Health Care Monitoring and Supporting System for Vietnamese (VAIPE)

The VAIPE project aims to build an intelligent health care system to assist users in collecting, managing, and analyzing their health-related data. It involves research and development of various tools and frameworks to facilitate the integration of services to end-users and third-party applications, including web-based systems, API platforms, and Smartphone applications. The AI-based smart health care applications for Android/iOs devices can provide smart calendars and reminders for the medications schedule, looking up medication information using pill recognition and detection, and tracking health information (weight, SpO2, blood pressure, electrocardiogram, etc.). During the experimental phase, the applications proved accurate in pill recognition, sleep apnea detection, identification of multiple cardiovascular abnormalities, and vision-based digitized neurological examination.

Sources: Nguyen, Anh-Tu et al. 2022; Nguyen, Anh Duy et al. 2022; Le et al. 2022; Nguyen, Trong-Tung et al. 2022; Trung-Hieu et al. 2022; Nguyen, Trung Thanh et al. 2022; VAIPE 2023.

Notes: AI = Artificial intelligence; IoT = Internet of Things; API = Application programming interface; SpO2 = Oxygen saturation.

❖ Wearable medical devices

The use of medical wearables for telemonitoring has proven effective in reducing hospitalization and improving health outcomes, particularly when used for NCDs. Wearable sensors can measure heart rate, body temperature, blood pressure, blood glucose, blood oxygen saturation, posture, walking patterns, electrocardiogram, etc. A smartphone with an app is typically used to collect and transmit data to a remote server for storage and analysis (Wu and Luo 2019). Wearable devices can be integrated into a digital platform to provide patients with education, self-monitoring with goal-setting and feedback, and regular visits. Telemonitoring can enhance medication adherence and overall responsibility, particularly when patients are empowered to adjust their medication based on their readings (Ammenwerth et al. 2015; Fairbrother et al. 2013). Wearables are also a promising rehabilitation technology thanks to their measurement of kinematic motion, neural activity, and muscle dynamics (Porciunclula et al. 2018). A systematic review found that automated device-based telemonitoring can reduce health failure-related hospitalizations and lower the risk of all-cause mortality (Bashi et al. 2017; Kitsiou Paré, and Jaana 2015). Home telemonitoring appears to have a positive effect in reducing respiratory exacerbations and hospitalizations among patients with chronic obstructive pulmonary disease (Cruz, Brooks, and Marques 2014). For those who live with Parkinson's disease, wearable devices can provide a more objective and accurate measurement of falls, sleep disorders, and disease progression, and help with medication management (Adam et al. 2021). Studies involving patients with hypertension and diabetes demonstrated the ability of telemonitoring to achieve better clinical outcomes (McKinstry, Hanley, and Lewis 2015; Paré et al. 2010; Wild et al. 2016).

The COVID-19 pandemic in Vietnam boosted the use of medical wearables and fostered telemonitoring in selected locations. Before the pandemic, medical wearables were commercially available in Vietnam's cities but were not commonly utilized by patients and professionals. As COVID-19 cases surged, several local authorities piloted the use of wearable wristbands to supervise people under home quarantine. In the epicenter, providers, patients, and family members were advised to use wireless pulse oximeters to detect early deterioration of COVID-19 patients at home (HCDC 2021). Noninvasive pulse photoplethysmography and other wearable sensors have been piloted to remotely monitor and access key continuous vital sign data in patients with COVID-19 (Chau et al. 2021), generating an opportunity to introduce Tele-ICU monitoring in COVID-19 critical care (Vietnamplus 2021).

Small-scale studies supported the acceptability and effectiveness of wearable telemonitoring for NCD management, but the scaling-up feasibility remains questionable. Several clinical trials have recently been conducted to evaluate the use of medical wearables in telemonitoring of blood pressure, blood glucose, electrocardiogram (ECG), and vital signs in Vietnam (Do et al. 2018; Khanh et al. 2020; Phu et al. 2022; Van et al. 2021). Early evidence demonstrated the effectiveness and acceptability of wearable telemonitoring for hypertension and diabetes management (Phu et al. 2022; Khanh et al. 2020). However, device unavailability, high cost, and other user-related factors (age, literacy, perception) may hinder the scaling-up of such approaches (Khanh et al. 2020). Further research is required to prove the durability, scalability, and cost-effectiveness of wearable telemonitoring in the Vietnam context (see Box 2.15).

BOX 2.15: A Patient's Journey through a Digital Diabetes Care Platform

A digital diabetes care platform was piloted at five hospital endocrinology clinics in Ho Chi Minh City. The platform comprises four main components: smart blood glucose monitor, engaging patient mobile app, cloud-based digital diabetes clinic, and control tower software. Three hundred patients with diabetes journeyed through this digital care platform from August 2018 to January 2019. In 12 weeks, patients self-monitored blood glucose data by using a glucose monitoring device, which transmits data to the cloud via smartphone. Alerts were generated automatically on the basis of each patient's glycemic control targets and self-monitoring of blood glucose adherence alert definitions. Digital visits were conducted monthly, constituting a review of the patient's glucose log and analytics using the digital diabetes clinic desktop application. The physician reviewed and determined the treatment regime. Upon completion of a digital visit, a summary message was sent to the patient. The pilot evaluation demonstrated the effectiveness and acceptability of a digital diabetes care platform in Vietnam. Possible obstacles to scaling-up the digital platform included lack of smartphone and internet connectivity, cost, limited availability, older age, requirement for training, and unacceptance of new technology. The durability, scalability, and cost-effectiveness of this approach merit further study.

Source: Khanh et al. 2020.

PART 3: THE WAY FORWARD: STRATEGIC ACTION AREAS

This chapter provides a greater understanding of the challenges facing innovators, patients, and PHC providers that have hampered the successful adoption of digital health applications to address the burden of NCDs. It identifies three problematic areas and proposes strategic actions to foster digital health innovation, enhance user engagement and uptake, and sustain digital health applications for patients with NCDs.

3.1 Fostering digital health innovations to address the burden of NCDs

Despite recent growth in digital health investment, there are not many digital applications for patients with NCDs in Vietnam. This study found that online health information and social networks are the most common applications for patients with NCDs managing their health. Numerous smartphone apps enable patients to update information, evaluate symptoms, look for services, book appointments, consult with health professionals, and purchase over-the-counter medications, but there are not many apps dedicated to NCDs. Particularly, there is a scarcity of digital applications for patients with NCDs to self-manage their chronic conditions. Digital applications tied to monitoring and wearable technology are limited, most are in the testing phase and on a small scale with little proof of their efficacy or impact. Even SMS intervention for NCDs is uncommon and lacks strong evidence of efficacy and sustainability. It is worth noting that Vietnam's situation parallels that of other LMICs, where the paucity of digital health interventions in PHC is disproportionate to the high demand for health system strengthening to address the burden of NCDs (Xiong et al. 2023).

Digital health innovators are working in a challenging environment that constrains research and development of digital applications for NCDs. The entrepreneurship ecosystem in Vietnam remains nascent with a nontransparent system and a weak regulatory framework (Nourhan Shaaban 2020). Start-ups interviewed for this study shared the same concern about the ambiguous nature of digital health regulations, as explained by a start-up manager, "There is a lack of clear legal guidelines, creating a gray area in terms of health data regulations, storage, and telemedicine implementation." Weak collaboration between the public and private sectors poses another challenge in health data exchange and innovation development. Connecting to the public information system is difficult, especially for enterprises with limited ICT resources. Public facilities express weak demand for adopting digital innovations from the private sector while clinicians tend to be uncomfortable with new digital tools. In the absence of government financial support, entrepreneurs typically rely on their network to find funding resources (Shaaban 2020). Concern was shared in the following terms by another start-up manager, "The question is whether digital health innovators have sufficient financial capacity and passion to endure, overcome market education and adaptation phases."

In this context, the central and provincial authorities should utilize existing resources to strengthen health innovation exchange and support entrepreneurship. It is pivotal to facilitate collaboration between the ICT industry, consumers, and the research sector, focusing on tackling NCDs. An innovation lab or a common platform (such as EHR) can facilitate networking among entrepreneurs and connection with health professionals, researchers, strategic partners, and policy makers. Innovators can receive the support they need and use data to identify opportunities to work collaboratively on designing digital health solutions. The government should provide

incentives for impactful digital health applications, such as those improving the prevention or early detection of NCDs, allowing providers to monitor patients with NCDs remotely, and prescription medicines as patients with chronic diseases regularly need refills (Broadband Commission 2018). For small, capital-strapped businesses or those in the early stages of growth, incentives in the form of small grants would encourage health-tech start-ups to continue pursuing the research and development of applications to address NCDs (Shaaban 2020).

Policy makers should prioritize establishing a regulatory framework that supports innovations without compromising privacy, security, and intellectual property. Digital health is evolving rapidly, and regulatory frameworks must be established and appropriately adjusted to keep pace with its development. The first measure is launching a regulatory sandbox initiative. This would not only allow start-ups to experiment with new solutions but also help policy makers gain insights into new digital health technologies and engage with players from the start-up ecosystem. Moreover, a sandbox policy will help create appropriate regulations that balance privacy and security concerns with support for innovation. Enforcing strong intellectual property rules is another effective measure. Clear, detailed, and enforceable intellectual property protections and regulations are critical for ensuring fair competition, increasing innovation and entrepreneurship, and accelerating the commercialization of research.

3.2 Enhancing user engagement and uptake of digital health applications

This study found several digital health applications for people with NCDs struggling to scale. The MOH launched the “Depression” mobile app in 2012 and the “Vietnam Cardiovascular Health” mobile app in 2019 but received little public response. Recently, the MOH launched another smartphone application on elderly health through a mass communication campaign but recorded a relatively low uptake combined with a strong desire for ICT support among older persons. At present, the uptake of official electronic services remains low, except for online health information sources.

Uptake is not simply a matter of having a digital health tool but depends on user acceptance and engagement. At the device or platform level, the most reported enablers for use in the Asia Pacific region related to the ability of digital health technologies to meet users’ individual needs, such as those that integrated easily with users’ lives or workflows and those that were adapted to local languages, cultures, and literacy levels (Kosowicz et al. 2023). From the perspective of digital health users in LMICs, guidance for people with NCDs and training for primary providers on using digital health tools facilitated the uptake of digital health interventions in NCD management at the PHC level (Xiong et al. 2023). Evidence shows that adherence to apps or monitoring devices tends to deteriorate over time but may be higher when recommended by a professional (Aitken and Lyle 2015; Ledger and McCaffery 2014).

Establishing trust in digital health applications is essential for user engagement and adoption. Providing useful information is a popular way to build trust with patients as they are likely to trust providers who can give reliable educational content online. Follow-up calls, mailers, hotlines, and an online helpdesk are also effective in engaging with patients, helping to solve their questions in a timely fashion, and acting as a way to attract more people to use digital health innovations. Moreover, data protection is a major concern for adopters of digital applications. Health service providers need to provide data privacy notices that include the identity of the data controller, the purposes for which the data will be used, and why and who the data will be transferred to or shared with. Both PHC professionals and facility managers play important roles

in this regard. The local experience was shared in the following terms by a PHC system manager, “We face many difficulties from users in building trust in digital health products as well as taking a lot of effort in educating users about the value, effectiveness of digital health applications.”

The uptake of digital health applications for patients with NCDs requires both professional and organizational behavior changes. A PHC worker should carry out additional activities beyond traditional work including showing patients how to use online services, demonstrating the benefits, explaining what information the EHR contains, identifying and recommending appropriate self-management tools, employing shared decision-making, helping patients understand data and information, and encouraging adherence by drawing on patient-generated data (Castle-Clarke and Imison 2016). This new way of working requires improved competencies of PHC professionals as well as changes in the organizational behavior of PHC settings. Policy makers in Vietnam may consider developing a training curriculum, revisiting staffing assignments, and proposing incentive schemes to support this transformation at the grassroots level.

It is critical to build digital capability in the health workforce to facilitate the adoption of digital applications for patients with NCDs. Vietnamese health professionals have long been ill-equipped in ICT skills. A decade ago, about 50 percent of Vietnamese health graduates participated in the labor market without confidence in ICT skills (Le et al. 2013); nowadays, about half of the health professionals working with health data are not trained in common health information systems (Pham et al. 2022). To promote the adoption of digital technologies, the MOH and provincial DOHs occasionally organized ad hoc conferences or workshops that targeted mostly health managers and had no direct impact on the competencies of PHC professionals at the grassroots level. Unless education and training for digital health transforms, Vietnam cannot create a competent workforce to deliver digitally enabled PHC to patients with NCDs. Policy makers may need to develop digital profiles or digital competency frameworks to describe the different requirements of the health workforce, depending on the role the individual plays in the design, implementation, and adoption of digital technologies (Australian Digital Health Agency 2020). Education and training institutions will require additional investment in competency-based curricula and e-learning courses, which can help improve digital health literacy and competencies among health professionals.

Simultaneously, the government of Vietnam should make an effort to address low digital literacy and the digital divide across population groups. Digital skills among the active population in Vietnam remain low, ranking it 97 out of 141 countries (WEF 2019). Priority should be given to older people, given they are high users of services relating to NCDs and less engaged with internet use. Only 12.7 percent of older people have access to the internet, while a few older people use ICT gadgets for sending emails (2.1 percent), messaging (2.3 percent), and playing video or computer games (2.2 percent) (Vu et al. 2020). People with disabilities and ethnic minorities are also digitally disadvantaged groups. People with disabilities used mobile phones and the internet 2 times and 6.5 times less than nondisabled people, respectively (Vietnam GSO 2018). While 61.3 percent of ethnic minority households have access to the internet, only 10.3 percent of ethnic minority households use a computer (desktop or laptop) (Vietnam CEMA and GSO 2020). As digital exclusion often stems from a combination of multiple factors, digital inclusion of vulnerable groups requires sophisticated, multipronged strategies, particularly professional support and encouragement, and policy makers must be aware of the additional resources this requires (Castle-Clarke and Imison 2016).

3.3 Sustaining digital health applications for patients with NCDs

Many digital applications for patients with NCDs in Vietnam are operating as a siloed technology to overcome specific challenges in the public health system. Patient-facing applications are not connected to or embedded in the current EHR systems deployed at CHSs and the MOH's PHR system offered to citizens, making it impossible to maintain a seamless flow of health information along patient journeys across different care settings. Information-blocking practices remain common, such as restricting patient access to EHR, developing products with limited interoperability, charging high fees for health data exchange, and making third-party access to standardized data difficult. Other barriers to integration include insufficient guidelines on health data governance and weak coordination among different stakeholders participating in health data exchange, particularly at the subnational level. Unless these barriers are mitigated, both patients with NCDs and health professionals will continue to have a disjointed and unsatisfactory experience with digital applications.

Moreover, it is very challenging to finance digital health applications for patients with NCDs. Public investment agencies in Vietnam are struggling to innovate due to unclear guidelines, limited experience, and fear of making mistakes. In the absence of a price schedule for digital services, neither Vietnam Social Security (VSS) nor private insurers reimburse digital health. Public providers cannot collect fees from users either. As a result, digital health applications for patients with NCDs are adopted mainly in the private health sector where providers can charge fees and users pay out of pocket. The lack of a sustainable financing model for digital health demotivates public providers to maintain digital applications, restricts long-term engagement among patients, and limits access to digital health services for vulnerable groups.

Government and policy makers play the leading role in changing the current situation for sustaining digital health applications in PHC. A priority area is advancing integration and interoperability across digital systems deployed at the grassroots level, which was a shared desire among the players in a digital health ecosystem. The implementation of a unique citizen ID is a key enabling condition for integrated, interoperable digital health systems to be able to create a people-centered view combining data from various sources over time (Broadband Commission 2018). The MOH should continue the development of data and interoperability standards to support broader and deeper types of health information flows and, in the meantime, ensure broad adoption of standards by health ICT vendors (WHO and ITU 2012). While promoting the development and adoption of core ICT systems (e.g., EHR for the CHSs, PHR for citizens), health system managers should allow patient-facing digital applications to be integrated into these common platforms to make data available for patients and health professionals whenever it is needed. It is also necessary to address information-blocking practices among providers and ICT vendors in the near term (Powell and Alexander 2019) and build a data-sharing culture in the long term.

Financial sustainability is another critical area for action. A starting point for government agencies is to review financing mechanisms and consider business models applicable to the Vietnam context. Public funds for core health ICT systems (e.g., EHRs, health information exchange, and registries) should be allocated through innovative financing mechanisms, such as pay-as-you-use models that make common digital health platforms more accessible for patients, providers, and other stakeholders (Broadband Commission 2018). Examples in LMICs have shown that saving or micro-insurance models driven by private partners can be cost-effective while sharing risks with the public sector. The common goal among key stakeholders (patients, providers, innovators, policy makers, etc.) is for digital health services to be covered by payer organizations,

either public or private insurance. Establishing a national reimbursement system for digital health applications, in reference to experience from HICs, would ensure financial accessibility in the long run, but also requires tremendous effort to accomplish this goal.

It is important for Vietnam MOH to undertake monitoring and evaluation to ensure that digital health applications for patients with NCDs are adopted in a safe, ethical, and cost-effective manner. Policy makers should consider establishing procedures for digital health technology assessment, which allow stakeholders to make informed decisions about which applications to use. Assessment of technology would require evidence of comparative effectiveness, economic benefit, and user experience, among others. Assessment frameworks should maintain a suitable balance between assurance rigor, on the one hand, and practicality and achievability, on the other, taking into account the maturity of digital health technologies in the country context (Orcha 2021). There remains little information about the impact of digital health applications on the Vietnamese population; hence, independent evaluation of digital health initiatives in both public and private sectors would help highlight best practices and avoid common pitfalls.

In summary, this report makes a call for action to advance the digital journey in PHC for patients with NCDs. The potential for transformational change comes from patients using digital applications at every step of their health journey (Castle-Clarke and Imison 2016). The development of patient-facing technologies is not a free process, and the uptake of digital applications is not an easy option for people with NCDs. All this requires resources and support for changes at the individual, organizational, and system levels. Our recommendations support an ecosystem approach to fostering digital health innovation to address the burden of NCDs and to mainstream digital applications into PHC for patients with NCDs.

NOTES

1. The Human Capital Index is developed by the World Bank to quantify the contribution of health and education to the productivity of the next generation of workers. It is an international metric that benchmarks the key components of human capital across economies.
2. The Ministry of Health's e-Government Architecture Version 2.0 was approved by the Minister of Health by Decision 6085/QĐ-BYT on December 30, 2019.
3. Four levels of online public service provision are described in the MIC's Circular 26/2009/TT-BTTTT dated July 31, 2009. Online public services at level 1 provide sufficient information about procedures, required documents, and fees. Online public services at level 2 include services at level 1 and allow users to download documents to fill. Online public services at level 3 include services at level 2 and allow users to send electronically filled documents to the public entity. Online public services at level 4 include services at level 3 and allow users to pay online for public services.
4. ICT adoption ranking was conducted by the MIC in 2019 and was based on the scores of ICT infrastructure, adoption of ICT in operation, electronic information portal/website, provision of online public services, policy framework for adoption of ICT, and human resources for adoption of ICT.
5. The Ministry of Health promulgated the criteria set on the adoption of information technologies in health care settings by Circular 54/TT-BYT dated December 29, 2017.
6. The Plan for Adopting ICTs at CHSs in the Period 2018–2020 was approved by the Ministry of Health by Decision No. 6111/QĐ-BYT dated December 29, 2017.
7. The National Masterplan for Building and Developing the Grassroots Network in the New Situation was approved by the prime minister by Decision 2348/QĐ-TTg on December 5, 2016.
8. Resolution No. 20/NQ-TW on Enhancing Health Protection, Care, and Promotion in the New Situation was issued by the Vietnam Communist Party's Central Executive Committee on October 25, 2017.
9. The National Plan for Preventing and Controlling NCDs and Mental Disorders in the Period 2022–2025 was approved by the prime minister by Decision No. 155/QĐ-TTg dated January 1, 2022.

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The study reviewed available patient-facing digital applications for people with noncommunicable diseases along their journey in primary health care settings and proposed strategic action areas to advance the digital health journey at the primary health care level. It brought together rich qualitative and quantitative information from primary sources (online surveys, interviews, focus group discussions) as well as secondary sources (literature review). Despite recent growth in digital health investment, there are not many digital applications for patients with noncommunicable diseases in Vietnam. At the primary health care level, 15 types of digital health applications are available. Online health information and social networks are the most common applications for patients with noncommunicable diseases to manage their health. Numerous smartphone apps enable patients to update information, evaluate symptoms, look for services, book appointments, consult with health professionals, and purchase over-the-counter medications, but there are not many dedicated to noncommunicable diseases. Digital applications tied to monitoring and wearable technology are limited, mostly in the testing period on a small scale with little proof of their efficacy or impact. Even short message service intervention for noncommunicable diseases is uncommon and lacks strong evidence of efficacy and sustainability. Particularly, there is a scarcity of digital applications for patients with noncommunicable diseases to self-manage their chronic conditions. This study also provided a greater understanding of the challenges facing innovators, patients, and primary health care providers that have hampered the successful adoption of digital health applications to address the burden of noncommunicable diseases. The authors made a call for action to advance the digital journey in primary health care by fostering digital health innovations, enhancing user engagement, and sustaining digital health applications for patients with noncommunicable diseases.

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