



REPUBLIC OF LEBANON
MINISTRY OF PUBLIC HEALTH



e-HEALTH
LEBANON

Case Study on the Digital Transformation of Health System in Lebanon

Supervised by:

Lina Abou Mrad

Prepared by:

Lina Abou Mrad

Karen Rizkallah

Hussein Shemali

Interviews conducted by:

Doris Mouawad

August 2022



Table of Contents

Background.....	4
Policy Environment.....	5
Digital Access, Literacy, and Maturity	11
Cost and Funding	13
Definition of priority investment areas	15
Potential health and economic impact from improved digital health access	17
Key Challenges.....	18
Recommendations.....	19
Conclusion	20
References.....	22
Acknowledgments	26
Authors	26

Background

Since the invention of modern medicine, e-health is regarded as the single most significant innovation in healthcare. It is a new area of medical informatics that is utilized in the administration and provision of healthcare services and data ⁽³⁴⁾. Although the digital transformation of health care has the potential to be disruptive, technologies like virtual care, remote monitoring, artificial intelligence, big data analytics, blockchain, smart wearables, platforms, tools enabling data exchange and storage, and tools enabling remote data capture have already shown promise in improving health outcomes.

For years, most countries of the world have chosen the digital path in order to accelerate the digital transformation of their economic activities, trade relations, industrial sectors and health systems. Even though some nations have achieved significant progress, many still need institutional support to build and consolidate national eHealth and digital health policies and to put their action plans into action, which typically calls for more resources and capabilities ⁽³¹⁾. Lebanon, like many other developing and industrialized nations, is affected by a number of crises, most notably the Covid-19 epidemic and societal stagnation. The Lebanese people are currently dealing with numerous difficulties that have an impact on their success, sustainability, and quality of life. Digital technology offers the opportunity to address health system difficulties and improve the availability and quality of health services and practice ⁽³¹⁾.

In the Arab region, Lebanon boasts one of the best quality healthcare sectors. Lebanon continues to offer high-quality healthcare at reasonable costs, despite the government not allocating a significant portion of GDP to the medical sector compared to other Arab nations ⁽²⁷⁾. E-health adoption is still in its early stages in Lebanon, which explains why utilization rates are relatively low ⁽²⁵⁾. It can be difficult to transition from traditional healthcare to e-health, particularly if the country's health system hasn't advanced recently and rural areas still don't have access to primary healthcare services.

Although significant funds have been invested in efforts to enhance the current situation, the overall picture is uninspiring considering the users' expectations and experiences. While the focus should be on efficiently transforming services, purchasing technology has received far too much attention. All the stakeholders in Lebanon are coming to the conclusion that the present digitization strategy, which involves making sporadic, incompatible, and uncoordinated small-step adjustments, is unsustainable ⁽¹⁴⁾. It is detrimental to the nation's digital industry, more expensive for the government, and less beneficial to the public. Therefore, it is now necessary to carefully consider the factors impeding our progress, create strategic enablers to deal with these issues, and select the best solutions—even if they initially appear to be too radical. In this report, we will analyze the political roadmap of the

digital environment in Lebanon, assess the current context of digital maturity amongst its population, explore the success stories and failures, as well as propose the opportunities, areas of investment, challenges and lessons learned.

Policy Environment

Lebanon's digital transformation journey began in early 1998 when the government took the step towards developing the ministerial committee of information and communication technology (MITC). In 2001, the MITC was launched and the first governmental digital strategy (e-governance) was formed in 2002 ⁽¹⁴⁾. With various amendments and improvements throughout the years, the first national digital strategy was formulated in 2018 with the help from the office of the minister of administrative reform (OMSAR). The primary aim of this strategy is to lay-out the steps needed to initiate the integration of e-governance and other digital technologies within the national governing system. Correspondingly, the objectives of this strategy were to: (1) enhance the citizens' experience with the government, (2) enable the digital economy and private sector to flourish by involving them in the digital transformation process, (3) to transform the paper-based system of the public sector ⁽¹⁴⁾. In 2020, the plan was further refined, and a new strategy (2020-2030) was formed.

Ever since the late 1990s, several efforts and initiatives focused on developing a nation-wide digital transformation strategy. Stemming from that, several national policies exist that facilitate the adoption of such strategies. For instance, one of the first laws that was inaugurated by the Lebanese parliament—law 72 in 2005—pertained to formulating the minister committee of information and technology. A couple of years later, the Lebanese parliament also passed a legislation—number 12 in 2011—to warrant the minister of administrative reform to launch the digital central data system as well as be responsible for its development and maintenance. Not a year after, the minister of administrative reform refiled another proposal to launch the OMSAR website, and to publish the corresponding projects with their objectives—under legislation 55 in 2012. Towards the end of 2012, the government issued the unique citizen ID under law 241. This law entailed that each citizen would be identified in governmental documents and across all governmental agencies with a specific number. In early 2017, law 28 was developed to provide online access of personal data for citizens in Lebanon. Finally, in 2018, Several “building-block” regulations were also installed under law 81 titled: digital processes, and personal data. Such building blocks included electronic commerce services, electronic money, network service provider, data host, traffic data, processing of personal data, and many others. Moreover, for the protection of personal data and to develop the cybersecurity sector in the country, under the same law 28, subjects 85-93 explore several aspects of personal data protection and use. All of the aforementioned

laws and regulations have provided the nation with an essential corner-stone for building nation-wide digital transformation strategies.

Nevertheless, even with the existing building blocks for digital transformation, the main issue remains with the lack of focus on developing each sector of the government. For instance, while the digitization of the health sector was mentioned in past digital strategies, the information was not elaborate, and no unique budget lines, or monitoring and evaluation plans were allocated to the sector. Nevertheless, the MoPH managed to be the first ministry to develop an online website that offers application submission and tracking services for citizens. The website was rigorously developed over the years and received several excellence awards ^(17,20,25). Other e-health initiatives took place from the era between the beginning of digitization in Lebanon until this day, some of which are summarized below:

1. The National E-Health Program (2013)

The first national e-health program was established in Lebanon in 2013 under the regulation Nb. 227/1 of the health minister back in 2013. The national program's primary aim was to develop the health sector and enhance the quality of healthcare provision through the incorporation of Information and Communication Technology (ICT) ⁽¹⁾. The program's activities revolved around four main tasks: (1) to strengthen the health information systems on a national level, (2) to facilitate electronic data sharing and interoperability between MoPH and other involved parties, (3) to integrate the use of tablets, mobile phones and other mobile communication devices in healthcare settings, and (4) to facilitate access to healthcare services by providing remote healthcare services or telemedicine ⁽¹⁸⁾. One of the primary products of this e-health initiative was the MOPH mobile application—which offered the user an access to the drugs' price list, information about the immunization program, as well as the geographic distribution of public and private hospitals and healthcare centers across the nation. Some of the objectives of this mobile application were to (1) enhance the quality of healthcare services, (2) improve the healthcare system, (3) facilitate an improved access to healthcare services, (4) ensure equity in healthcare services provision—especially towards marginalized and impoverished communities ^(1,18).

2. The National Health Strategy (2017 - 2020)

In May 2014, the MoPH also worked on drafting the first Health Technology Assessment (HTA) strategic plan with the help of the World Health Organization (WHO). The HTA is a systematic methodology that utilizes a multi-disciplinary holistic evaluation for assessing the properties of health technologies and the effectiveness of their interventions ⁽¹⁹⁾. Later in 2016, and to further develop the

efforts invested in adopting digital transformation in healthcare, the MOPH established and published its national health strategy plan 2017-2020, with the primary objective of modernizing health systems in Lebanon, and a specific focus on advancing the integration of e-health among hospital and primary healthcare centers in the nation ⁽¹⁹⁾. However, even with the significant efforts to promote technological development, there have been various setbacks when it came to the adoption of such services at healthcare centers across the country. In a study conducted on assessing the degree of e-health implementation in hospitals in North Lebanon, 14 major hospitals were interviewed. The results revealed that while 13 out of 14 hospitals adopted health information systems, the majority didn't implement the reform across all health departments. Such setbacks in the integration of digital health systems have been mainly attributed to the lack of proper legislation, and finances that are imperative to sustain such initiatives ⁽⁸⁾. Nevertheless, other major private hospitals in Lebanon such as Hotel Due, The American university of Beirut medical center, and Clemenceau medical center have successfully integrated digital health systems across all of the departments ⁽⁸⁾.

3. The National Barcode Information System (NBIS) — MediTrack (2017)

The National Barcode Information System (NBIS) is a standardized information system which utilizes a GSI DataMatrix 2-D Barcode to identify and track unique medications. The GSI 2-D Barcode is a rectangular symbol made up of black and white squares that are arranged in a unique manner for each item. This Barcode is read through any camera-based cellular phone that has the feature of detecting barcodes. The NBIS proposal was first presented in June 2016 by the director of the national E-health program. This initiative aimed to enhance the reliability of pharmaceutical supply to patients while ensuring compliance and patient safety. The opportunity and motivation behind this project stem from the increasing regional and national development in the field of Information and Communication Technology (ICT). By developing a platform and a unique 2-D Matrix barcode identifier for all imported and local pharmaceuticals, the MoPH introduced a standardized process for all stakeholders to identify, capture and share information about the medication ⁽¹⁷⁾. This program will also benefit the overall health system monitoring and evaluation by increasing transparency and accountability, as well as reducing the prevalence of counterfeit and illegal medications ^(17,22). There were four main objectives of this program, and they were: 1) to reduce medication errors, (2) to detect counterfeit medication, (3) to enhance tracing and quick product recall or withdrawal, and (3) to provide real-time accurate information flow between stakeholders.

The MediTrack program, a track and trace tool for pharmaceuticals, was launched by the former minister of health in collaboration with the WHO ^(17,22,24).

Following the success of the pilot study in 2018, the implementation phase started in late 2020 with drugs importers and wholesalers and an implementation guide for all stakeholders was produced by the MoPH which included all the steps needed for integrating and properly implementing the program ⁽²⁾. However, due to the multifaceted crises that arose—represented by the Covid-19 pandemic, economic crises, the implementation phase for pharmacies was delayed till 2022. Currently the MediTrack system is piloted in the six biggest university hospitals and few community pharmacies to control the dispensing of the subsidized anti-neoplastic drugs to patients. Following this pilot study, the system will be implemented in all hospitals and community pharmacies by the end of 2022.

. The opportunity and motivation behind this project stem from the increasing regional and national development in the field of Information and Communication Technology (ICT). By developing a platform and a unique 2-D Matrix barcode identifier for all imported and local pharmaceuticals, the MoPH introduced a standardized process for all stakeholders to identify, capture and share information about the medication ⁽¹⁷⁾. This program will also benefit the overall health system monitoring and evaluation by increasing transparency and accountability, as well as reducing the prevalence of counterfeit and illegal medications ^(17,22). There were four main objectives of this program, and they were: 1) to reduce medication errors, (2) to detect counterfeit medication, (3) to enhance tracing and quick product recall or withdrawal, and (3) to provide real-time accurate information flow between stakeholders. The MediTrack program, a track and trace tool for pharmaceuticals, was launched by the former minister of health in collaboration with the WHO ^(17,22,24).

Following the success of the pilot study in 2018, the implementation phase started in late 2020 with drugs importers and wholesalers and an implementation guide for all stakeholders was produced by the MoPH which included all the steps needed for integrating and properly implementing the program ⁽²⁾. However, due to the multifaceted crises that arose—represented by the Covid-19 pandemic, economic crises, the implementation phase for pharmacies was delayed till 2022. Currently the MediTrack system is piloted in the six biggest university hospitals and few community pharmacies to control the dispensing of the subsidized anti-neoplastic drugs to patients. Following this pilot study, the system will be implemented in all hospitals and community pharmacies by the end of 2022.

4. Tele-Health in Primary Healthcare Centers

The protracted refugee crises in Lebanon posed a great burden on health service provision over the past few years. In an effort to alleviate the burden on the hospitals, reduce costs on the patient, and contribute to the universal health coverage—the MOPH launched the tele-health in PHC initiatives. The project entailed the integration of tele-health services across 26 districts in Lebanon in 30 primary health centers—with three main hubs (The American university of Beirut, Hotel Dieu de France, and St. Georges Hospital University Medical Center. The first pilot phase for this project was initiated in November 2017. Moreover, the implementation plan and solution design of this project included the provision of a cybersecure medical tablet, with the ability to conduct a secure video conference and a full range of vital sign measurements. For instance, the system will be able to measure cardiopulmonary data, SPO2 Pulse oximetry, Non-invasive Blood Pressure, electronic stethoscope, among others.

5. COVID-19 Response Platforms

In response to the increasing burden of Covid-19 cases across the nation, the MOPH launched the Covid-19 online ChatBot—which offered the user a platform to assess their symptoms. The ChatBot was later extended to WhatsApp applications to reach more audiences and a virtual tool was added later to allow remote medical consultation with physicians in collaboration with Microsoft ⁽²³⁾. Moreover, to enhance the contact tracing of exposed and infected individuals and to limit the spread of the virus, the MOPH launched the Ma3an (together) against Corona, the official contact tracing and exposure notification mobile app. for Lebanon in collaboration with a team of experts from the American University of Beirut (Faculty of Health Sciences, Maroun Semaan Faculty of Engineering and Architecture, and Faculty of Arts and Sciences) ⁽²¹⁾. The application collects information such as date and time of contact to other devices and encrypts it exclusively on the user's phone for a period of 30 days. If the individual tests positive for the virus, the application will notify the users in contact without revealing the identity of the infected person. The application works by using Bluetooth technology to broadcast an anonymous signal to individuals in close proximity to a Covid-19 positive case. Ma3an complements the contact tracing activity carried out by the Ministry of Public Health.

Another platform was put in place for all passengers wishing to come to Lebanon; they must register to MOPH PASS platform and upload specific documents for COVID19 mainly the vaccine certificate and the PCR test to allow the MoPH to track and control infected people coming from abroad and stop the spread of COVID19. Passengers who performed a PCR test at Beirut Rafic Hariri International Airport will receive the test result by sms. Moreover, the Covax platform, been developed in collaboration with “Impact” to organize and digitalize the vaccination process in Lebanon. IMPACT

is an eGovernance platform owned by the Central Inspection. Financing is under the Governance Oversight and Accountability project funded by the UK. Some software development by the implementer (Siren company) to get the platform started till funds are provided. The program's website displayed open data regarding numerous variables and indicators associated with the program's effectiveness. For instance, over six million COVID-19 vaccination appointments were reserved through the application, and over 5.5 million doses were administered—2.5 million of which are first doses and around 2.2 million are second doses.

6. Unique Health ID

The MoPH started working in October 2021 in collaboration with “Impact” on developing a registration platform to provide recipients of health services with a Unique health identifier with the objective to improve quality and continuum of care, strengthen surveillance of communicable diseases, eradicate diseases, and optimize provider and payer transactions in health financing schemes. This platform is GDPR compliant. Demographic information is mainly collected in addition to biometrics (starting with facial recognition). This was done in an agile approach and strategic way to build longer term methodology. Two months ago, hospitals started piloting the system. First target is to manage cancer medication patients on the MediTrack system. This UHID will be mandatory for patients wishing to receive any healthcare services in the future.

7. The Road Towards Universal Healthcare Coverage

The National Health Strategy's primary objective is to achieve universal health coverage (UHC), which is founded on the values of justice, equity, poverty alleviation, and resource efficiency. To meet everyone's needs at a reasonable cost, it is necessary to finance or provide high-quality curative and preventive healthcare for all. UHC continues to place a high priority on minimizing the financial burden on households, particularly the poor. The problem with Lebanon's healthcare system is that PHC services and preventive care are not universally covered yet tertiary care, advanced treatments, such as joint replacement procedures, open heart and pricey cancer patent medications, are all covered. A crucial component of the national health strategy is strengthening the network of primary healthcare centers and connecting them to public hospitals via a referral system. The expansion of the centers' operations will result in a rise in demand for the critical medications that the MOPH provides or pays for, as well as more administrative work for the primary health care division, which will necessitate more staff members and financial resources. The government will be required to contribute 40 billion LBP, or

around 6% of the 2013 MOPH budget, toward the initial phase's 60 billion LBP estimated cost. The health centers' revenues are anticipated to increase as a result of this program in the first year, allowing them to hire more skilled staff members and improve their capacity to deliver high-quality services.

8. Academic Institutions and the Private Sector

Other studies have assessed the feasibility of e-health implementation in Lebanon and the perceptions of healthcare providers and other stakeholders. In a study conducted on 213 primary health care centers in Lebanon, the results revealed that the majority of physicians, nurses, and other healthcare providers were either very comfortable or comfortable with using computers. In terms of digital availability and usage the majority of healthcare providers stated that they had access to computers at the primary healthcare centers ⁽³⁶⁾. The study concluded a significant level of readiness amongst healthcare workers at primary healthcare center in Lebanon. More specifically, the findings recommended a specific area of investment to be primary healthcare centers—with a focus on capacity building programs for healthcare providers on the use of e-health technologies ⁽³⁶⁾.

Most of the published literature that was obtained addressed the implementation of e-health technology in providing care for marginalized and impoverished groups such as refugees and Lebanese people of low socio-economic status. Another major area of focus was the incorporation of health technologies in the treatment and management of mental health disorders among a wide variety of communities. For instance, one study conducted in 2018 aimed to integrate a digital health program called “E-Sahha”, to enhance the quality of chronic care provision for individuals suffering from non-communicable diseases ⁽²⁶⁾. Other initiatives by the American University of Beirut’s Global Health Institute (GHI) yielded the launch of the “Sijili” electronic health records (eHR) a cloud-based platform that includes the EHR of refugees and migrants residing in the country. Additionally, interventions by the WHO and other international organizations have also utilized digital transformation systems to specified populations and settings ⁽³⁶⁾.

Digital Access, Literacy, and Maturity

In January 2022, Lebanon had 6.01 million internet users ⁽¹³⁾. At the start of 2022, Lebanon's internet penetration rate was at 89.3 percent of the overall population. When it comes to the growth of broadband Internet connections, described as high-speed, dependable Internet access, Lebanon is falling behind. Approximately 6% of people have a fast Internet connection that is at least 256 kbit/s faster than

the previous ISDN standard ⁽²⁹⁾. Access to mobile phones is available to 62.83 percent of all citizens. Health care providers, patients, and consumers are among these users.

A study by Hitti et al. aimed to investigate the prevalence and frequency of mobile device use, as well as attitudes about clinical and personal usage, among healthcare professionals. These participants included attending physicians, residents, and nurses, in the Emergency Department (ED) of a significant academic medical institution in Lebanon ⁽¹⁰⁾. The results of the study revealed that 84.4 percent of physicians reported using applications for medical formularies and drug references, while 69.5 percent reported using those for disease diagnosis and management. The majority of respondents concurred that mobile devices improved patient care by enabling greater coordination of treatment among providers ⁽¹⁰⁾.

Lebanon's overall performance is hampered by poor readiness scores, with the country ranking 97th out of 100 in the Index. The policy environment and poor literacy levels in Lebanon continue to be the country's weaknesses; it is ranked 99th out of 100 in terms of policy and 92nd in terms of literacy in the world. The School of Arts and Sciences at LAU hosted a week-long workshop on empowering women and youth via media literacy pedagogies and multimedia skills for its eighth edition of the Media Digital Literacy Academy of Beirut (MDLAB). By serving as an incubator of creative ideas and a hub for a network of regional institutions and media educators, MDLAB has been successful in bringing media and digital literacy to 60 colleges and schools in 12 Arab nations since its founding ⁽⁷⁾.

The idea of digital maturity came about as a result of eGovernment projects, whose goal was to make public services more centered on the needs of citizens, which was then applied to the field of health care. In addition to the accessibility of resources and the sophistication of systems, digital maturity also refers to the systems' interoperability and ability to have an impact on the general population ⁽⁹⁾. Lebanon possesses all the necessary components to prosper as a digital nation and to dominate the developing regional digital economy. With a historically rich multi-culturalism, a strong entrepreneurial spirit, and a high rate of digital usage, Lebanon has a generally well-developed multilingual education system, a respectable GDP, and a developing digital literacy. According to the World Development Report 2016, Lebanon's adoption of digital technology places it in the higher emerging category when compared to other peer nations ⁽³⁷⁾. Moreover, Lebanon outperformed the global average of 0.44 and placed 63rd overall and sixth in the Arab world in the UNCTAD's 2021 Technology and Innovation Index with a score of 0.50 ⁽¹⁵⁾. However, Lebanon is only capturing 4.7 percent of its digital potential (16.4), according to the McKinsey Global Institute (MGI) ⁽³⁸⁾.

Cost and Funding

The Civil War in Lebanon took a heavy toll on the healthcare system from 1975 to 1992. During this era, several interventions have been initiated to reform and rehabilitate this sector. Such interventions included collaborative public-private financing mechanisms such as: National Social Security Funds, Security Forces Coverage, Cooperative of the Civil Servants, Private Insurance, Mutual Funds, Donor assistance and Out-of-pocket payments ⁽⁴⁾. According to the World Health Organization in its global database, the health expenditure profile in Lebanon attributes \$663.05 per capita, in 2019 ⁽³⁴⁾. Healthcare funding is dispersed and subject to many levels of supervision in Lebanon. Thus, the flow of funds moves from the pooling of funds to their distribution for services, followed by their payment to the providers. Lebanon has high healthcare spending—about 8.8% of GDP compared to 5% on average in the MENA area—with hospitalization accounting for 75% of total spending ⁽³⁾. According to the director of the national e-health program, there's no direct budget line for e-health activities in the country. The department of digital health only receives a small ration from the funds pertaining to maintenance and technology fees.

Due to the varying health and economic sectors, the financing and spending for healthcare must be recalculated in light of the current economic crisis. The whole MoPH budget for 2018 was 728,849,074,000 LL, which was comparable to 485.9 million dollars but is currently less than 24.3 million dollars. The MoPH publishes the majority of the information regarding ongoing initiatives and projects on its website. While the overall budget of the project is usually provided, it's difficult to estimate the exact values of investment in each sector of digital health. This is because incorporating digital health on a national basis is still in development, and external funding specific to the digital sector is somewhat disregarded. Nevertheless, there are some examples of budgets allocated to general health interventions. For instance, a new component was added to the Lebanon Health Resilience Project (LHRP) which is **“to Strengthen Capacity to Respond to COVID-19” -- this project had an estimated funding of 18 million US dollars. Another example is the New World Bank Loan**, which aimed to strengthen Lebanon's COVID-19 Response Project—with a budget of US\$29 million and a two-year term. Similarly, with the Meditrack system budget, which received €400,000 from the EU through the WHO and \$70,000 from MOPH in 2020–2021, as well as €600,000 from the Italian embassy in 2022–2023. While no concise data exists regarding the costs, the rough costs of the segmented sectors of the program were provided by the director of the national e-health program. It was estimated that around 150,000 US dollars were invested in the software development of the program. The deployment

costs included the purchase of barcode readers for around 600,000 US dollars. Finally, the operations sector—which included experienced staff members at the MOPH—costed around 42,000 US dollars.

The COVID-19 epidemic has had a significant impact on the healthcare industry, which has encountered enormous challenges in coping with and responding to the epidemic, with a lack of readiness being the most significant obstacle faced by healthcare facilities ⁽¹¹⁾. The World Bank asserts that Lebanon's disastrous financial crisis and unmatched economic downturn have prevented it from reducing the COVID-19's consequences, when many other countries have been able to do so ⁽³⁰⁾. According to qualitative data analysis from the interviews, the pandemic was a turning point for digital health in Lebanon. While some e-health initiatives were hampered due to the financial situation, the MoPH developed the IMPACT website with the aid of international NGOs ⁽²³⁾. The IMPACT vaccination system proved to be successful in providing equal access to the COVID-19 vaccinations in Lebanon. It was also evident that the healthcare workforce was ready and accepting of such rapid transition to digital health services.

Major international donors have almost remained the same since the Civil War (1975-1990). Western states, particularly the United States and some European nations, Gulf states that are allies of the West, like Saudi Arabia or Kuwait, and Iran have been the largest bilateral donors. International organizations within the UN system have continually contributed significantly to humanitarian, development, and refugee efforts ⁽¹²⁾. Similarly, non-governmental organizations (NGOs) from all three sectors as well as participants in the Red Cross Red Crescent system have long been active in Lebanon as donors or aid channels. According to Mac. Ginty & Hamieh, reconstruction, humanitarian, and development aid have all been significantly contributed to by Lebanese actors themselves, both as implementers and donors ⁽¹⁶⁾.

The European Union (EU) became the first donor in the health sector and notably aided the Lebanese government's response to fulfill the basic medical needs of vulnerable Lebanese and Syrian refugees by funding health initiatives in Lebanon for a total of €165 million since 2014 ⁽⁶⁾. New equipment, child vaccines and free medications have been distributed to more than 200 Primary Healthcare Centers (PHC) of the MoPH, Social Development Centers of the Social Affairs Ministry, and public hospitals. Training has also been provided to medical personnel. Furthermore, the EU supports Syrian refugees' access to secondary health facilities and pays for treatments that save lives through medicine and surgery. Additionally, the EU has begun testing a basic set of primary healthcare services, including maternal and child care, reproductive, and mental health services for all vulnerable groups, at a fair and reasonable cost ⁽⁶⁾.

The Lebanese healthcare system is made up primarily of private hospitals, which serve as its foundation. The MOPH's dedication to achieving "health for all" encouraged the creation of the nation's primary health care plan and of a referral network connecting public and private healthcare facilities. The public sector is responsible for 33.6% of health spending while the private sector is responsible for 66.5%, according to the National Health Accounts from 2015 ⁽⁴⁾. Donor funding constitutes 3.24% of total funding in 2015, up from 1.96% in 1998. In almost equal amounts, three main sources of funding are used to pay for healthcare: government spending from tax income (1/3), private insurance and payment through cooperative funds and the National Social Security Fund (NSSF) (1/3), and direct patient out-of-pocket (OOP) payments (1/3). The private sector is nevertheless regarded as a significant component for the nation's economic growth in the region, despite the lack of sufficient evidence on the overall influence on healthcare quality and systems. When compared to the public sector, the private sector in Lebanon is thought to be the primary provider of health care services. 90% of hospital bed offerings are now provided by the private for-profit sector, which has steadily increased in size and capacity. As 64% of the budget for private hospitals is provided by public funding, compared to the MOPH alone providing 30% of the budget, the profit and expenditure of the private sector are largely dependent on interactions between the private and public sectors ⁽⁴⁾. Since the private sector depends heavily on the public sector, the MoPH has also worked to strengthen its leadership and governance roles by creating a national regulatory body for health and biomedical technology, an accreditation program for all hospitals, and contracts with private hospitals for particular inpatient services at particular rates.

The adoption of e-health in hospitals in Lebanon will be hampered without funding and a supporting legal framework. The WHO Lebanon Office might have a significant impact on the implementation of e-health by fostering local initiatives, enhancing local expertise in e-health technologies, and disseminating international best practices and guidelines drawn from successful e-health implementations. In order to enable localized data recording via internet connection, hospitals must supply the necessary and sufficient equipment. Since 50% of Lebanese hospitals have not yet implemented e-health, HISs, or EHRs, these conditions are generally required ⁽³³⁾. The implementation of such tools is still not required of hospitals by the Lebanese government or the MoPH in Lebanon.

Definition of priority investment areas

The MOPH conducted key informant interviews with six stakeholders that were perceived to have an added value to the case-report given their relevant expertise in digital transformation and digital

health development. The analysis of the KIIs revealed that four key investment areas are deemed as essential for the continuous development of digital strategies in the country. As proposed by the director of the national e-health program, the priority key investment area right now is the development of a clear national e-health strategy. Without the presence of such a strategy, it is highly unlikely that there would be a significant improvement in the digital health sector in Lebanon. Secondly, several stakeholders—the general director of a big private hospital, among other healthcare professionals—stressed on the importance of investments in developing electronic medical records across all public and private hospitals in Lebanon. Moreover, the success stories of EHR and some e-health services within major private hospitals in Lebanon, such as the case of the American University of Beirut Medical Center and the Epic System, is perceived as an enabling factor for the adoption of such systems on a national basis.

The third key investment area that was emphasized in the interviews pertained to supplying the healthcare centers with the hardware and software that are needed to implement e-health activities. The stakeholders believed that the proper implementation of e-health activities, such as tele-health and tele-medicine, required necessary software and hardware (such as suitable audio and video devices among various others) to facilitate the implementation. Two interrelated key investment areas that were mentioned in the analysis were capacity-building and recruitment programs for e-health initiatives in Lebanon. The multifaceted crises in Lebanon had set-back most of the digital initiatives, and pushed the majority of the young healthcare workforce outside the country. Therefore, such investments can alleviate the crises-induced burden on the health sector, and can facilitate the development and sustainability of e-health initiatives.

On another note, most of the stakeholders highlighted the need for investing in programs that promote inter-sectoral collaboration between involved agencies, such as ministries, NGOs, and academic institutions. This was deemed as imperative for the success of any program, project or initiative that aimed to tackle digital health in Lebanon. In fact, the director of the national e-health program at the MoPH, stressed that the collaboration and sharing of information and data between agencies is essential to minimizing duplicated efforts and promoting a cross-sectoral approach to developing new e-health initiatives, as well as improving existing projects. From this perspective, the MoPH has already initiated such a project—with the creation of the nation's primary health care plan and of a referral network connecting public and private healthcare facilities.

On a similar note, it appears that there is a clear alignment between the investment areas that were identified by the stakeholders and the nine pillar investment areas mentioned in the Transform Health Conceptual framework. For instance, the priority investment area (PIA) dedicated to developing

a national e-health strategy is directly related with PIA number six from the conceptual framework—namely “Policy, governance, and research”. The national e-health strategy is also related to PIA number 2—which is focused on digitizing health financing and transaction services. Similarly, the key investment area which focuses on developing the EHR, is aligned with PIA number three “Health worker management/support”—which pertains to digitizing patient records and tracking. The EHR investment area also aligns with PIA number nine “Service delivery”, which pertains to client identification and registration. Last but not least, the final key investment area related to providing the necessary hardware and software falls under PIA number eight which is focused on tele-medicine and remote healthcare. intersectoral collaboration and data sharing between all associated organizations, is related to PIA number 4 “Information systems. Finally, there could also be a relationship seen between the key investment area pertaining to intersectoral collaboration and data sharing, with PIA number four—which discusses Information systems and data services.

Potential health and economic impact from improved digital health access

According to the analysis from secondary literature and key informant interviews, there are several health and economic impacts that are expected from implementing e-health strategies. The most prominent impact that was mentioned, pertained to the major reduction in healthcare costs and spending on a national level. While there are no local studies to assess the return on investment from such projects, the regional and international literature provide great evidence on the effectiveness of such projects. Moreover, technological advancements, such as the electronic health record, have been proven to greatly facilitate the provision and access to healthcare services. In other words, the ability to receive healthcare services locally or remotely has been made possible by the usage of digital health to empower people in general and patients in particular. As mentioned by the director of the national E-Health Program, “The digitization of health services is expected to have a significant influence on patient satisfaction, waiting times, and overall disease outcomes”. The secondary literature also supports these claims—a study published in PLOS Medicine found that a new digital mental health intervention called Step-by-Step, developed by the World Health Organization (WHO) in collaboration with the National Mental Health Programme (NMHP) at the MoPH Lebanon and other partners, was successful in lowering depression among Syrian refugees in Lebanon (5). It was discovered that those who underwent the digital intervention under the remote supervision of trained non-specialist helpers experienced

significantly less depression and had significantly better functioning following the intervention as compared to those who underwent enhanced usual care in the control group. People who got Step-by-Step also showed improvements in their post-traumatic stress disorder, anxiety, general well-being, and personal issues, and all of these benefits persisted at the three-month follow-up. The findings of this study corroborate those of a Step-by-Step trial conducted concurrently with Lebanese and other communities in Lebanon, which also produced encouraging outcomes ⁽⁵⁾.

Furthermore, in an e-health initiative conducted by the Global Health Institute, called “E-Sahha”, a study evaluated the attitudes of people with hypertension and/or diabetes regarding the population-based mobile application “E-Sahha” in rural areas and Palestinian refugee camps. Higher educated individuals and people between the ages of 40 and 50 were more effectively reached by the evaluated SMS-based mobile health intervention ⁽²⁶⁾. The majority of the targeted people thought SMS texts were a useful instructional tool and wanted to keep getting the service. It also brought attention to the fact that older, uneducated, and jobless people needed special care and a variety of educational approaches because they were less likely to fully benefit from SMS-based treatments. One such strategy is the use of audio messages, which can be tailored to the users' characteristics to the greatest extent possible. This study offers comprehensive understanding for decision makers in Lebanon regarding prospective opportunities for the design and application of customized mHealth interventions within the PHC setting among patients with chronic diseases who have distinct experiences, needs, and opportunities ⁽²⁶⁾.

Key Challenges

The implementation and sustainability of e-health initiatives in Lebanon face a handful of interrelated barriers and challenges that ultimately slow improvements and developments in the field. These challenges were identified at distinct levels: at the organizational level, national level, and international level. Starting with the national level, was the protracting economic crisis that the country witnessed ever since 2019. The director of the national e-health program, among several other stakeholders, have expressed their deep concerns for the severe devaluation of the health sector funding in the country. To elaborate, the MoPH's budget for 2018 was around 728 billion Lebanese Pounds—which was equivalent to 485 million dollars—currently, this amount is equivalent to less than 24.3 million dollars. Consequently, the economic crisis had directly impacted the retention rates at the organizational level. Similarly, the lack of funding had resulted in a partial or complete halt of e-health interventions in the country. On an international level, the main challenge with the funding is that its significantly fragmented. In other words, the investments are being done by several donors and funders

towards several organizations, programs and individuals—thereby increasing the likelihood of inefficiencies, and duplicated work (as supported by several stakeholders). Similarly, an issue with international and national funds from NGOs is that they only support the first period of the e-health initiative launch—whereby they send a team of experts, devices, and necessary maintenance equipment for the program. This is a challenge since the programs that are usually funded internationally, cannot be feasibly sustained and maintained locally—which results in the failure of programs and frustration of employees.

Moreover, issues pertaining to data availability regarding e-health services in the country are also considered to be a great barrier for the proper implementation of digital health strategies. The absence of national data standards, as well as effective intersectoral collaboration between government sectors are prime examples of how data inaccessibility can pose as a great challenge for the development of e-health services.

Other challenges may pertain to cultural and socio-economic factors of the community. For instance, a study by Talhouk et al. was conducted to learn more about the potential for technological integration in the delivery of basic healthcare in the context of Lebanon's ongoing Syrian refugee crisis (28). According to this study, there are some resource-related challenges to technology integration when it comes to providing health care for refugees in a low- or middle-income country like Lebanon. These limitations are similar to those that are present in other contexts. However, it was found that participant perceptions of refugees' technological and medical literacy presented unique difficulties in the context of the current refugee crisis. When thinking about refugee health technology, these issues need to be addressed (28).

Recommendations

In order to develop the health sector and enhance the healthcare quality, the MoPH aims at developing the National E-Health Program. Like healthcare services provision, the road towards digital health transformation requires a collaborative approach from distinct agencies and stakeholders. The development of a networking structure is advocated for a collaborative governance strategy focused on collaboration with other ministries, the commercial sector, local, and international NGOs, and key stakeholders. On another note, one critical component towards a successful and sustainable National E-Health Program is the state of funding. It is crucial to continue funding the project in 2018 that aims to provide a roadmap for electronic medical records. As the foundation of e-health, the creation of an electronic health record for every patient across all public and private hospitals in Lebanon will

significantly improve the delivery and accessibility of healthcare services. When it comes to delivering healthcare to refugees in a low- or middle-income country like Lebanon, there are some resource-related barriers to technological integration. One of the possible recommendations that was found by the researcher conducting the study is to make refugee capacities more visible and set up refugee health technology in such a way that they enable refugee empowerment inside the healthcare system and enable them to challenge the findings of the study (28).

Another important recommendation is that given that the MoPH is the cornerstone of the nation's development in terms of health, it is advised that the ministry fully digitize its services. As also recommended by the WHO, it is necessary for the MoPH to make an unambiguous political commitment to implement e-health. This commitment needs to be supported by ongoing funding for e-health implementation as well as initiatives for capacity building and assessment that are in line with a national e-health strategy (33).

As a specific area of investment with an emphasis on training programs for healthcare practitioners on the use of e-health technology, funding research is advised to more precisely measure the level of readiness among healthcare workers in Lebanon. The medical staff must possess the necessary knowledge and training to participate more actively in the digital transformation of the health sector as new digital health platforms and applications are introduced. Training the medical personnel to use technology, especially doctors who must learn how to store the data and link it to the digital patient medical records, is one of the most crucial steps that must be taken. The medical staff's duty to promote awareness among patients and encourage them to use this system also includes a significant educational component.

Conclusion

One of the highest-quality healthcare systems may be found in Lebanon. In contrast to other Arab countries, Lebanon's government does not devote a sizable portion of GDP to the healthcare industry, but the country nonetheless provides high-quality healthcare at affordable prices. Although the digital transformation offers Lebanon a wealth of opportunities, some challenges in the community and economy are still difficult to resolve. Thus, e-health adoption is still in its early stages in Lebanon especially given that the country's health system has not recently advanced and that rural areas continue to lack access to primary healthcare services. The challenges that are preventing us from moving forward must now be thoroughly considered, strategic enablers must be developed to address these challenges, and the best solutions must be chosen, even if they initially seem too radical. Digital

transformation requires support from the appropriate digital framework, the proper legitimate qualified human resources, and other administrative and educational factors... The government will have the opportunity to affect numerous health-related services and industries as a result of the proper implementation of digital transformation.



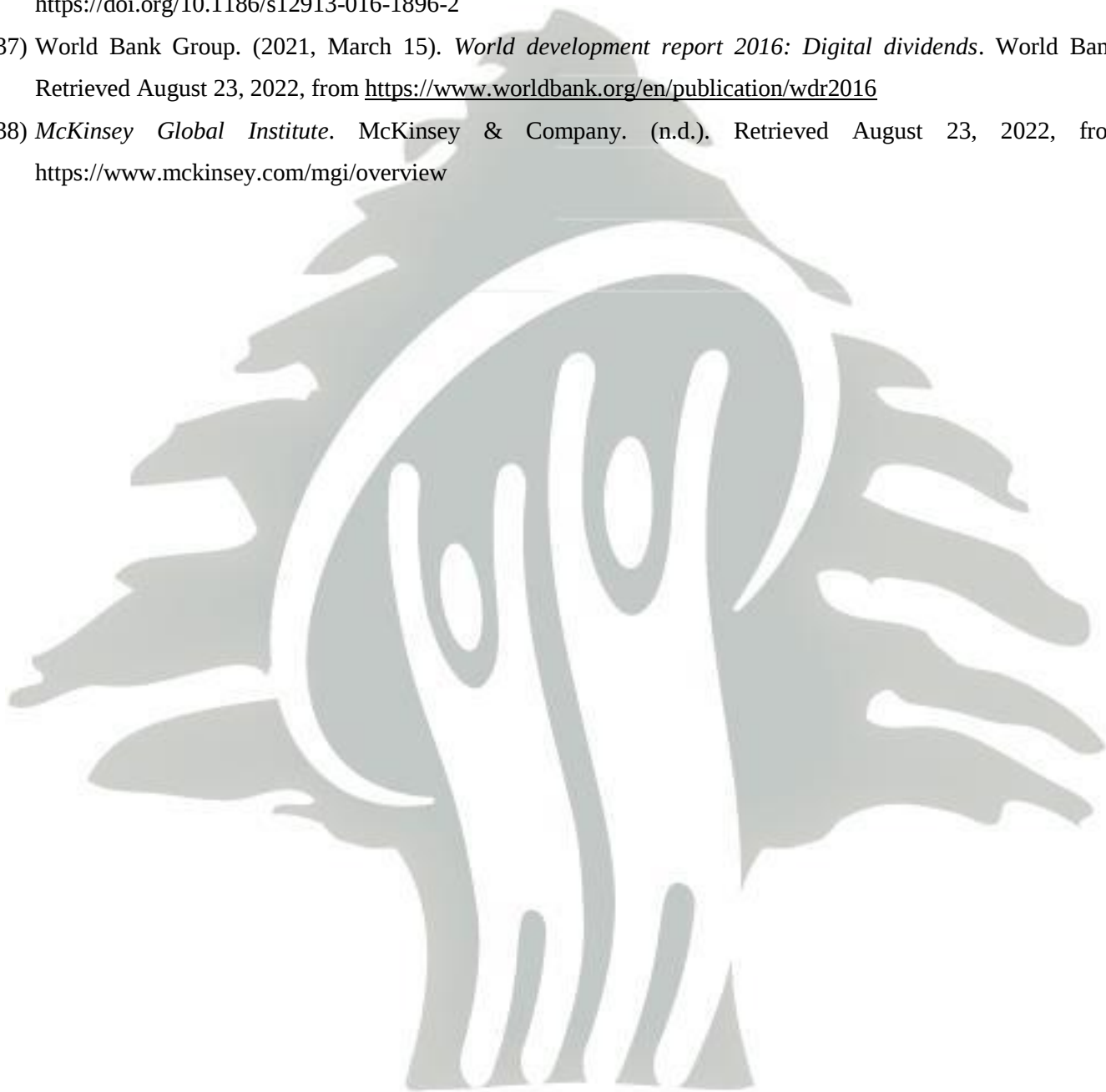
References

- 1) Abou Mrad, L. (2014, March 4). *e-Health Initiative*. Ministry of Public Health - Lebanon. Retrieved August 21, 2022, from <https://moph.gov.lb/userfiles/files/Programs%26Projects/NationalE-healthProgram/E-Health%20Solutions-2014.pdf>
- 2) Abou Mrad, L., Fransawi, C., & Rached, S. (2020, November). *Guidelines on the implementation of 2D data Matrix Barcode for Pharmaceuticals in Lebanon*. Ministry of Public Health. Retrieved August 21, 2022, from <https://moph.gov.lb/userfiles/files/Programs%26Projects/Barcode%20Program/Guidelines-Implementation%20of%20the%202D%20BarCode%20on%20Pharmaceuticals-Edition2-2020.pdf>
- 3) Akala, F. A., & El-Saharty, S. (2006). Public-health challenges in the Middle East and North Africa. *The Lancet*, 367(9515), 961–964. [https://doi.org/10.1016/s0140-6736\(06\)68402-x](https://doi.org/10.1016/s0140-6736(06)68402-x)
- 4) Asmar, M. K., & Yeretizian, J. (2020, December). *Private Health Care Assessment in Lebanon*, | Request PDF. Research Gate. Retrieved August 21, 2022, from https://www.researchgate.net/publication/346528548_Private_health_care_assessment_in_Lebanon
- 5) Cuijpers, P., Heim, E., Abi Ramia, J., Burchert, S., Carswell, K., Cornelisz, I., Knaevelsrud, C., Noun, P., van Klaveren, C., van't Hof, E., Zoghbi, E., van Ommeren, M., & El Chammay, R. (2022). Effects of a WHO-guided digital health intervention for depression in Syrian refugees in Lebanon: A randomized controlled trial. *PLOS Medicine*, 19(6). <https://doi.org/10.1371/journal.pmed.1004025>
- 6) EEAS Website. (2018). *EU biggest donor to the Lebanese Health Sector*. EU biggest donor to the Lebanese health sector | EEAS Website. Retrieved August 21, 2022, from https://www.eeas.europa.eu/node/41772_en
- 7) Gharib, B. (2022). *MDLAB 2022: Empowering women and the youth with media literacy*. LAU. Retrieved August 6, 2022, from <https://news.lau.edu.lb/2022/mdlab-2022-empowering-women-and-the-youth-with-media-literacy.php>
- 8) Halwani, J., & Mouawad, D. (2021). Implementation of e-health Innovative Technologies in North Lebanon hospitals. *Eastern Mediterranean Health Journal*, 27(9), 892–898. <https://doi.org/10.26719/emhj.21.030>
- 9) Hamadeh, G., Max Wakim, J., Romani, A., Hamam, H., Daher, N., Nassar, R., American University of Beirut Medical Center, A. U. B. M. C., & Ministry of Public Health, M. O. P. H. (2019, July). *EHR Readiness: Building Consensus on the Readiness for EHR in Lebanon*. American University of Beirut. Retrieved August 21, 2022, from <https://aub.edu.lb/fm/CME/Pages/EHR-Readiness.aspx>
- 10) Hitti, E., Hadid, D., Melki, J., Kaddoura, R., & Alameddine, M. (2021, January 21). *Mobile device use among emergency department healthcare professionals: Prevalence, utilization and attitudes*. Scientific reports. Retrieved August 6, 2022, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7820016/>
- 11) Human Rights Watch. (2020, October 28). *Lebanon: Covid-19 worsens medical supply crisis*. Retrieved March 31, 2022, from <https://www.hrw.org/news/2020/03/24/lebanon-covid-19-worsens-medical-supply-crisis>

- 12) *International aid to Lebanon - GSDRC*. (n.d.). Retrieved August 19, 2022, from <https://gsdrc.org/docs/open/HDQ979.pdf>
- 13) Kemp, S. (2022, February 15). *Digital 2022: Lebanon - DataReportal – Global Digital Insights*. DataReportal. Retrieved August 6, 2022, from <https://datareportal.com/reports/digital-2022-lebanon>
- 14) Lebanon Digital Transformation, L. D. T., & Office of the Minister of State for Administrative Reform , O. M. S. A. R. (2018, May). *Lebanon Digital Transformation Strategy 2018*. Office of the Minister of State for Administrative Reform (OMSAR). Retrieved August 21, 2022, from omsar.gov.lb/getattachment/b4b8b496-d357-49dc-bd85-a6a850c088e4/Digital-Transformation-Strategy-in-Lebanon
- 15) *Lebanon ranks 63rd in the 2021 technology and innovation index*. Credit Libanais - Economic Research. (2021). Retrieved August 6, 2022, from <https://economics.creditlibanais.com/Article/210278#en>
- 16) Mac Ginty, R., & Hamieh, C. S. (2010). Lebanon case study. In: Harmer, A., & Martin, E. (2010). *Diversity in Donorship: Field Lessons*. ODI, Humanitarian Policy Group, Report 30, 39-48. <http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/5876.pdf>
- 17) Ministry of Pubic Health , M. O. P. H. (2020). *Programs and Projects | MediTrack- Pharmaceuticals 2D Barcode Project . Ministry of Pubic Health - Lebanon*. Retrieved August 21, 2022, from <https://www.moph.gov.lb/en/Pages/6/15089/meditrack-pharmaceuticals-2d-barcode-project#/en/view/54400/ministerminister-hasan-launches-health-id>.
- 18) Ministry of Public Health, M. O. P. H. (2013, March 4). *The National E-Heath Program*. Ministry of Public Health - Lebanon. Retrieved August 21, 2022, from <https://www.moph.gov.lb/en/Pages/6/2651/national-e-health-program>
- 19) Ministry of Public Health, M. O. P. H. (2016). *National Health Strategy (2016-2020)*. Ministry of Public Health - Lebanon. Retrieved August 21, 2022, from <https://www.moph.gov.lb/en/Pages/9/1269/strategic-plans#/en/view/11666/strategic-plan-2016-2020->
- 20) Ministry of Public Health, M. O. P. H. (2017). *Health Minister Receiving Smart Government Award*. Ministry of Public Health - Lebanon. Retrieved August 21, 2022, from <https://moph.gov.lb/en/Pages/6/2651/national-e-health-program#/en/view/35890/health-minister-receiving-smart-government-award>
- 21) Ministry of Public Health, M. O. P. H. (2020, September 1). *"Ma3an" Together Against Corona*. Ministry of Public Health - Lebanon. Retrieved August 21, 2022, from <https://www.moph.gov.lb/en/Pages/6/15089/meditrack-pharmaceuticals-2d-barcode-project#/en/Pages/6/40882/ma3an>
- 22) Ministry of public health, M. O. P. H. (2021). *MediTrack- Pharmaceuticals 2D Barcode Project. Ministry of Public Health - Lebanon*. Retrieved August 21, 2022, from <https://www.moph.gov.lb/en/Pages/6/15089/meditrack-pharmaceuticals-2d-barcode-project#/en/view/56776/minister-abiad-training-workshops-meditrack-system>.

- 23) Ministry of Public Health, M. P. H. (2020). *MoPH Releases the New Version of COVID-19 Symptom Checker Chatbot*. Ministry of Public Health - Lebanon. Retrieved August 21, 2022, from <https://www.moph.gov.lb/en/Pages/6/15089/meditrack-pharmaceuticals-2d-barcode-project#/en/view/35974/new-version-of-covid-19-symptom-checker-chatbot>
- 24) Ministry of Public Health. (2016). Track & Trace E-Health Solutions. In *Ministry of Public Health*. Beirut. Retrieved August 21, 2022, from <https://www.moph.gov.lb/userfiles/files/Programs%26Projects/NationalE-healthProgram/Track%26Trace-%20E-Health%20Solutions-2016.pdf>.
- 25) *New milestone towards e-health in Lebanon*. Telecom Review. 19 April 2018. <https://telecomreview.com/index.php/articles/exclusive-interviews/2229-new-milestone-towards-e-health-in-lebanon>
- 26) Saleh, S., Farah, A., El Arnaut, N., Dimassi, H., El Morr, C., Muntaner, C., Ammar, W., Hamadeh, R., & Alameddine, M. (2018, December 1). *MHealth use for non-communicable diseases care in primary health: Patients' perspective from rural settings and Refugee Camps*. Journal of public health (Oxford, England). Retrieved August 17, 2022, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6294037/>
- 27) Schellen T. (2018). A look into Lebanon's healthcare. Untangling myriad business strings. Executive. 6 August 2018. <https://www.executive-magazine.com/special-report/a-look-into-lebanons-healthcare>
- 28) Talhouk, R., Akik, C., Araujo-Soares, V., Ahmad, B., Mesmar, S., Olivier, P., Balaam, M., Montague, K., Garbett, A., & Ghattas, H. (2020). Integrating Health Technologies in Health Services for Syrian Refugees in Lebanon: Qualitative Study. *Journal of medical Internet research*, 22(7), e14283. <https://doi.org/10.2196/14283>
- 29) *Telecommunication in Lebanon*. Worlddata.info. (n.d.). Retrieved August 6, 2022, from <https://www.worlddata.info/asia/lebanon/telecommunication.php>
- 30) The World Bank. (2020). *Macro Poverty Outlook for Middle East and North Africa*. Retrieved from https://www.worldbank.org/en/publication/macro-poverty-outlook/mpo_mena#sec1
- 31) WHO. (2019). *Global strategy on digital health: 2020-2024*. World Health Organization. Retrieved August 4, 2022, from <https://www.who.int/docs/default-source/documents/g4dhdaa2a9f352b0445bafbc79ca799dce4d.pdf>
- 32) WHO. (2020). *COVID-19 and digital health: What can digital health offer for COVID-19?* World Health Organization. Retrieved August 4, 2022, from <https://www.who.int/china/news/feature-stories/detail/covid-19-and-digital-health-what-can-digital-health-offer-for-covid-19>
- 33) World Health Organization. (2021). *Implementation of e-health Innovative Technologies in North Lebanon hospitals*. World Health Organization. Retrieved August 4, 2022, from <http://www.emro.who.int/inpress/research/implementation-of-e-health-innovative-technologies-in-north-lebanon-hospitals.html>
- 34) World Health Organization. (n.d.). World Health Organization. Retrieved August 18, 2022, from https://apps.who.int/nha/database/country_profile/Index/en

- 35) نقاش استراتيجي حول قابلية التوسع في مشروع "سجلّي" في الجامعة الأميركية Global Health Institute. (1970, November 1). Retrieved August 21, 2022, from <https://ghi.aub.edu.lb/sijilli/>
- 36) Saleh, S., Khodor, R., Alameddine, M., & Baroud, M. (2016). Readiness of healthcare providers for eHealth: The case from Primary Healthcare Centers in Lebanon. *BMC Health Services Research*, 16(1). <https://doi.org/10.1186/s12913-016-1896-2>
- 37) World Bank Group. (2021, March 15). *World development report 2016: Digital dividends*. World Bank. Retrieved August 23, 2022, from <https://www.worldbank.org/en/publication/wdr2016>
- 38) McKinsey Global Institute. McKinsey & Company. (n.d.). Retrieved August 23, 2022, from <https://www.mckinsey.com/mgi/overview>



Acknowledgments

This report was written and formulated by three main authors. Housin Al Shamali and Karen Rizkallah were responsible for conducting the literature review, analyzing qualitative transcripts, referencing, and ultimately writing the final report. Ms. Lina Abu Mrad – the director of the national e-health program – was responsible for supervising and the writing up of the report, as well as contributing to the literature review by providing expert opinion on the related subjects. Finally, the interviews with the stakeholders were conducted and transcribed by Ms. Doris Mouawad.

Authors

Ms. Lina Abu Mrad – Director of the national e-health program

Mr. Housin Al Shamali – Master's in Public Health (Health management and policy concentration)

Ms. Karen Rizkallah – Master's in Public Health (Health management and policy concentration)

