REPUBLIC OF LEBANON
MINISTRY OF PUBLIC HEALTH

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National Digital Health Transformation Strategy

FOREWORD

Lebanon has long been recognized as a country of innovation and resilience, an early adopter of transformative technologies across many sectors, including health. Even in the face of economic hardship, political instability, and a protracted humanitarian crisis, Lebanon's healthcare sector has continuously shown creativity, adaptability, and resolve. It is with this same spirit that we present the National Digital Health Transformation Strategy, a bold yet practical roadmap that seeks to fundamentally reshape how healthcare is delivered, accessed, and managed in Lebanon.

Digital transformation is no longer a luxury reserved for high-resource settings. It is a necessity, especially for countries like ours that strive to deliver equitable and quality healthcare amidst constrained resources. This strategy is not just about technology. It is about equity, efficiency, and empowerment. It is about ensuring that no mother in a rural village, no older adult in an underserved community, and no child living with chronic illness is left behind in our vision for health. Digitalization is, above all, a health reform tool. It strengthens governance, builds transparency, enhances decision-making, and ensures continuity of care. It allows for more targeted, timely, and patient-centred services. It lays the foundation for proactive population health management, where data drives decisions and people drive outcomes.

This strategy, developed with the support of UNICEF and the Copenhagen Institute for Futures Studies, reflects a collective national vision anchored in evidence, foresight, and stakeholder collaboration. It outlines a phased, realistic approach that embraces innovation while acknowledging our current limitations. It proposes a system where interoperability, standards, and regulatory agility are not abstract ideals, but lived practices.

The Ministry of Public Health calls on all our partners, including public institutions, academic bodies, private sector innovators, frontline healthcare workers, and civil society to rally around this shared agenda. We need to view digital health not as a distant goal, but as a present-day solution. We need to harness digital health to close the gaps, improve outcomes, and unlock Lebanon's full health potential. Through digital health transformation, we can collectively build a more inclusive, accountable, and future-ready health system, one that delivers on the promise of health as a right, not a privilege.

Dr. Rakan Nassereldine
Minister of Public Health
Lebanon

OVERVIEW OF THE STRATEGY

This Digital Health Transformation Strategy represents a roadmap to enable the health vision charting a pathway toward resilience, equity, and sustainability for 2030 and beyond. Developed under the leadership of Lebanon's Ministry of Public Health (MoPH) with support from UNICEF and the Copenhagen Institute for Futures Studies (CIFS), the strategy seeks to leverage digital health technologies to address systemic challenges and align with Lebanon's Health Vision 2030 and beyond. The Vision aims to expand Universal Health Coverage (UHC), enhance health data systems, and ensure patient-centred care, with digital health acting as both a catalyst and enabler in achieving these goals. Central to the Digital Health Strategy are six strategic pillars designed to strengthen governance, build digital competencies, and foster innovation, enabling Lebanon to align with international standards and achieve UHC for the citizens.

ACKNOWLEDGEMENTS

We are deeply grateful to Lebanon's Ministers of Public Health, Dr. Firass Abiad and Dr. Rakan Nassreldine, whose leadership and vision have been instrumental in driving this initiative.

We also extend our sincere appreciation to all members of the MoPH team for their dedication, expertise, and determination to enhance Lebanon's health system, especially Mrs Lina Abou Mrad, Mrs Jenny Roumanos, and Mr Ali Roumani. Their continuous efforts and commitment have been vital to the development and implementation of existing plans and solutions from which this strategy also drew inspiration. Their determination to enhance Lebanon's health system despite all challenges should be highly commended. Additionally, we would like to express our sincere gratitude to Dr. Nadeen Hilal for her unwavering support from the inception of this work. Her guidance, insights, and feedback were instrumental in shaping this strategy.

This strategy reflects the valuable insights and contributions of multidisciplinary stakeholders, including policymakers, healthcare providers, patient representatives, and health technology experts. Their dedication to the health and well-being of Lebanon's citizens has been instrumental in shaping this roadmap.

We acknowledge the foundational work conducted by the Ministry of Public Health's technical teams, and numerous partners and researchers, whose previous work, publications, and initiatives have established the groundwork for this effort. Their continuous commitment to improving Lebanon's health information systems and digital infrastructure is highly recognised.

Special recognition is extended to UNICEF, especially Rima Chaya, for its commitment to strengthening Lebanon's healthcare and supporting future generations.

Disclaimers: *While every effort has been made to ensure the accuracy and relevance of this strategy, it is important to acknowledge that the document reflects the prevailing circumstances and priorities at the time of its preparation. The strategy is intended to serve as a guiding framework and should be regarded as a living document, adaptable as Lebanon's healthcare landscape evolves. Recommendations should be implemented in consultation with all relevant stakeholders, with due consideration given to emerging challenges and opportunities. CIFS assumes no responsibility for any consequences arising from the misuse of this information. It is the responsibility of the user to verify its suitability for specific circumstances.*

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1. INTRODUCTION

The Digital Health Transformation Roadmap for Lebanon presents a strategic and forward-looking framework to modernize the country's healthcare system. By harnessing e-Health innovations, including medical informatics and AI-driven decision-making, the roadmap aims to enhance service delivery, improve health outcomes, and ensure more efficient resource utilization. However, Lebanon's adoption of digital health has been hindered by persistent challenges such as governance fragmentation, inadequate infrastructure, and funding limitations, and other obstacles that must be addressed to enable sustainable progress.

Recognizing that digital health transformation cannot be driven by a single entity alone, this roadmap promotes a sustainable co-creation and implementation approach, encouraging collaboration between government bodies, international agencies, healthcare institutions, the private sector, and civil society. By engaging diverse stakeholders, this strategy reflects real-world constraints, aligns with national priorities, and builds upon previous efforts led by MoPH and other key actors who have championed health system reforms in Lebanon.

"We're in this together, everyone's contribution is needed to elevate the overall health landscape of Lebanon"

Lebanon's history may be plagued by crises and constraints, but it also holds unique strengths that can drive transformation. Despite ongoing challenges, these strengths can be leveraged to successfully initiate transformations by 2030 and achieve higher goals by 2035-2040, ensuring a resilient, efficient, and accessible healthcare system.

The well-established history of collaborative health initiatives has demonstrated the value of multi-sectoral cooperation in addressing healthcare challenges. One of the most notable efforts in recent years was the Policy Support Observatory (PSO) initiative in 2018, developed through a partnership between MoPH, the World Health Organization (WHO), and the American University of Beirut (AUB). This initiative institutionalized evidence-informed policymaking and promoted stakeholder-driven governance in Lebanon's health sector. Shortly after that, the Electronic Health Record (EHR) Readiness Meeting in 2019 convened key public and private healthcare providers, policymakers, and IT professionals to assess Lebanon's preparedness for EHR implementation and build consensus on the need for a national EHR system. These collaborative discussions identified major barriers and set the stage for future digital health advancements. The COVID-19 Response Plan and Taskforce (2020–2022) further highlighted the importance of co-creation in Lebanon's health sector. In response to the pandemic, MoPH teams led national coordinated efforts involving government agencies, private sector partners, international donors, and academic institutions to develop and implement crisis management strategies. This collective action enabled the creation of effective response tactics to manage the crisis, including the establishment of the National Health Strategy (NHS): Vision 2030, which laid the groundwork for strengthening Lebanon's health system resilience beyond the pandemic.

The Digital Health Transformation Roadmap aims to build on these strengths and past experiences, ensuring that Lebanon's digital health strategy is not only technically robust but also inclusive, scalable, and aligned with both national and global health priorities.

1.1. Background and Rationale

Lebanon's digital health journey has seen both early promise and persistent challenges. The establishment of the Ministry Committee of Information and Communication Technology (MITC) in the late 1990s and the launch of the first Digital Strategy in 2002 reflected forward-thinking leadership, laying the groundwork for streamlining public administration through digital governance.

Building on these early efforts, the Office of the Minister of State for Administrative Reform (OMSAR) developed a National Digital Transformation Strategy (2020-2030), emphasizing the importance of placing digital transformation at the core of public service reform, focusing on user convenience, service integration, and sustainable development. The strategy underscored the need to digitize government operations across multiple sectors, including health, education, and public administration. While digital health was included as a key component, promoting telehealth, artificial intelligence (AI), and big data analytics, implementation remained limited due to resource constraints, siloed initiatives, and lack of a cohesive governance structure for digital health transformation,,,.

Within the health sector, the MoPH led the development of several digital solutions. Notable achievements include PHENICS (2016), a primary healthcare information system strengthening management of the Primary Healthcare Network; the Mobile Epi Registry Application (MERA)/MERA pro, (2018), digitizing immunization tracking; MediTrack (2022), enhancing medication management for chronic disease patients; and Sohatona app (2022), improving immunization schedules for parents and caregivers as well as many others. Despite some challenges, these initiatives, led by MoPH's teams, and supported by local and international organizations (World Bank, WHO, UNICEF, and several local NGOs) underscore Lebanon's capacity for digital health innovation despite various challenges related to the broader national crises, workforce losses, and insufficient funding mechanisms.

The private healthcare sector in Lebanon shows isolated technological advancements but suffers from severe interoperability challenges. Private hospitals and clinics have adopted various electronic health records and digital solutions that operate as disconnected systems with minimal data exchange. The lack of national standardized standards and protocols has created data silos across institutions, hindering continuity of care. While some providers have developed innovative solutions like telemedicine platforms in response to the COVID-19 despite the economic crisis, these efforts face sustainability challenges due to the aging national infrastructure, IT brain drain, and absent regulatory frameworks for secure data exchange. Public-private partnerships are needed to define national standards that will protect, enable and harmonise the use of data enabling wider access to care.

The compounding crises experienced over the past few years have resulted in fragmented initiatives and the loss of highly skilled workforce, with pilot programs often operating in isolation and lacking integration into national health systems. Furthermore, inconsistent funding mechanisms and a reliance on donor-driven projects have limited long-term strategic planning and investment.

At the regional level, stronger investments in digital health infrastructure, policy enforcement, and data governance have demonstrated the importance of comprehensive, well-integrated national digital strategies, highlighting areas where Lebanon must strengthen its approach.

In early 2023, the National Health Strategy: Vision 2030 underscored digital transformation as a vital enabler for healthcare system strengthening. To advance this priority, the MoPH hosted a Digital Health Retreat in May 2023 that convened key stakeholders to assess the national digital health landscape, identify challenges, and explore future opportunities. The retreat reinforced the need for a unified vision emphasizing robust governance, data management, interoperability, and user-centric care, as well as the potential for digital health to expand access, improve efficiency, and strengthen resilience. This resulted in the development of a digital health vision.

In alignment with internationally recognized imperatives that emphasize agility, consolidation, integration, and the use of open platforms in today's rapidly evolving health environments. A national roadmap should guide transformation priorities that enable more effective and sustainable digital health adoption. International evidence further underscores the need for meaningful stakeholder engagement, sustainable resource allocation, and continuous monitoring and evaluation to ensure that digital health initiatives remain responsive, adaptable, and impactful.

Against this backdrop, Lebanon now has a critical opportunity to consolidate past achievements and lessons learned into a roadmap that aspires to foster a system-wide integration, sustainable governance, and equitable healthcare access through digital innovations, repositioning Lebanon as a regional leader in health, technology and innovation.

1.2. Commitment to Health System Improvements

MoPH has long recognized the value of digital health, embedding it as a strategic pillar within its National Health Strategy 2030 and reaffirming its importance during the Digital Health Retreat held on May 18, 2023. Yet despite these foundational efforts, Lebanon still has a long way to go to keep pace with global digital health advancements and fully realize the transformative potential of technology.

Across the MoPH and the broader healthcare sector, physicians, nurses, pharmacists, and public health experts actively champion digital solutions. Their innovative contributions drive improvements in patient care despite limited resources. Complementing these efforts, MoPH teams of IT professionals, although notably understaffed, play a critical role in safeguarding and advancing digital health systems. Their technical expertise, enhanced through partnerships with international organizations, private sector entities, and academic institutions has led to the development of essential, tailor-made solutions that address Lebanon's unique healthcare challenges.

Over the years, this skilled but under-resourced workforce has laid crucial groundwork for the nation's digital health infrastructure, developing in-house systems such as PHENICS, MERA, MediTrack, Sohatona and others. These initiatives illustrate the resilience and adaptability of MoPH team. However, despite all their efforts, development and collaborative abilities there remains a widening gap between local progress and the rapidly evolving global landscape. Persistent economic constraints, reduced incomes, and mounting mental health challenges continue to challenge their commitment, yet they remain committed to driving innovation and ensuring continuity of care.

Beyond clinical and patient-centred applications, the MoPH has invested in building solutions to effectively fulfil its broader mandates, particularly in regulatory oversight, disease surveillance, and strategic policymaking, particularly with solutions such as MediTrack and DHIS2. Strengthening these solutions further would provide the MoPH with more data-driven insights to further streamline processes, improve resource allocation, licensing, and accreditation. By building an integrated digital ecosystem, the MoPH can monitor public health trends more effectively, anticipate emerging challenges, and swiftly adapt national strategies to ensure quality and accessible healthcare services.

MoPH has invested in its workforce as much as possible to maintain and strengthen existing solutions by partnering with global organizations. However, it recognises that further efforts are needed to position Lebanon as a key player within the regional and global digital health space. Moving forward, these efforts must be intensified to bridge the gap and ultimately align with global digital health standards, ensuring long-term benefits for Lebanon's healthcare system.

1.3. Alignment with the National Health Strategy (NHS)

The NHS aims to expand Universal Health Coverage (UHC), improve health data systems, and ensure patient-centred care.

At its core the Digital Health Transformation Strategy aligns with broader health policies and NHS objectives, emphasizing resilience, equity, and innovation. This alignment positions digital health as both a catalyst and an enabler in achieving these goals. Hence building further, the capabilities of administrative and clinical solutions, such as medication and supplies management, appointment scheduling, EHRs, referrals, telehealth applications and others in support of the key objective of enhancing health services delivery at every level.

Furthermore, making sure that solutions are tightly integrated facilitates patient-centred care, streamline workflows, supporting healthcare providers in delivering quality care. Meaningful integrations can also improve financial management by providing accurate data on healthcare utilization and expenditures, thereby informing decisions, policy briefs and resource allocation.

Emergency preparedness is another critical focus of Vision 2030. Health data analytics and digital health solutions further enhance Lebanon's capacity to respond to health emergencies by enabling rapid data collection, real-time surveillance, and efficient communication among healthcare providers. These technologies ensure a coordinated and effective response during crises, ultimately safeguarding public health.

Past initiatives and notable achievements made through the NHS over the last couple of years highlight the value of strong leadership and collaborative approaches to transforming health. Lebanon received the 2023 UN Inter-agency Taskforce Award for its advancements in scaling up digital health initiatives.

The two-year progress of the NHS goals presented in February 2025 included improvements in digital solutions such as:

- MediTrack expansion to PHC centres.
- PHENICS upgraded to include emergency care modules, and offline modules for use by mobile units delivering care especially for the displaced. It was also updated to integrate with several other systems.
- EHR Planning for regulating and implementing user-friendly, standardized EHRs across healthcare facilities to ensure consistency and interoperability.
- Automation of Hospital Discharge Summaries Digital automation is being implemented to streamline hospital workflows and improve patient record management.

1.4. Contribution of Partners

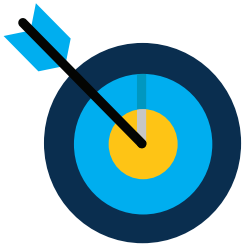
Over the past two decades, in response to the overlapping crisis and challenges, UNICEF and other international partners have played a critical role in supporting and strengthening healthcare services, including funding and implementing digital health solutions to enhance accessibility for vulnerable populations.

UNICEF has also been at the forefront of expanding digital health solutions to improve service delivery and immunization coverage. In collaboration with MoPH, UNICEF has supported digital immunization tracking systems, ensuring that children receive life-saving vaccines on time. A key initiative is also the Sohatona App, a mobile app which allows caregivers to track their children's vaccination status in real time, providing updates and reminders.

Beyond immunization, UNICEF, WHO, UNFPA, World Bank, the EU and other key partners have been instrumental in supporting and strengthening Lebanon's digital health infrastructure. One of their notable contributions has been the enhancement of the Primary Healthcare Network Information Communication System (PHENICS), a key health information system (HIS) implemented across 326 public primary healthcare centres (PHCCs) to improve data management and service delivery.

The WHO has played a pivotal role in strengthening real-time disease surveillance in Lebanon, including funding the expansion of DHIS2[10], the country's national health information system for integrated data management and program monitoring. It has also supported the development and deployment of several digital health solutions, such as MediTrack, the GIS system, the data dashboard for the Public Health Emergency Operations Centre (PHEOC), and the Logistics Management System (LMS)[10] at the Ministry of Public Health's central warehouse. In 2022, in collaboration with the Ministry's National Mental Health Programme (NMHP), WHO launched Step-by-Step, a digital mental health intervention that has led to improved mental health outcomes among Syrian refugees in Lebanon.

Although Lebanon's digital health initiatives are still in their early stages and remain fragmented, these efforts mark the available potential and instrumental ability of integrating technology into healthcare services.



2. STRATEGIC OBJECTIVE

MoPH aims to transform Lebanon's healthcare system through a collaborative and technology-driven digital health strategy that aligns with the NHS 2030 and extends toward 2040. The strategy leverages innovative and scalable digital solutions to support progression towards UHC, healthcare accessibility, and service efficiency while considering existing constraints and uncertainties.

By strengthening governance, interoperability, and stakeholder collaboration, the MoPH seeks to position Lebanon as a regional and global model for resilient, patient-centred, and data-driven health systems, ensuring adaptability to future healthcare challenges.

To guide this long-term transformation amidst uncertain national context, a futures-oriented approach was adopted that enables the exploration of plausible futures that can inform a proactive planning and adaptive implementation.

2.1. Methodology

A strategic foresight methodology was used to explore and navigate possible futures of Lebanon's complex and evolving healthcare landscape toward 2030 and beyond. By leveraging foresight tools, the strategy was informed with identified plausible futures, anticipated challenges, defined priorities and goals that can adapt to future uncertainties.

The process began with comprehensive desktop research and mapping, consolidating valuable insights from prior initiatives to establish a robust foundation. This was followed by an in-depth policy review which systematically identified gaps and prioritized immediate, medium, and long-term actions.

Central to this approach was stakeholder engagement through structured interviews, questionnaires, and interactive workshops involving policymakers, healthcare providers, IT specialists, and civil society organizations. By capturing diverse perspectives, the roadmap reflects collective intelligence, ensuring alignment with stakeholder needs and enhancing the strategy's implementation.

To expand stakeholders' understanding of possible futures, scenario planning was introduced. Participants explored multiple plausible scenarios by systematically considering megatrends, such as demographic shifts, technological advancements, socio-economic developments, and geopolitical uncertainties, that could significantly impact Lebanon's health ecosystem. By analysing these scenarios, stakeholders identified resilient and adaptable pathways for transformation, effectively transcending linear or rigid planning assumptions.

Additionally, a futures-oriented SWOT analysis was conducted, integrating Lebanon's internal strengths and weaknesses within the healthcare system, alongside external opportunities and threats emerging from anticipated future environments. By explicitly addressing uncertainties and potential disruptions, ranging from technological breakthroughs and economic instability to environmental crises and shifting global health priorities, this approach illuminated strategic vulnerabilities and opportunities that are often overlooked in traditional analyses.

More importantly, this foresight-driven methodology integrated best practices and lessons from globally recognized digital health transformation frameworks. Ultimately, this integrated approach enables a future-ready strategy capable of navigating uncertainties, seizing strategic opportunities, and sustainably advancing Lebanon's digital health transformation initiatives.

2.2. Towards 2040

During the design process, participants were asked to imagine the future of healthcare in Lebanon where healthcare services could be seamless, personalized, and powered by integrated intelligent digital health solutions, completely transforming the patient experience.

This vision is not just a futuristic concept, it is a global megatrend shaping healthcare systems worldwide as AI-driven precision medicine, digital therapeutics, and data-driven public health strategies are redefining how care is delivered, making healthcare more efficient, accessible, and patient-centred.

Despite its current challenges, Lebanon, has the potential to leapfrog traditional healthcare models and build a next-generation health system with powered by digital tools. By drawing inspiration from countries such as Estonia, Rwanda, and Thailand[18], which have successfully integrated digital health despite financial and infrastructural constraints, Lebanon can position itself at the forefront of innovative and resilient healthcare transformation.

Health Education and Human Behavioural Change

To achieve this transformation, health education and behavioural change must begin with the new generation. Digital health is not just about technology, it is about reshaping how individuals perceive, access, and engage with healthcare services. A national digital health literacy and health education initiative, embedded in school and university curricula and on the job trainings, will ensure that children grow up understanding the value of preventive health, the use of wearable health devices, and the potential of AI-powered health assistants. This cultural shift will empower individuals to actively manage their health, reducing reliance on reactive medical interventions and fostering a preventive, wellness-centric healthcare model. Future-focused countries such as Singapore,, Denmark, and South Korea have successfully integrated digital health education and behavioural change programs into their national policies. These initiatives ensure that citizens are equipped to engage with future AI-driven healthcare, self-monitor chronic conditions, and participate in telemedicine consultations as a default rather than an exception. Lebanon has the potential to follow global best practices to enabling its population to proactively engage with next-generation digital healthcare solutions.

Smart & Connected Health Infrastructure

Imagine waking up feeling unwell and, instead of navigating a complex healthcare system, you consult an intelligent health assistant on your phone or home hub. The assistant analyses your symptoms, accesses your wearables data, your medical history from secure national EHR systems, and provides an immediate recommendation. If an in-person consultation is needed, it can help you book an appointment instantly via a national digital health platform, selecting from an integrated network of primary care providers, and telehealth services. Upon arrival at a clinic, biometric authentication and intelligent pre-screening tools ensure a seamless check-in process, while clinical decision support systems provide doctors with real-time insights, assisted diagnoses, and personalized treatment plans.

Countries like Estonia and Rwanda have already implemented strategies for fully interoperable digital health ecosystems, proving that resource constraints do not prevent smart, scalable digital health innovation. Estonia's nationwide digital identity system and EHRs provide seamless, secure healthcare access for citizens, while Rwanda's AI-powered telemedicine initiatives aim to dramatically expand rural healthcare access despite financial limitations.

Patients with chronic conditions use wearable devices and home monitoring tools, allowing remote healthcare teams to track their progress and intervene proactively, reducing hospital admissions and ensuring better long-term outcomes.

Data-driven, Learning Public Health System

On a national scale, Lebanon's healthcare ecosystem could be driven by real-time data, AI-powered predictive analytics, and machine learning models. Imagine a public health intelligence dashboard tracking disease outbreaks, predicting epidemiological trends, and allocating resources dynamically based on real-time population health data.

Governments worldwide are already investing in intelligent public health surveillance to predict and mitigate epidemics. For example, Thailand's AI-powered disease monitoring system helped detect and contain COVID-19 outbreaks faster than traditional surveillance methods. Similarly, India's national digital health mission is leveraging AI and big data to optimize healthcare delivery despite significant resource constraints and the largest population by far.

Equitable, Accessible, and Sustainable Healthcare

The future health system must be equitable and inclusive, ensuring that Lebanon's rural populations, refugee communities, and socioeconomically disadvantaged groups have equal access to healthcare services. An open, modular, cloud-based digital health platform can bridge the urban-rural divide, providing telehealth consultations, digital prescriptions, and remote diagnostics even in remote areas.

Countries like Bangladesh and Kenya have leveraged mobile health (mHealth) solutions to bring low-cost, high-impact digital health interventions to underserved populations, proving that innovative policy frameworks can overcome economic barriers. Spain is also leading in the innovation and development of advanced digitally enabled health services.

Empowering Healthcare Professionals and Fostering a Digital Health Workforce

A digitally skilled healthcare workforce is critical for sustaining this transformation. Lebanon must invest in digital health training programs, AI-assisted decision support tools, and medical informatics education, ensuring that doctors, nurses, and allied health professionals are fully equipped to navigate a digital-first healthcare environment. Singapore's National AI Strategy for Healthcare has already integrated AI-assisted diagnostics into medical education, and Denmark, with one of the world's most digital enabled healthcare systems, is ensuring that all healthcare workers are learning how to use AI-driven clinical tools.

Regulatory and Administrative Services Automation

The automation of regulatory and administrative services provided by the MoPH is a critical enabler for a digitally integrated, efficient, and transparent healthcare system. By leveraging Robotic Process Automation (RPA), Artificial Intelligence (AI), and interoperable digital platforms, MoPH can streamline service delivery, reduce inefficiencies, minimize delays, and enhance inter-ministerial coordination. Automating core regulatory functions, including licensing, real-time compliance monitoring, and public health quality oversight, will accelerate processes and ensure more responsive, data-driven healthcare governance.

The strengthened nationally integrated digital infrastructure will facilitate seamless coordination between public, private, and academic healthcare providers, linking civil registries, health insurance systems, trade regulators, workforce accreditation, and supporting health services such as laboratories, pharmacies, and professional health organizations. Additionally, the streamlining of Health Technology Assessment (HTA) will guide evidence-based decision-making for treatment approvals, resource allocation, medication and supplies distribution, and certification processes, ensuring that innovative and cost-effective health interventions are adopted across the healthcare ecosystem.

By prioritizing evidence-based digital health policies, Lebanon can position itself as a regional leader in digital health innovation. Strategic public-private partnerships, investment in health tech startups, and regulatory frameworks that support AI-driven healthcare solutions will drive economic growth and healthcare modernization. AI-driven public health analytics will further enhance disease surveillance, optimize accreditation processes, and enable precision health policies, reinforcing a resilient, high-quality, and future-ready healthcare system.

At the Forefront of Health Innovation

The adoption of technology, AI, and other advanced health innovations is inevitable, with healthcare organizations worldwide increasingly integrating these solutions into their operations. As digital transformation accelerates, coordinated efforts at the national level become crucial to ensure that these technologies are deployed strategically, efficiently, and equitably. Without a unified national approach, fragmented and siloed implementations may lead to duplication of efforts, inefficiencies, data islands, and resource wastage. By establishing a structured e-health governance framework that aligns with national initiatives that leverage AI-driven, Lebanon can maximize the impact of AI and digital health solutions, ensuring that they enhance patient care, optimize healthcare delivery, and contribute to a more resilient and future-proof health system.

Participatory and Inclusive Future of Health

“It takes a village” to implement effective digital health solutions, concrete strides are needed towards a holistic, collaborative model that seeks to tackle pressing healthcare challenges while laying a foundation for a more resilient, efficient, and digitally advanced future healthcare system.

The question is not whether Lebanon can achieve this vision, but how quickly it can take decisive steps to make it a reality. National transformation requires bold leadership, strategic investments, and a national commitment to embedding health across all sectors and everyday life.

As with any long-term transformation initiative, uncertainties will inevitably emerge during implementation, whether from shifting political landscapes, economic fluctuations, or technological advancements. Lebanon’s path toward a stronger health system lies not in rigid adherence to predefined plans, but in further building agility and fostering multi-stakeholder collaboration that enables more structured responsive adaptation to changing circumstances.

Practical Realities from 2025

When Lebanon’s Digital Health Transformation Strategy was initiated in 2024, the nation faced significant challenges with most insights pointing toward futures dominated by slow recovery and grassroots survival Scenarios C “Darkest Before the Dawn” or D “Grassroots”. This was worsened with the war in late 2024 creating more uncertainties.

Therefore, rather than defining a fixed path, the strategy is designed as an adaptive recommendation. Its six transformation priorities create building blocks that can be implemented to give the MoPH control as circumstances evolve, also considering the National Health Strategy.

In 2025 new dynamics emerged. While international partners faced significant funding cuts that could threaten support programs, other local changes provided renewed optimism. Renewed leadership interest in digital transformation hinted that Scenarios B ("Conscious") or C might become achievable.

Scenario B represents a future where Lebanon consciously builds self-reliance through practical innovation and public-private collaboration. Even with reduced international funding, this path could emerge if stakeholders unite around transparent governance and gradual, sustainable progress. The strategy's modular approach allows decision-makers through the e-health governance to pivot toward this scenario by creating initiatives that build trust, foster local innovation, and maximize limited resources.

The transformation priorities, from governance structures to innovation ecosystems, are designed as stepping stones. Each initiative completed, each partnership formed, and each small success creates momentum toward a stronger health system. Whether Lebanon ultimately achieves the cautious optimism of Scenario B or navigates the longer recovery of Scenario C, the strategy provides the flexibility to adapt while maintaining focus on the goals. For the full scenarios used in this process, please refer to the Appendix.

3. READINESS FINDINGS

Structured readiness assessment and monitoring of the current health systems capabilities served to evaluate Lebanon's ability to leap forward with initiatives that can support the NHS goals and beyond. Research and stakeholders' engagement included an exploration of the strengths, weaknesses, opportunities, and threats within Lebanon's healthcare system with the 2040 in mind. These findings and insights were structured into key focus areas based on which digital healthcare transformation priorities were formulated.

Stakeholder and experts' discussions have highlighted Lebanon's healthcare system as a complex ecosystem involving public institutions, private healthcare providers, and humanitarian organizations, each contributing to service delivery. While stakeholders recognize Lebanon's strong cadre of medical professionals, technology experts, and private sector leadership, they emphasize critical systemic challenges that must be addressed to enable effective national digital health adoption. A lack of unified governance, fragmented initiatives, and a heavy reliance on donor funding have led to inconsistencies in digital health implementation, preventing a cohesive national strategy. Additionally, stakeholders pointed to a shortage of skilled personnel in healthcare IT and informatics, which limits Lebanon's capacity to sustain, scale, and integrate digital health solutions effectively, particularly in the MoPH and in public hospitals and rural areas. Outdated or unreliable ICT infrastructure was identified as a key barrier, restricting access to digitally enabled healthcare services.

Despite these challenges, stakeholders recognize a significant opportunity for Lebanon to advance in digital health. There is growing public awareness and interest in digital health applications, and international donors are increasingly prioritizing digital health investments. Stakeholders also stressed that a lack of comprehensive digital health policies and weak inter-ministerial coordination continue to slow progress. While the MoPH has introduced initial digital health policies, stakeholders pointed out that the current regulatory framework remains incomplete. There is an urgent need to expand regulations to include interoperability standards, data privacy laws, and integration with e-government platforms.

Notably, high confidence was expressed in the MoPH's leadership and its ability to drive the digital transformation agenda forward. They recognized the Ministry's vision and commitment to maintaining and improving healthcare services despite ongoing crises, as well as its efforts to introduce digital health initiatives that align with Lebanon's broader healthcare strategy. This trust in leadership provides a strong foundation for mobilizing and building support, fostering collaboration, and leading the changes needed to transform the health system.

3.1. MoPH Digital Health initiatives

The MoPH teams have been gradually laying the groundwork for a more efficient and accessible health system with partners' support that provide digital health focused investments. This has included strategic planning support, solutions upgrade, integration or the implementation of new digital solutions [,,,,] (Figure 1).

To build on past efforts, many of these initiatives are still valid and were used to guide some of the transformation priority initiatives.

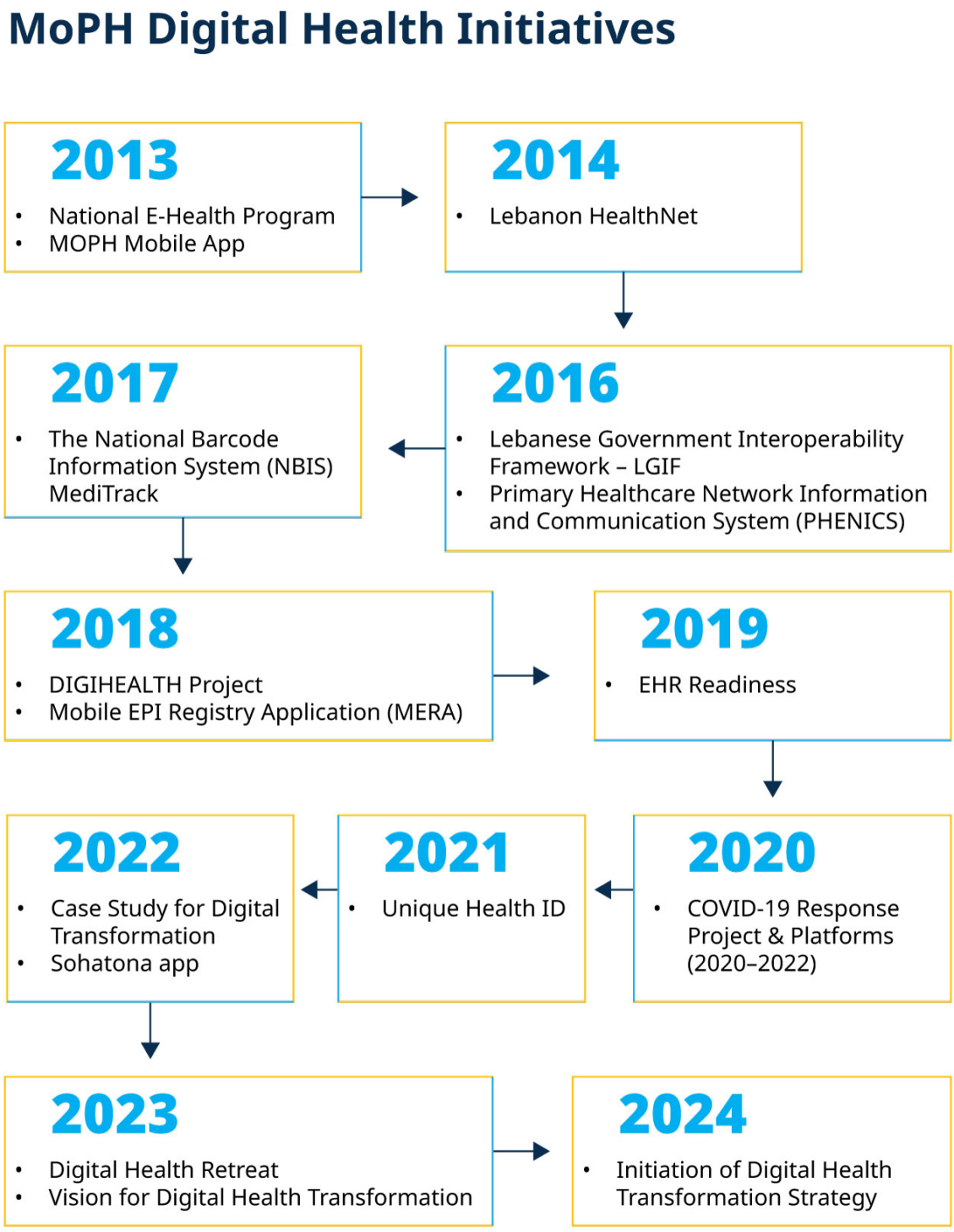


Figure 1 MoPH Digital Health Initiatives Timeline

3.2. Strategic Leadership and Organizational Capacity

The findings highlight strong strategic planning within the MoPH, particularly in developing a national health roadmap and ensuring support for health teams. Leadership demonstrated confidence in technical staff and showed willingness to change, reflecting a commitment to digital transformation. However, gaps exist in governance, evaluation frameworks, user adapted support, and real-time access to essential data, which hinders decision-making.

The variability in leadership understanding across departments further highlighted the need to better communicate plans and objectives. This highlighted a clear need for more inclusive engagement in digital transformation efforts, incorporating equity and human-centred approach that can lead to enhancements to health service accessibility and usability for health professionals and the population.

Staffing shortages at the MoPH and other government agencies have dramatically increased workload and responsibilities for remaining team members. Remaining individuals manage multiple digital health platforms simultaneously, handling system administration, troubleshooting, training, and development across numerous solutions with minimal support. This concentration of responsibilities creates significant operational risks, as overextended staff lack capacity for knowledge transfer or strategic planning while managing growing technical demands. This unsustainable situation threatens both existing digital initiatives and the implementation of new solutions aligned with Lebanon's digital health vision.

WORKFORCE LITERACY AND TRAINING

Digital health capacity remains limited at both the Ministry of Public Health and the national healthcare workforce level. Within MoPH, critical staff shortages, heavy workloads, and dependence on a small IT team strain operations and delay digital initiatives. Many staff lack adequate digital skills and structured training, with limited exposure to technologies like AI and health data standards. At the national level, digital health is not yet fully integrated into educational curricula, and continuing professional development opportunities remain scarce. The aging workforce and lack of succession planning further exacerbate these challenges. Strengthening workforce capacity requires sustained investment in digital literacy, formal education and training programs, and targeted upskilling to support a resilient and digitally enabled health system.

Stakeholder Engagement and Public Acceptance

There is strong stakeholder trust in digital health solutions, particularly among healthcare professionals, patients, and ministry staff. However, engagement with users and healthcare workers in the design and deployment of digital health solutions remains weak. The perception is that the Ministry lacks a structured approach to assess stakeholder digital literacy, leading to barriers in accessibility, connectivity, and usability.

While some initiatives, such as the accelerated adoption of tools during COVID-19, showcased inclusive strategies, there is room for improvement in active participation, particularly for addressing the needs of rural populations and vulnerable groups. Strengthening collaborations with educational institutions and technology partners could enhance digital literacy programs and user-centred design in healthcare innovations.

FINANCIAL SUSTAINABILITY

Digital health initiatives remain underfunded, with insufficient allocation in the national health budget. While mechanisms for financial review and reallocation exist, health technology assessment (HTA) reviews are not sufficiently conducted, creating inefficiencies in cost evaluation for new digital health solutions. Partnerships with private entities and NGOs provide moderate financial support, but a long-term financial strategy is lacking to ensure sustainable digital health implementation.

Enhancing HTA processes and establishing coordinated portents' funding models are necessary to align financial planning with digital health priorities to reduce duplications and waste.

DATA GOVERNANCE, PRIVACY, AND CYBERSECURITY

The legal framework for data protection and eHealth operations is weak, with limited regulations and patient privacy protections. While internal data management and communication processes are functional, data-sharing agreements with external entities are weak, posing risks to population health management, and compliance. Cybersecurity remains a growing concern, but proactive steps such as cybersecurity reviews indicate progress.

Structured governance policies, cybersecurity resources, training, and legal enforcement mechanisms are needed to ensure comprehensive data security and compliance with international standards.

POLICIES & REGULATIONS

The landscape of digital health policy in Lebanon is currently in its early stages. The MoPH has taken steps by establishing several policies and regulations related to digital health, yet this framework remains embryonic. The continuous evolution of digital health necessitates a faster and more comprehensive approach, encompassing a wider range of aspects and stakeholder involvement.

This necessitates expanding and updating the existing policy corpus and introducing new laws and regulations that address not only healthcare delivery but also pertinent aspects in adjacent sectors such as e-government, security, social, education, labour, and finance.

PROJECT AND CHANGE MANAGEMENT

While staff confidence in the ability to lead digital transformation is high, execution strategies remain weak. The Ministry's technical teams exhibit adaptability, but comprehensive, actionable implementation plans for a digital health platform need consolidation. Additionally, existing governance frameworks need strengthening to ensure systematic engagement across departments and facilities.

Increasing resources and stakeholder participation in planning and implementation phases will enhance alignment between leadership vision, ground-level execution and optimisations.

FEEDBACK MECHANISM

Mechanisms exist for tracking patient health outcomes from digital initiatives, but structured feedback loops for users and healthcare professionals remain underdeveloped. The Ministry lacks a dedicated resources and system for evaluating unmet user needs, hindering the ability to refine and scale digital solutions.

Establishing systematic feedback collection and response mechanisms will enhance user-centric health services and solutions.

FUNCTIONS AND FEATURES

The current digital health solutions support basic healthcare workflows but lack advanced features such as decision support systems, AI automations, and data interoperability. While stakeholders value digital health tools, there are usability, reliability and data quality issues. The weak use of standardized international clinical coding or architypes (e.g. ICD, CPT, SNOMED, FHIR) also complicates interoperability and benchmarking. Existing e-Health portals and mHealth applications and functional but are not all used. Weaknesses in solutions architecture, development and documentation were also reported.

Investment in open data sharing architecture, AI-integrations for automation and decision-making, advanced analytics, and the use of international standards will significantly enhance functionality, health data interoperability and usability.

INFRASTRUCTURE AND TECHNOLOGY

Lebanon's health information technology (IT) infrastructure is currently in a phase of development, facing severe challenges. A national facility assessment of primary healthcare centres revealed that many facilities lack essential IT resources, including reliable power, cooling and internet connectivity. Strategic priorities highlight the opportunities and need to enhance the availability in coordination with the national digital transformation strategy. Although the aspired IT infrastructure aligns with current health goals, there are limited resources to leverage technologies such as AI, cloud computing, and blockchain. Health facilities possess basic or outdated end user equipment, networking and integration with medical devices. The low adoption of cybersecurity tools and cloud solutions highlights security and efficiency risks.

Funding is required for upgrading or replacing infrastructure components, end user hardware, accessories, and networking. Upgrading data centres, using cloud services, and cybersecurity tools are essential for business continuity, and long-term sustainability of digitally enabled health services.

DATA AND INTEROPERABILITY

Health data analytics and reporting capabilities are moderately functional, supporting real-time decision-making. However, gaps in eHealth solution integration result in inefficient workflows. Health data registries lack compliance with international standards, and data exchange mechanisms remain underdeveloped.

Strengthening health AI-based predictive data intelligence with enforced standards and interoperability framework will significantly improve information visualisation, and utilisation for decision-making.

INNOVATION AND SCALABILITY

The Ministry demonstrates strong partnerships with private and non-governmental organizations, facilitating digital health implementations. However, long-term innovation strategies require greater integration of emerging technologies, such as AI-driven diagnostics, machine learning, and predictive analytics.

Strengthening structured innovation with multi-stakeholder groups will enhance Lebanon's position as a digital health leader.

WILINESS TO CHANGE

A major challenge is resistance to organizational change, particularly in institutions accustomed to rigid hierarchies and physician centred paper-records. Digital health transformation requires breaking silos, enhancing coordination between care providers, facilities, even ministries, and creating more agile, interoperable systems. This includes sharing access to electronic patient records, automating administrative tasks, and improving data sharing across public and private healthcare providers.

Lebanon's rich cultural heritage and strong resilience have long been defining characteristics of its people. This same spirit of adaptability and innovation must now extend to the digital transformation of healthcare.

MoPH teams, partners and other stakeholders have expressed optimism and willingness to embrace modern healthcare technologies, recognizing that digital solutions can enhance accessibility, efficiency, and quality of care. Healthcare professionals, administrators, and patients alike have shown the willingness to adapt to new ways of delivering and receiving healthcare.

The MoPH related organizations must be prepared to undergo structural and operational shifts. While some foundational elements are in place, many healthcare facilities are constraint to operate under manual administrative models, leading to inefficiencies, duplication of efforts, and a fragmented healthcare experience.

4. GUIDING PRINCIPLES

One of the key enablers is agreeing on principles to establish a common language and a collective ethos that act as change facilitators. All stakeholders typically understand that digital health solutions must align with the national health strategy, they also appreciate how each innovation contributes to Lebanon's broader healthcare goals. Guiding Principles provide further coherence and direction needed to navigate complex decisions. Stakeholder also ensure that these principles are meaningful, relevant, and adopted by all. This combination lays the groundwork for building a resilient, inclusive, and human-centred digital health environment in which technology serves as a tool to enhance well-being, reduce disparities, and improve the quality of care for every person in Lebanon.

By emphasizing sustainability and long-term scalability, principles ensure that investments are not short-lived experiments, but enduring assets that grow and evolve with the healthcare ecosystem. Interoperability and integration principles likewise guarantee that solutions will not remain in isolated silos; instead, they will work seamlessly across the continuum of care, benefiting providers and patients alike.

Data governance, security, and privacy principles help maintain public trust, particularly in a world where personal health information is increasingly valuable and vulnerable. Stating clearly that patient data will be treated ethically and protected robustly assures citizens that digital health is not only about convenience, but also about respecting their fundamental rights. Similarly, when inclusivity and user-centred design are enshrined as principles, it sends a powerful message that every patient, regardless of background or circumstance, deserves to benefit from digital health advancements. And by prioritizing digital literacy and capacity building, the healthcare system invests in its people, empowering them with the skills they need to wield technology effectively and confidently.

Yet, having a guiding set of principles is only half the story. The other crucial element is the engagement of all stakeholders. Principles gain their true strength when everyone involved in the healthcare ecosystem, policy makers, clinical and operations administrators, medical professionals, technology teams, patients, and partners contribute to their formation, understands their significance, and remains committed to applying them consistently. This shared commitment transforms principles from a static list of ideals into a dynamic framework for action and decision making.

Stakeholder engagement ensures that the principles are not imposed from the top down but rather co-created and genuinely reflective of Lebanon's healthcare needs, cultural context, and long-term aspirations. When stakeholders are actively involved, they become champions of the principles, advocating for their application at every turn. They bring forward diverse perspectives, hold each other accountable, and keep the focus on delivering the highest value for patients and communities.

Alignment with National Health Vision 2030

All digital health initiatives must align with the National Health Strategy (NHS), ensuring strategic coherence, stakeholder engagement, and transparent communication to integrate digital efforts within broader healthcare objectives.

Human-Centred and Inclusive Design

Digital health tools must be accessible, intuitive, and equitable, prioritizing patients and healthcare professionals while leveraging partnerships to foster innovation, streamline processes, and enhance user experience.

Digital Literacy and Capacity Building

Continuous training and skill development for healthcare professionals, administrators, and patients will ensure the effective adoption and sustainability of digital health services.

Interoperability and Integration

Digital solutions must support seamless data exchange across public and private healthcare systems, adopting national standards and integrating with other sectors for holistic service delivery.

Data Governance, Security, and Privacy

Strong data protection, accountability, and compliance measures must be embedded by design, ensuring patient trust, secure handling of health data, and regular security audits.

Sustainability and Scalability

Digital health systems must be resilient, adaptable, and financially sustainable, with crisis-ready infrastructure and long-term funding strategies to ensure continued effectiveness and expansion.

In essence, principles and stakeholder engagement work together as the foundation of a thriving digital health ecosystem. These guiding principles should be reviewed, updated and adopted by the e-health governing body to facilitate decision making.

4.1. Alignment with the National Digital Transformation Strategy

It's important to note, Lebanon has a Digital Transformation National Strategy 2020-2030, updated in 2022, that include elements foundational to the digital health strategy. In the absence of its implementation, the Ministry of Public Health would need to maintain core solutions with limited technical and financial resources. Without access to shared infrastructure, each health solution, ranging from the primary care centre solution to EHRs exchange platform to telemedicine and administrative solutions, needs to be built and maintained by the MoPH, leading to duplicated efforts and inconsistencies across the healthcare and non-healthcare ecosystems.

The below outlines the importance of closely aligning Lebanon's Digital Health Strategy with the broader National Digital Transformation Strategy. This is vital for unlocking the full potential of technology in healthcare. Such integration leverages shared foundations, capacity building initiatives, governance, legal frameworks, resilient infrastructure, and an inclusive digital agenda, to deliver more coordinated, equitable, and innovative health services to the population. Aligning with the NHS, the MoPH can effectively focus on strengthening health services quality, and implementing robust systems that serve both present and future needs, all while remaining an integral part of Lebanon's overall digital landscape.

GOVERNANCE AND STRATEGIC ALIGNMENT

Lebanon's Digital Transformation Strategy (2020–2030) lays out a central governance model and outlines how ministries and public institutions coordinate on large-scale technology initiatives. This includes the establishment of a central Digital Transformation Unit (DTU) under the Office of the Minister of State for Administrative Reform (OMSAR), which sets cross-government standards, mitigates duplication of efforts, and ensures interoperability across all sectors.

By aligning with the national strategy, the MoPH ensures that healthcare-specific digital projects, fit into a cohesive, government-wide approach. This governance alignment also helps prevent fragmented or duplicated efforts and solutions in the public and private health sectors. This can be done by leveraging locally agreed on standards and centralized knowledge and support for implementation, capacity building, and resource allocation.

Resilience and continuity of operations

A core pillar of Lebanon's national digital plan is the emphasis on robust, secure infrastructure, supported by business continuity and disaster recovery protocols. These measures are designed to keep critical government operations running, even during periods of economic or social disruption, and uphold confidence in public e-services.

In healthcare, maintaining operational continuity under crisis conditions can be a matter of life and death. By building on the resilience models defined at a national level, the MoPH can implement digital health systems, such as telemedicine, hospital information systems, and emergency communication tools, that remain functional and interconnected during crises, thereby safeguarding patient care and public health surveillance.

EQUITY, ACCESSIBILITY, AND INCLUSION

The national digital agenda prioritizes universal access to secure internet infrastructure and services for all communities, bridging urban-rural divides and ensuring vulnerable populations are not left behind. Additionally, it promotes citizen-centred government e-services, underscoring inclusion and transparency.

Aligned with those overarching equity goals, Lebanon's digital health agenda focuses on expanding Universal Health Coverage (UHC) through telehealth, patient portals, and integrated data systems. Ensuring these tools are accessible via mobile devices or remote-care applications helps underserved communities benefit from technology-driven innovations, just as the broader national plan aspires to provide equitable digital services for every citizen.

INNOVATION AND IMPROVED SERVICE DELIVERY

By championing a "cloud-first" policy, digital identity, open APIs, and a data-centric approach, Lebanon's digital transformation blueprint seeks to stimulate a vibrant digital economy. National guidelines for data exchange, privacy, and cybersecurity enable different sectors to innovate while maintaining citizen trust in e-services.

Health-specific innovation taps into the same infrastructure, secure cloud platforms, shared data registries, and open APIs, to modernize clinical workflows, streamline patient referrals, and power analytics-driven policy decisions. By following the broader innovation principles in the national framework, the MoPH can adopt cutting-edge technologies (e.g., AI-driven diagnostics) more confidently and rapidly, driving improvements in patient outcomes and service delivery.

LEGAL AND REGULATORY FRAMEWORK

The national plan advocates for comprehensive legal and policy reforms, including data-protection laws, cybersecurity regulations, and frameworks for open government. It ensures that all digital initiatives, be they in finance, education, or health, operate under uniform rules that protect user data and foster trust.

Patient privacy, electronic consent, and digital health legislation are paramount in digital health. By embedding healthcare regulation within a robust national legal structure, the MoPH can adopt or adapt these laws to protect health data, standardize cross-institutional data sharing, and regulate some healthcare services. This alignment reduces fragmentation and helps health initiatives gain broader legitimacy and security.

CAPACITY BUILDING AND WORKFORCE DEVELOPMENT

Lebanon's digital roadmap invests in building a digitally skilled public-sector workforce through initiatives like the National Digital Academy, which fosters continuous learning and adoption of new technologies. This approach addresses the nation's talent needs, ensuring both leadership and frontline staff have requisite digital competencies.

Similarly, healthcare requires clinicians, pharmacists, and administrative staff to optimize digital tools for patient care. Tying digital health training to national digital literacy capacity-building efforts ensures that professionals receive consistent, high-quality education, with shared standards and certification pathways across ministries and the academic sector. Ultimately, this strengthens Lebanon's overall e-government ecosystem as well.

OPEN GOVERNMENT AND STAKEHOLDER ENGAGEMENT

Central to Lebanon's digital plan is the principle of open data, citizen engagement, and transparency, supported by portals. This openness builds public trust and fosters partnerships with the private sector, universities, and civil society, fuelling continuous innovation.

The e-health innovation hub can harness these open-government channels to publish aggregated health statistics, invite feedback on digital health pilots, and collaborate further with technology partners. By capitalizing on the national push for open data, healthcare innovation becomes more transparent and evidence-based, ultimately benefiting patients and system-level reforms alike.

EMERGENCY PREPAREDNESS AND RAPID RESPONSE

One of the country's stated goals is to enhance real-time data collection, ensure interoperability among ministries, and improve crisis-response mechanisms across sectors. By strengthening centralized databases, cybersecurity protocols, and communication networks, Lebanon's digital strategy provides tools for robust emergency management.

In a health crisis, timely data sharing and coordinated action are paramount. Digital health systems, supported by the national digital infrastructure, allow for real-time epidemiological surveillance, quick patient triage, resource tracking, and streamlined communication between hospitals and public-health authorities. This synergy ensures MoPH can respond faster and more effectively to health emergencies or any national-scale disaster.

5. TRANSFORMATION PRIORITIES

The six interconnected Digital Transformation Priorities (TPs) collectively enable the roadmap for Lebanon's Healthcare Transformation.

- **e-Health Governance and IT Leadership** (5.1): Establishing robust governance structures and leadership capacity to guide the digital health transformation journey
- **Human-centred Care** (5.2): Designing digital solutions that enhance patient experience, improve outcomes, and empower individuals in their healthcare journey
- **Workforce Development** (5.3): Building digital health capabilities and skills across healthcare professionals at all levels of the system
- **Standards and Interoperability** (5.4): Developing technical frameworks and protocols to enable seamless information exchange across healthcare systems
- **Policies & Regulations** (5.5): Strengthening the legal frameworks to enable and accelerate digital health adoption while ensuring data protection
- **e-Health Innovation Ecosystem** (5.6): Fostering partnerships and innovation for sustainable digital health solutions

The transformation priorities were selected based on the unique position Lebanon's health system is in. They are alignment with global best practices, scientific research, and international health standards. They aim to progressively strengthen the health system leveraging people, regulations, health technologies and data.

They support both the National Health Strategy towards 2030, and the digital transformation vision defined during the multi-sectorial stakeholder retreat in May 2023.

Central to these priorities is empowering patients and equipping healthcare professionals with skills and tools to maximize health outcomes. The transformation priorities are also guided by the core objectives of equity, data-driven decision-making and innovation.

Strong leadership and participatory governance are pivotal for fostering collaboration, engaging stakeholders, and ensuring accountability at every level. Collectively, the initiatives build toward a learning health system with enhanced health intelligence capabilities.

5.1. e-Health Governance and IT Leadership

Lebanon's digital health transformation requires strengthened governance structures to bridge gaps in leadership, funding mechanisms, and legislative frameworks. This priority outlines the foundation structure through which all other priorities will be coordinated and implemented to establish a sustainable, interoperable, and patient-centric digital health ecosystem that supports the National Health Strategy and aligns with the broader National Digital Transformation Strategy.

5.1.1. Challenges

Lebanon's digital health landscape reflects the broader challenges facing the healthcare system. The challenges span policy, infrastructure, coordination, and resource allocation domains, requiring a comprehensive approach that acknowledges both immediate constraints and long-term transformation needs. The following challenges represent system-wide barriers that must be addressed through coordinated governance initiatives:

- **Fragmented Governance:** Digital health initiatives operate in silos with inconsistent policies and wasted resources, reflecting the absence of centralized coordination mechanisms that align stakeholders around common goals and standards.
- **Weak Regulatory Oversight:** Insufficient mechanisms exist to enforce standards across public and private healthcare sectors, allowing divergent practices that complicate interoperability and quality assurance.
- **Limited Interoperability:** The inefficient exchange of patient data hinders care continuity and public health surveillance, creating barriers to coordinated care and comprehensive population health management.
- **Inadequate Data Protection:** Insufficient legal protections for patient privacy and cybersecurity expose sensitive health information to risks and undermine trust in digital health solutions.
- **Underdeveloped e-Government Services:** Poor integration with other government services like civil registries and social security prevents the creation of a unified digital identity ecosystem essential for seamless healthcare delivery.
- **Resource Constraints:** Insufficient resource allocations and inconsistent leadership engagement limit the sustainability and impact of digital health initiatives, particularly in public sector institutions.
- **Outdated Legal Framework:** Existing laws impede progress in data privacy protection, health information exchange, and telehealth regulations, failing to keep pace with technological innovations and evolving healthcare needs.

5.1.2. Strengths

Despite facing significant challenges, Lebanon possesses a remarkable foundation of institutional capabilities, human capital, and growing momentum for digital transformation. These strengths exist not only within the Ministry of Public Health but across the broader healthcare ecosystem, spanning public institutions, private sector organizations, academic centres, and international partnerships. Collectively, these assets provide a platform for overcoming current limitations and building a more coherent and effective digital health governance structure.

ESTABLISHED INSTITUTIONAL CAPACITY WITHIN MOPH

The Ministry has successfully developed and implemented large-scale digital solutions (e.g., PHENICS, MERA) using internal teams and strategic vendor collaborations, demonstrating proven capability in managing complex digital health initiatives despite resource constraints.

STRONG NATIONAL PROJECT MANAGEMENT AND TECHNICAL EXPERTISE

Lebanon has demonstrated coordination capability for complex health information systems and donor-funded initiatives, creating implementation knowledge that can be leveraged for future governance frameworks.

EMERGING ECOSYSTEM OF SKILLED PROFESSIONALS

A growing pool of health and technology talent with relevant expertise exists across public, private, and academic sectors, offering diverse perspectives and specialized knowledge for digital health initiatives.

VALUABLE INTERNATIONAL AND REGIONAL PARTNERSHIPS

Established relationships support capacity building, knowledge transfer, and alignment with global best practices, providing access to technical assistance and financial resources for governance strengthening.

PUBLIC FAMILIARITY WITH DIGITAL TOOLS

Increasing adoption of mobile health apps, telehealth services, and digital engagement platforms among citizens creates a foundation of user readiness that governance frameworks can build upon.

MOMENTUM FOR DIGITAL REFORM

Growing policy interest and inter-ministerial dialogue around digital transformation and interoperability signals recognition of the importance of coordinated approaches to digital health governance.

5.1.3. Priority Value

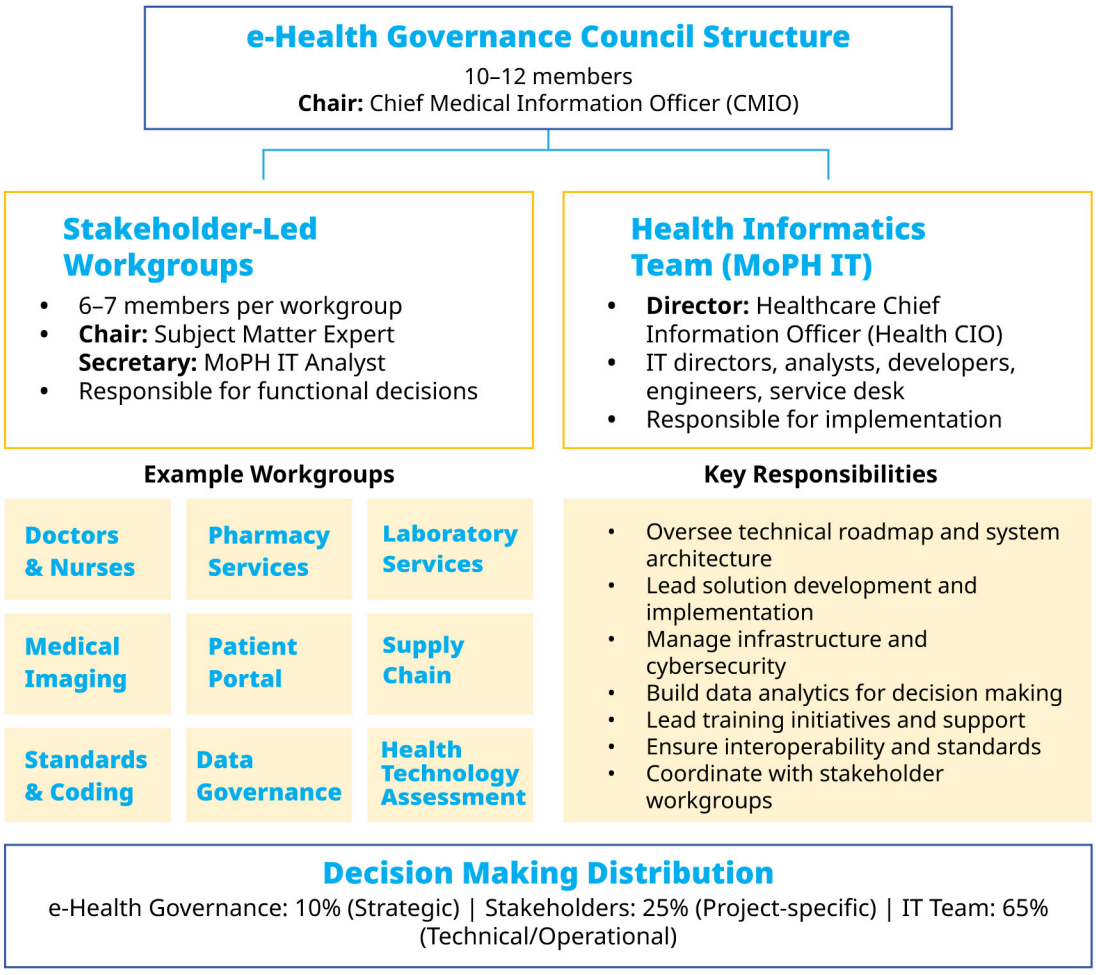
The essential purpose of an e-Health Governance framework is to unify high-level decision-making, policy enforcement, and resource management under a lean structure capable of accelerating decentralized digital solution implementations. This approach harmonizes fragmented efforts, achieve cost-effectiveness, and strengthens readiness to future challenges reducing the need for firefighting.

5.1.4. Governance Model

A lean hybrid e-Health governance model is recommended, combining centralized strategic oversight with decentralized implementation and innovation. The e-Health Governance body will serve as the main steering and coordination entity for digital health initiatives. While anchored in the Ministry of Public Health, its mandate will need to be defined and endorsed by the Council of Ministers to ensure cross-sectoral authority and alignment.

This model emphasizes a bottom-up approach, where the Health Informatics Team makes operational and technical decisions, while Stakeholders-Led Groups critically contribute to ensuring the system meets user needs, and e-Health Governance provides strategic direction.

This hybrid model aims to enable and empower it to oversee more closely the national priorities, restructuring needs, introduction of standards, capacity building, regulatory development and all other associated initiative in close collaboration with health system stakeholders.



E-HEALTH GOVERNANCE COUNCIL

Acts as the main steering body for the national digital health strategy rollout, building multi-sectorial support, defining priorities, standards, capacity building, policies, and regulatory oversight initiatives. It works at the national level with multi-sectorial support.

HEALTH DATA INTELLIGENCE

Operates as a specialized division within the governance structure, responsible for transforming Lebanon's fragmented health data landscape into actionable intelligence for evidence-based decision-making. This entity establishes national data standards, manages the health data warehouse, and provides advanced analytics capabilities including AI-powered insights for population health management, operational, and policy decisions. The HDI team works closely with all governance components to embed data-driven insights into national health planning and emergency preparedness.

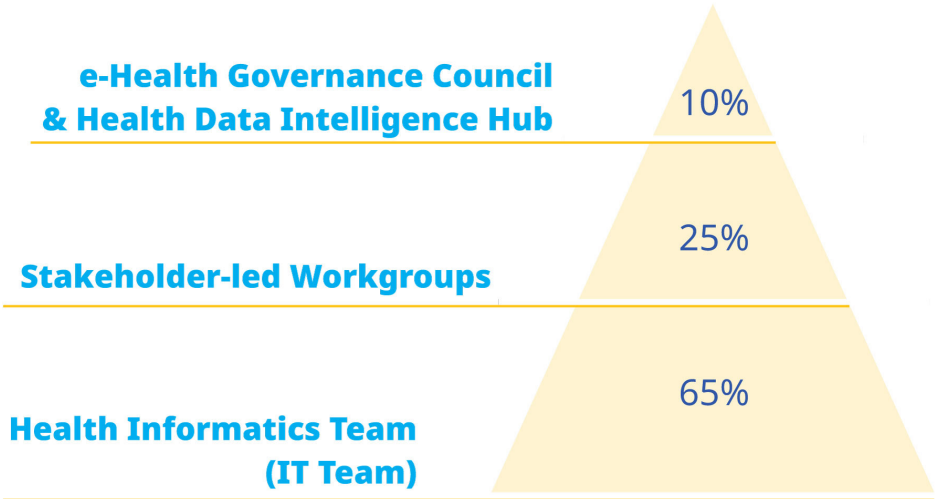
HEALTH INFORMATICS TEAM (IT TEAM)

This is the main body leading projects implementation, solutions management and support at MoPH. Some solutions implementations may still be decentralized and conducted by capable teams in public or private sector in coordination with the MoPH Team and based on the agreed guidelines defined by this steering council.

STAKEHOLDER-LED WORKGROUPS

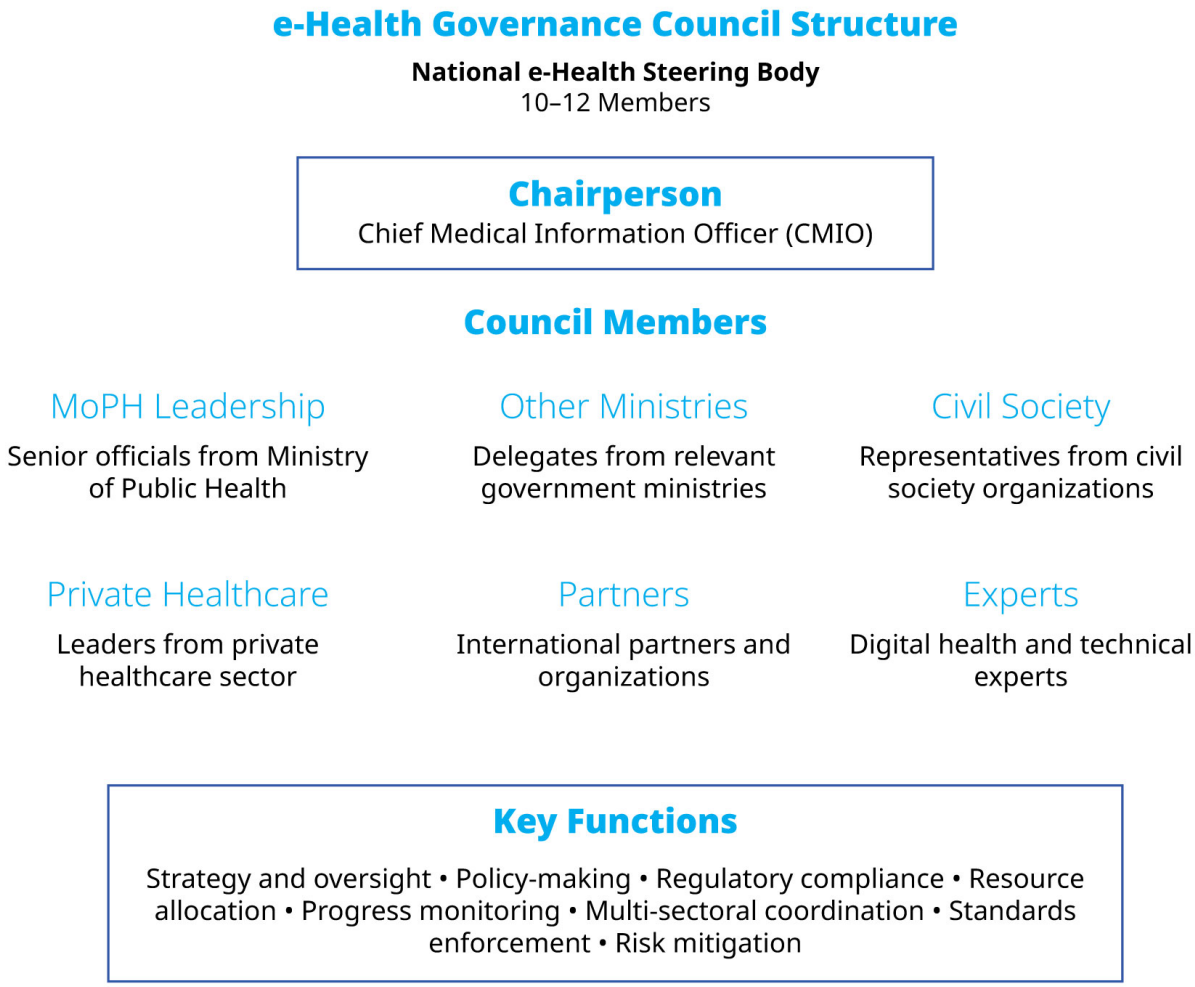
Decentralized advisors that are responsiveness to local needs, make key decisions, foster innovation, ensure communication, and enable collaboration.

This balanced approach ensures strategic alignment with human-centred need, clear accountability, flexibility, and stakeholder buy-in, facilitating effective and sustainable digital health transformation.



5.1.4.1. e-Health Governance Council

EXAMPLE OF STRUCTURE



Size of e-health steering council: 10-12 members

MANDATE

The council acts as the primary steering group, owns digital health transformation strategy; existing initiatives, new initiatives, funding/resources, progress monitoring, capacity building, training, policy recommendations, and risks mitigation.

DECISION MAKING

e-Health Governance makes the key 10% of decisions. This includes high-level strategic oversight, policy-making, and regulatory compliance.

CHAIRPERSON

Appoint a new role/position at the MoPH "Chief Medical Information Officer (CMIO)" This is a new recommended position.

MEMBERS

MoPH leadership, delegates from other ministries, civil society representatives, private healthcare sector leaders, partners, experts.

RESPONSIBILITIES INCLUDE

- Owns the national digital health strategy roadmap
- Embodies guiding principles
- Ensure alignment with National Health Strategy
- Build multi-sectorial consensus on health priorities
- Review, prioritize and approve projects and funding
- Coordinate with partners to secure funding
- Oversee progress, and mitigate risks
- Enforce legislation and interoperability frameworks
- Make informed decisions based on intelligent data analytics
- Owns change management initiative
- Coordinate implementation of all transformation priorities:
  - Promote human-centred design approaches (Priority 5.2)
  - Facilitate workforce development initiatives (Priority 5.3)
  - Enforce standards and interoperability frameworks (Priority 5.4)
  - Develop and enforce policies and regulations (Priority 5.5)
  - Foster innovation ecosystem development (Priority 5.6)

OVERALL VALUE

Overall, clear and transparent e-Health Governance lays the groundwork for a resilient digital health ecosystem, enabling Lebanon to accelerate its advancement toward building a health information architecture that can effectively support the National Health Strategy (NHS) goals and beyond.

5.1.4.2. Health Data Intelligence Lab

As emphasized by the OECD's health data governance frameworks and WHO's Global Strategy on Digital Health, health data are essential to modern health care delivery, health system management, and research innovation, requiring robust governance to foster their use while protecting privacy and data security. Lebanon's current fragmented data landscape, with information collected through multiple systems with minimal standardization, creates significant barriers to evidence-based decision-making at clinical, operational, and policy levels.

The exponential growth in health data volumes from electronic health records and diagnostic imaging to genomics and IoMT devices necessitates not just collection systems but coordinated approaches to transform data into actionable intelligence. A Health Data Intelligence lab, functioning as a specialized unit within the e-Health governance structure, addresses these challenges by converting Lebanon's health data into valuable insights for improved health outcomes.

MANDATE

The Health Data Intelligence lab serves as the central coordinating entity for implementing Lebanon's health data analytics strategy, operating under the oversight of the e-Health Governance Council and managed by specialized data intelligence teams within the MoPH. This strategic investment transforms data from a by-product of healthcare processes into a strategic asset driving continuous improvement and innovation.

The Lab establishes national health data frameworks by developing and enforcing data standards, quality metrics, and governance policies that ensure information accuracy, consistency, and appropriate utilization across the healthcare ecosystem. Aligned with international health data governance frameworks, the lab supports the e-health governance council with health data privacy and security recommendations to build trust while maximizing public benefit. Core functions include:

NATIONAL HEALTH DATA INFRASTRUCTURE

The Lab oversees implementation of a national health data warehouse coordinated with e-Health initiatives, including integrated analytics tools and visualization platforms that make data accessible and actionable. This infrastructure supports population health surveillance, emergency response capabilities, and the Clinical Data Repository (CDR) with comprehensive health data registries. This centralised approach helps to provide partners with validated data related to the initiatives they support.

ADVANCED ANALYTICAL CAPABILITIES

The Lab enhances capabilities from basic statistical methods to advanced predictive modelling and artificial intelligence applications. It provides augmented analytics capabilities with data from digital health solutions deployed across Lebanon's healthcare system (Public and Private), supporting both immediate decision-making and future planning through predictive models.

EVIDENCE-BASED DECISION SUPPORT

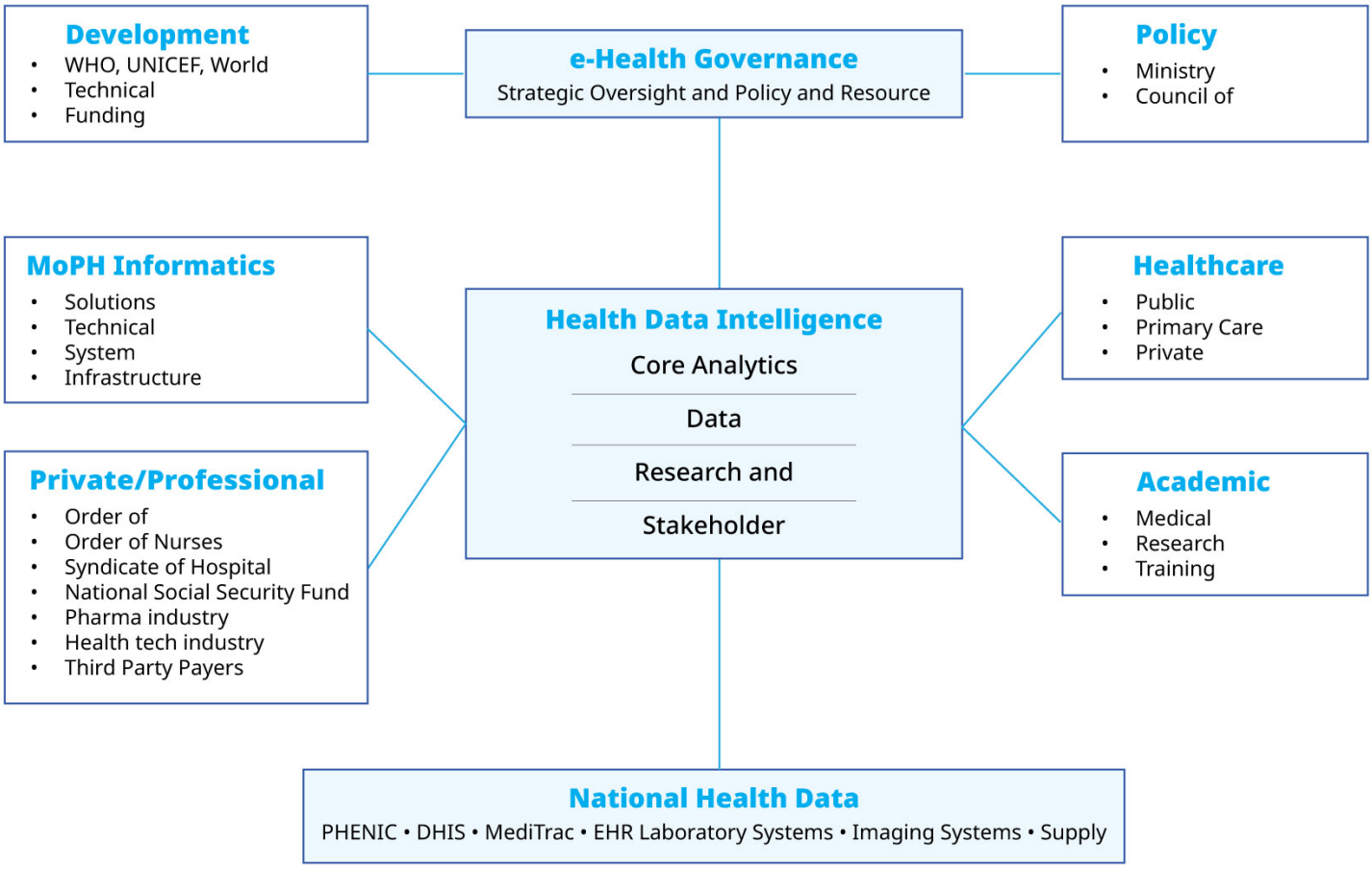
The Lab provides data analytical services and insights supporting population health, operational, and policy decisions across the healthcare system, ensuring that investments in digital health systems yield measurable improvements in population health outcomes and healthcare efficiency.

HEALTH DATA CULTURE PROMOTION

The Lab promotes collaboration on health data literacy and evidence-based approaches among healthcare professionals, administrators, and policymakers.

OPERATIONAL MODEL AND INTEGRATION

The Lab operates as a specialized unit within the e-Health governance structure, staffed with data scientists, biostatisticians, health informaticians, and visualization experts. It acts as the primary interface between governance, operational teams, stakeholders, and data sources. This structure should be adapted to enable health data as a transformation catalyst that is coordinated, evidence-based, and responsive to both strategic priorities and operational realities.



MEMBERS

Core Analytics Team	Transforms raw data into meaningful insights. Builds data warehouse, Integrations, data extraction, transformation and the building of analytics dashboards.
Data Governance Workgroup	Representatives from clinical, administrative, public health, and technical domains. Oversees data governance standards and policies in coordination with the e-health governance council.
Stakeholder Engagement Workgroup	Identifies key stakeholder needs and works with the core team to build analytical dashboards.
Innovation collaboration	Explores advanced analytical methods including AI and machine learning with e-Health Innovation Hub community.

INTEGRATION WITH TRANSFORMATION PRIORITIES

The Lab maintains tight integration with the broader e-Health governance structure, with its director holding a seat on the e-Health Governance Council. This ensures analytics considerations are incorporated into all digital health decisions while supporting coordination across all transformation priorities.

PHASED APPROACH TO BUILDING THE LAB

Foundation (Years 1-2)	**Optimise** (Years 3-4)	**Advanced Capabilities** (Years 5-6)
Establish governance structure and core team	Expand data integration from all relevant sources	Deploy predictive analytics for clinical and operational use
Strengthen data warehouse architecture	Implement clinical quality analytics leveraging AI	Implement policy simulation and impact assessment tools
Develop quality dashboards and operational reports	Develop real-time population health monitoring	Develop advanced resource optimization analytics
Augment disease surveillance capabilities	Identify improvement and cost-saving opportunities	Establish automated quality improvement mechanisms
Explore AI tool applications	Increase collaboration with Innovation Hub	Apply advanced AI models

OVERALL VALUE

By making the Health Data Intelligence Lab part of the e-Health governance structure, Lebanon ensures that its digital health investments align with international best practices for health data governance to build the means to benefit from the wealth of data generated by the health system. This approach also enables the e-Health Governance Council to monitor and achieve the National Health Strategy goals through evidence-based planning and decisions.

5.1.4.3. Stakeholder-Led Workgroups

It is paramount that digital health solutions are aligned with users' needs. Engagement of stakeholders is critical in making sure solutions meet those needs. Dedicated stakeholder workgroups are key to establishing sounding boards on individual aspects of digital health projects and initiatives. These workgroups will bring together subject-matter experts, end-users, implementers, technical specialists, and other relevant stakeholders to ensure detailed project-level planning, development, and implementation meets the objectives.

Workgroups are typically guided by a healthy informatics analyst but are shared by a key stakeholder. They act as the reference for the context-specific area, ensuring key decisions are made and user requests are reviewed and prioritized. Additionally, they actively disseminate updates and improvements to keep community engaged and informed reducing resistance to change ensuring smooth implementation.

EXAMPLES OF WORKGROUPS

Doctors	Nurses	Pharmacy services	Laboratory services	Imaging services	Patient portal services
eHealth policies	Standards and Coding	Data Governance	Health Technology Assessment	Ambulatory services	Others

Size of each workgroup: 6-7 members

MANDATE

Discuss and make specific project decisions, foster innovation, facilitate stakeholder collaboration, maintain accountability, communicate decisions and address local healthcare needs responsively.

DECISIONS

Stakeholders-Led Groups make 25% of decisions. This involves input from healthcare providers, patients, policymakers, and industry partners to ensure administrative and care standards are harmonized, inclusivity and based on consensus.

Even though, the work groups are specific to a key area, and needs, Individually, they can each include multistakeholder representatives, doctors, nurses, administrators, implementation/funding partners, e-health informatics and others.

CHAIRPERSON

A subject matter expert with experience in digital health.

SECRETARY

Health informatics analyst from the MoPH IT team.

SPECIALTY AREAS INCLUDE

- Doctors, Nurses (but also Midwifes, Dietitians, Physiotherapists and other relevant health professionals), Pharmacy Services
- Laboratory Services, Medical Imaging
- Patient Portal, Supply Chain
- eHealth Policies, Standards & Coding (aligned with Priority 5.4 and 5.5)
- Data Governance, Health Technology Assessment
- Patient Experience Design (supporting Priority 5.2)
- Workforce Training & Development (supporting Priority 5.3)
- Innovation & Ecosystem Development (supporting Priority 5.6)
- Ambulatory Services, others

RESPONSIBILITIES INCLUDE

- Advise to Governance council and Health Informatics team
- Make specific project decisions
- Foster innovation and stakeholder collaboration
- Address local healthcare needs responsively
- Maintain accountability and communication
- Enable change management

OVERALL VALUE

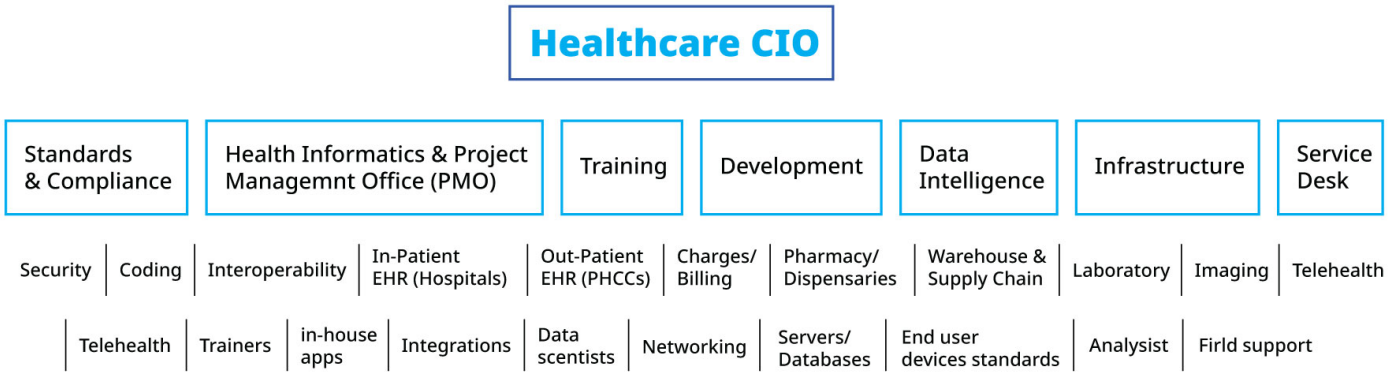
Stakeholder workgroups deliver targeted, actionable recommendations and detailed implementation plans, ensuring standardization, alignment with national priorities, accelerating innovation adoption, enhancing accountability, and facilitating informed strategic decision-making by the e-health governance steering council.

5.1.4.4. Health Informatics Team (MoPH IT Team)

Despite constraints, MoPH teams demonstrated effectiveness by leading diverse initiatives and coordinating with multisectoral stakeholders, fostering collaborative innovation, and maintaining accountability. However, despite these strengths, the team remains understaffed, with critical gaps in both the number of technical positions and the breadth of expertise required to support national the expansion of the digital health transformation. The current reliance on a small, overextended group limits the team's ability to scale, sustain operations, and respond to growing digital demands. To address these challenges, it is crucial not only to empower the MoPH health informatics leaderships and team through capacity-building and clear role definition but also to expand the team by creating additional positions with specialized functions. Strengthening this workforce should go together with the establishment of an agile model of decision-making that minimizes bureaucracy, enhances cross-functional collaboration, and ensures timely, accountable actions.

The team leads projects implementations, provides long-term operations and optimisation. The team leadership, project managers, health informatics analysts and technical team members, coordinate with stakeholder-led groups for standardised configurations and decisions. Activities of the team are focused on operations and support, and the implementation of priorities defined by the e-health governing council.

EXAMPLE STRUCTURE OF HEALTH INFORMATICS (FUNCTIONAL ROLES)



SIZE

Significantly more staff are needed to be build the national health information system platform as well as structural changes to how the team is organised. (supporting Priority 5.3)

MANDATE

Oversees technology stack, system development, implementation, data security, operations, and interoperability of all solutions (clinical, administrative and financial). It drives innovation, supports stakeholders, ensures compliance, and implements scalable solutions. It aligns technology with healthcare goals, integrating emerging tech while maintaining regulatory and ethical standards in line with the e-health governance decisions.

DECISIONS

Health Informatics Team make 65% of decisions. This team handles most decisions, focusing on technical implementation, system design, configuration of standards, best practices, data management, interoperability, operations and support.

DIRECTOR

Healthcare Chief Information Officer (Healthcare CIO).

KEY ROLES

IT directors, health informatics projects and application managers, analysts, integration experts, developers, database experts, data analytics, trainers, Infrastructure engineers and service desk team.

A solid core health informatics team plays a pivotal role in orchestrating data-driven insights, championing interoperability, and ensuring the seamless integration of technology to cater for administrative, clinical and financial application needs. By bridging health informatics expertise, IT knowledge, and change management principles, the team acts as catalysts for innovation and sustained digital health transformation.

The recommended structure is intended as a starting guide and can gradually be formed to unify support for the national health information systems platform which includes, ERP, EHR, LIS, Medications Tracking, Supply chain, Imaging, Interoperability, devices integrations and others.

RESPONSIBILITIES

- Oversee technical roadmap and system architecture
- Define functional requirements with stakeholder-led groups
- Lead RFIs, RFPs, and solutions elections in coordination with HTA team
- Manage solutions implementation
- Lead solution development
- Manage infrastructure and cybersecurity
- Build and provide data analytics for decision making
- Lead trainings initiatives and support end users
- Systems optimization
- Ensure interoperability between health IT systems
- Enforce regulatory compliance and data protection

OVERALL OUTCOME

A dynamic and effective health informatics team builds stronger stakeholders' engagement with the delivery of solutions that demonstrate improvements in delivery of quality care, data security, and care continuity. This also bolsters the public's confidence in digital health initiatives, paving the way for broader acceptance and expansion of e-health services.

5.1.5. Recommended Initiatives

Initiative	Description	Expected Value	Key Stakeholders
Establish National eHealth Governance Body and Review Structure of MoPH IT team	Formalize a multi-stakeholder body to oversee the detailed planning and implementation of the digital health strategy / priorities. Review Structure of MoPH IT team with the future in mind.	Transparent decision-making Strategic alignment of initiatives	MoPH (lead) Healthcare stakeholders IT leaders
		Stable financial resources for digital health Transparent and efficient resource allocation	MoPH (lead) Ministry of Finance Donor organizations Private sector
		Streamlined approach for long term digital health transformation Efficient resource allocation Coordinated implementation across sectors	MoPH (lead) Partner organizations Private sector representatives
Health Data Intelligence Lab	Establish a specialized division within the MoPH health informatics structure to coordinate and implement health data analytics	Standardized data management Enhanced data quality Defined data responsibilities	MoPH Health informatics team Data governance experts
		Integrated data environment Enhanced analytical capabilities	MoPH IT specialists Data engineers
		Improved clinical and operational intelligence Evidence-based & agile decision-making Improved surveillance and response	MoPH Healthcare facilities Academic institutions

Initiative	Description	Expected Value	Key Stakeholders
Stakeholder-led Working Groups	Formalize specialty-focused groups with decision-making authority in their domains	Greater stakeholders buy-in Improved needs alignment More representative decision-making	MoPH Clinical specialists Healthcare administrators Academic institutions
		Enhanced collaboration Reduced silos Accelerate implementation	MoPH Healthcare stakeholders Academic institutions
		Adopt domain-appropriate standards for Lebanon Support interoperability	MoPH Technical experts Domain specialists
Legal Reforms & Cybersecurity	Develop and pass regulations on telehealth, data privacy, data protection, and security	Clear regulatory framework Increased provider confidence	Parliament MoPH Legal experts
		Defined accountability Risk management framework	MoPH Legal experts Healthcare organizations
		Enhanced data protection Reduced security vulnerabilities	MoPH Cybersecurity specialists IT departments
Existing Solutions Enhancement	Develop and implement plans to strengthen and optimize existing digital health solutions	Improved functionality Enhanced user experience	MoPH Solution vendors End users
		Higher system availability Better system performance	MoPH IT teams Solution vendors
		Greater utilization of existing investments Wider system benefits	MoPH PHCs Hospitals
Implement National Health Information System	Prepare requirements and RFPs for needed new solutions with stakeholder input	Well-defined solution needs Stakeholder-validated specifications	MoPH Healthcare facilities Clinical experts
		Transparent procurement process Value-based acquisition	MoPH Procurement specialists
		Functional core systems Integrated health information infrastructure	MoPH Healthcare facilities Solution providers

Initiative	Description	Expected Value	Key Stakeholders
Standards & Interoperability Framework	Mandate and implement health data exchange standards (HL7/FHIR, terminologies) across healthcare systems	Enhanced information sharing Consistent data formats	MoPH Standards specialists Healthcare facilities
		More efficient data collection Lower administrative burden	MoPH Healthcare providers
		Seamless patient transitions Complete information at point of care	Healthcare facilities Clinical providers
National Health Information Exchange	Establish an open platform for real-time health data sharing among authorized providers	Cross-facility information access Integrated care delivery	MoPH Healthcare facilities IT providers
		Comprehensive patient histories Lifetime health perspectives	MoPH Healthcare providers Patients
		Enhanced population health monitoring Better disease surveillance	MoPH Public health authorities
Health Informatics Capacity Building	Develop training programs and career pathways in health informatics and clinical technology	Enhanced clinical-technical collaboration Better system adoption	Universities Clinical institutions IT departments
		Local specialists in health IT Reduced dependency on external consultants	Universities Medical orders MoPH
		Long-term workforce stability Continuous knowledge development	MoPH Educational institutions Health employers
Telehealth & Remote Care Platform	Develop and strengthen national telehealth infrastructure and remote care capabilities	Extended healthcare reach Equitable service distribution	MoPH NSSF Telecom operators
		More efficient specialist utilization Lower facility congestion	Hospitals MoPH Clinical providers
		Resilience during crises Service continuity	MoPH NSSF Healthcare providers

Initiative	Description	Expected Value	Key Stakeholders
Digital Health Innovation Ecosystem	Establish frameworks and partnerships to foster local digital health innovation	Contextually appropriate innovations Locally relevant technology	MoPH Universities Technology developers
		Health tech entrepreneurship Economic development	MoPH Innovation hubs Investors
		Continuous innovation flow Long-term ecosystem development	MoPH Universities Private sector

Key Indicators examples

Initiative	Objectives	Suggested KPIs
Establish National eHealth Governance Body and Review Structure of MoPH IT team	Review and agree project priorities and governance processes	Clear inventory of solutions with process to maintain up to date, status and stakeholders List of Multisectoral initiatives and stakeholders
	Develop sustainable funding mechanisms	Digital health budget secured Sustainable funding sources (diversified)
	Review MoPH IT (Health Informatics) structure, standardize processes, division of functions, responsibilities, and collaboration between entities internally and externally.	Plan for MoPH structure Mapping of all solutions, roles and responsibilities
Health Data Intelligence	Strengthen data governance framework with clearly defined standards to implement a CDR and Registries	Approved data governance framework Well documented relational diagram of all solutions and data that can be used to build ETLs to a Data warehouse
	Implement data warehouse and analytics infrastructure	Data warehouse implementation milestone completion # of data sources integrated
	Build robust intelligent analytical capabilities to collect ana analyse data from across the health system and solutions	# of intelligent dashboards developed and actively used # of data sharing agreements

Initiative	Objectives	Suggested KPIs
Stakeholder-led Working Groups	Form stakeholder workgroups as part of the participatory governance	Working groups established Member engagement levels
	Enable communication between stakeholders	Established a secure means of communication # of members committed and engaged
	Facilitate domain-specific standard adoption	Health standards & Interoperability framework (5.4) Implemented supporting policies # of compliant sites
Legal Reforms & Cybersecurity	Provide legal clarity for digital health	# of laws/regulations enacted
	Establish clear responsibilities and liabilities	% of entities with defined compliance roles # of liability frameworks established
	Strengthen cybersecurity provisions	# of vulnerability assessments conducted # of cybersecurity trainings completed # of security patches implemented
Existing Solutions Enhancement	Augment features based on user feedback	# of new features requested vs implemented User satisfaction
	Improve reliability and performance	Improvement in system uptime Performance metrics improvement
	Increase adoption and usage	% increase in system utilization # of active users
Implement National Health Information System	Define comprehensive requirements	% of stakeholders engaged in requirements Requirements quality assessment
	Develop procurement strategy	# of RFPs developed and released Procurement efficiency metrics
	Implement core national health information system components	% of requirements met in procured solutions Implementation milestone achievement
Standards & Interoperability Framework	Improve data exchange capabilities	% of systems compliant with standards # of successful data exchanges
	Reduce duplication of information	% reduction in duplicate data entry Time savings in data collection
	Enable continuity of care	% of patient transfers with complete data Reduction in duplicate test rates
National Health Information Exchange	Enable clinical data sharing across settings	# of facilities connected to HIE Volume of data exchanged
	Create longitudinal patient records	% of population with longitudinal records Completeness of records
	Support public health intelligence	# of public health indicators tracked Timeliness of surveillance data

Initiative	Objectives	Suggested KPIs
Health Informatics Capacity Building	Bridge gap between IT and clinical practice	# of professionals with cross-training Improvement in system design quality
	Build local health informatics expertise	# of specialists trained annually # of specialized roles filled
	Create sustainable digital health workforce	Retention rate of trained personnel Career progression metrics
Telehealth & Remote Care Platform	Improve healthcare access for underserved areas	Geographic coverage increases # of underserved patients accessing telehealth
	Reduce pressure on urban hospitals	% reduction in unnecessary referrals Facility utilization metrics
	Enable continuous care during disruptions	# of teleconsultations during disruptions Patient satisfaction ratings
Digital Health Innovation Ecosystem	Develop local digital health solutions	# of local solutions developed vs used
	Support health technology startups	# of health tech startups supported vs years
	Create sustainable innovation pipeline	# of partnerships established Investment attracted to digital health

5.1.6. Priority Summary

Shifting Lebanon's healthcare sector toward a future ready digital ecosystem requires cohesive governance, consistent funding, updated legislation, and robust leadership. The proposed governance structure offers a meticulous roadmap to modernize healthcare delivery while addressing the unique challenges of the Lebanese context.

As the foundational transformation priority, e-Health Governance and IT Leadership (5.1) establishes the coordinating mechanisms through which all other transformation priorities will be implemented:

- The governance structures established here will ensure Human-centred Care (Priority 5.2) remains at the forefront of all digital health initiatives, keeping patient needs and experiences central to technology decisions.
- The capacity building elements of this priority will work together with the Workforce Development (Priority 5.3) priority to create a digitally skilled healthcare workforce with both technical and leadership capabilities.
- The interoperability frameworks and data standards outlined here will be fully developed through the Standards and Interoperability (Priority 5.4), ensuring a technically coherent nationwide approach.
- The legal and regulatory aspects introduced in this priority will be comprehensively addressed through the Policies & Regulations (Priority 5.5), creating an enabling environment for digital innovation.

- The governance mechanisms established here will foster and coordinate the e-Health Innovation Ecosystem (Priority 5.6), creating sustainable partnerships and development pathways for local solutions.

By focusing on capacity-building, implementing global data standards, and emphasizing transparent, participatory governance, Lebanon can position itself at the forefront of digital health innovation. The result will be a system that not only reduces operational inefficiencies but also advances patient-centred care, ensuring equitable access to quality health services across the country.

This ambitious pathway, with aligned political will, adequate resources, and strong leadership, lays the foundation for a sustainable, interoperable, and innovative digital health ecosystem that fulfils both the National Health Strategy and the broader vision for Digital Transformation in Lebanon.

5.2. Human-Centred Care

Human-Centred care recognizes that healthcare services should be co-designed with and around people, patients, caregivers, and healthcare professionals. This priority focuses on ensuring that digital health initiatives in Lebanon are developed with the future user needs at the forefront, resulting in solutions that are intuitive, inclusive, and better suited to local future realities.

As one of six interconnected transformation priorities in Lebanon's Digital Health Strategy, Human-Centred Care (5.2) ensures that technology serves people rather than the reverse. This priority depends on strong governance frameworks (Priority 5.1), requires a skilled workforce (Priority 5.3), relies on technical standards (Priority 5.4), operates within appropriate legal frameworks (Priority 5.5), and both contributes to and benefits from an innovation ecosystem (Priority 5.6).

Amid Lebanon's economic challenges and overstretched health infrastructure, a human-centred approach can bridge gaps by tailoring digital health services to the cultural sensitivities, technical literacy, and daily realities of communities, ultimately promoting trust, reducing disruptions, and encouraging consistent engagement.

5.2.1. Rationale

Lebanon's journey toward digital health transformation has often been fragmented, donor-driven, and technologically siloed. By aligning with the National Health Strategy (2030) and the Digital Transformation Strategy (2020-2030) by OMSAR, a human-centred lens ensures that solutions meet real future needs, especially in a context of limited resources and multiple crises.

Globally, WHO and the World Bank emphasize that focusing on human experiences not only increases technology adoption but also ensures sustainable impact. This priority embodies the principle that successful digital health initiatives must be designed with and for the people who will use them.

5.2.2. Megatrends Impacting Human-Centred Care

DEMOGRAPHIC SHIFTS

As we move toward 2040, the aging population will continue expanding, with a substantial rise in patients over 70 managing multiple chronic conditions. Digital health solutions must adapt to support home-based monitoring, geriatric-friendly interfaces, and social support networks.

RAPID ADVANCEMENTS

By 2040, cutting-edge developments, such as advanced wearables, AI-driven diagnostics, 3D bio-printing, and neural interface technologies, could become standard in health. These advancements will require continuous workforce upskilling (Priority 5.3), redesigned clinical pathways, and iterative policy updates (Priority 5.5).

Patients will expect healthcare experiences comparable to highly personalized consumer services, with integrated data across multiple platforms. Providers must respond with solutions that respect privacy, cultural values, and diverse needs of different age groups.

As digital infrastructure matures, addressing linguistic diversity, cultural relevance, and equitable pricing models will remain vital. Solutions must accommodate local needs so that vulnerable populations are not left behind.

5.2.3. Moving towards Human-Centred Solutions

To create a truly human-centred digital health ecosystem, existing solutions can be enhanced in the short-term and replaced with time if needed. This balanced approach recognizes the value of current investments while addressing critical gaps.

MoPH can strengthen and transform the digital health landscape into a cohesive ecosystem that truly serves its users. Each solution category builds upon the others while addressing specific aspects of human-centred care. Over time, they will lead to a comprehensive ecosystem that meets the needs of patients, providers, and the healthcare system. If upgrades require significant investments, procuring or building new ones that can integrate with the national information system platform would make more sense.

Care coordination technologies represent the critical intersection of all stakeholder needs. By leveraging the Unique Health ID (UHID) infrastructure for patient identification and building toward a comprehensive Health Information Exchange, Lebanon can create the technical foundation for coordinated care that transcends individual facilities, reduces duplication, and provides the complete clinical picture necessary for quality care.

5.2.3.1. Multi-Stakeholder Engagement

PATIENT ENGAGEMENT AND EMPOWERMENT

Lebanon's path to patient engagement can begins with transforming existing fragmented applications into an integrated ecosystem. The MoPH Mobile Application provides a foundation for broader functionality, while the child-focused Sohatona app was aimed for targeted engagement that can be expanded to other populations. For patients, consolidating these interfaces into a comprehensive platform eliminates the confusion of navigating multiple systems while providing a single access point for appointments, health records, communication, and education.

Patients with chronic diseases can particularly benefit from self-management tools that could integrate with PHENICS, which already captures NCD data across 326 primary health centres. By extending PHENICS' clinical capabilities to include patient-facing components, providers gain contextual data between visits while maintaining continuity with existing clinical workflows. Administrators value this integration for its efficiency, building on operational infrastructure rather than creating parallel systems, while reducing preventable hospitalizations through earlier intervention.

The MoPH Symptom Checker could also be integrated. it demonstrates Lebanon's steps toward digital patient side decision support. Evolving this tool to include shared decision-making functionality creates meaningful clinical conversations where patients and providers collaboratively determine treatment approaches. This partnership approach increases treatment adherence, improves outcomes, and strengthens patient-provider relationships while providing administrators with more predictable utilization patterns.

TELEHEALTH INTEGRATION

Lebanon's National Helpline for Emotional Support provides an excellent foundation for expanded telehealth services across clinical domains. Scaling this infrastructure to support secure video consultations, remote monitoring, and virtual care teams would significantly enhance healthcare access, particularly in rural areas with limited specialist availability. For patients, telehealth reduces travel burden, costs, and time away from work or family, while providers can efficiently manage larger patient panels through virtual triage and follow-ups. Hospital administrators benefit from reduced facility congestion and better capacity management, while the healthcare system gains resilience during disruptions like civil unrest or public health emergencies. The PHENICX existing data collection and NCD management capabilities could be extended to support telehealth disease management, post intervention monitoring creating a unified approach to virtual care delivery that leverages Lebanon's demonstrated strengths in remote service provision.

HEALTHCARE PROFESSIONS ENGAGEMENT

Healthcare professionals already demonstrate remarkable resilience despite system challenges. PHENICS' successful adoption across primary care demonstrates that well-designed systems can gain clinical acceptance when they support rather than disrupt workflows. Future enhancements to PHENICS and other clinical systems should further reduce documentation burden through templates and automation, allowing providers to recapture time for direct patient care.

The DHIS2 platform showed its value towards standardized data collection. It can further be used to support other datasets and field workers through integrations, simplified interfaces and its offline capabilities.

The Transactions and Workflow System (TWFS) provides a starting point for administrative streamlining that could significantly reduce paperwork burdens.

Healthcare professionals gain efficiency through systems that respect their expertise and judgment, while administrators benefit from reduced training needs and higher staff retention when systems align with clinical practice.

Digital solutions must particularly be designed to enhance rather than detract from professional wellbeing

- Implement digital tools that reduce administrative burden and increase clinical time.
- Design systems that support work-life balance through appropriate after-hours protocols.
- Create dashboards that highlight positive impacts of digital tools on patient outcomes.
- Ensure EHR and other systems incorporate wellbeing metrics in design evaluations.
- Develop "digital wellness" programs to optimize technology use for clinician satisfaction.

By engaging healthcare professionals as true partners in digital transformation, Lebanon can ensure that technology solutions enhance rather than disrupt the care delivery process. This approach recognizes that human-centred care must focus not only on patients but also on the needs and experiences of those providing care.

ENABLING TECHNOLOGIES

One of Lebanon's strongest systems centres around medication management (AMAN, MediTrack, MediPrice...) and demonstrate successful technology implementation at scale. These types of platforms provide mature infrastructure that could be extended to support broader functionalities and integrations to minimise human interventions. Both patients and providers can benefit from reliable information at the point of care, while administrators gain system-wide visibility into prescribing patterns and resource utilization.

The Logistics Management System (LMS) successfully manages supply chains and demonstrates integration capabilities by connecting with solutions like PHENICS. The use of standards-based interoperability tools could expand to connect other clinical systems in healthcare facilities, creating efficiencies that benefit all stakeholders through reduced manual data entry and fewer supply disruptions.

The following features can also substantially support human-centred care delivery:

Point-of-Care Decision Support

- Real-time clinical guidelines integrated into workflow.
- Medication interaction and dosing support.
- Risk prediction tools for preventive interventions.
- Order sets and care pathways with evidence links.

Care Coordination Technologies

- Secure messaging platforms for care team communication.
- Shared care planning tools accessible to patients and providers.
- Transition of care alert systems.
- Social determinants of health screening and referral platforms.

Remote Monitoring Infrastructure

- Secure data transmission protocols for home devices.
- AI-powered anomaly detection in patient-generated data.
- Virtual care delivery platforms supporting multiple modalities.
- Clinical workflow integration for remote monitoring data.

Ambient Clinical Intelligence

- Voice-activated documentation assistance.
- Natural language processing for visit summaries.
- Passive monitoring of clinical interactions for quality improvement.
- Environmental sensors for clinical workflow optimization.

CO-DESIGN WITH END USERS

Engage patients, healthcare providers, and administrators from the earliest planning stages through continuous feedback loops during development and after deployment. Include diverse user groups (elderly, low literacy, people with disabilities) to ensure solutions work for everyone. Leverage advice from stakeholder-led workgroups (Priority 5.1).

Denmark's healthcare portal success demonstrates this approach's effectiveness. By involving elderly patients in interface design sessions, they created intuitive navigation that increased adoption rates among seniors by 68% compared to previous systems.

IMPLEMENT ROBUST USER TESTING IN REAL CLINICAL ENVIRONMENTS

Test digital solutions in actual healthcare settings. Observe workflow integration, measure time impacts, and capture both quantitative metrics and qualitative feedback to prioritize fixes based on impact on clinical care and user experience.

When Estonia implemented their national e-Health system, solutions that underwent rigorous field testing in rural clinics had 43% fewer post-launch issues than those tested only in controlled environments.

DEVELOP LOCAL DIGITAL HEALTH CHAMPIONS NETWORKS

Identify and train influential clinicians and community leaders as digital advocates, creating clinical super-user programs in healthcare facilities with peer-to-peer support structures for technology adoption (Priority 5.3).

Community health worker digital program can achieve over 90% adoption by establishing a network of local champions who provided contextual training and ongoing support.

CHANGE MANAGEMENT

Human-centred design fosters collaboration across MoPH, health professionals, and end-users. Efforts must include robust change management to mitigate provider burnout. Continual user feedback helps refine solutions pre-launch, rather than waiting for large-scale failures.

The implementation approach must be coordinated through the governance mechanisms established in Priority 5.1, with the e-Health Governance Council providing oversight and coordination across priorities. For examples:

ITERATIVE PROTOTYPING

Dedicate resources, lead and launch small pilots, measure adoption, refine features.

STAKEHOLDER INCLUSION

Form inclusive stakeholder-led workgroups representing civil society, patient groups, clinicians.

CAPACITY BUILDING

Integrate digital literacy modules for medical and nursing curricula, aligning with Workforce Development initiatives (Priority 5.3).

EVIDENCE AND KPIS

Continually track user satisfaction, feedback and analyse usage patterns with logs and data analytics.

5.2.4. Recommended initiatives

Initiative	Description	Expected Value	Key Stakeholders
National e-Health Portal	One-stop platform for patients to access records, schedule appointments, and manage their health information	Improved patient engagement Greater health literacy Enhanced self-management	MoPH Public/private hospitals Patient advocacy groups
		Comprehensive patient records Reduced information gaps Enhanced care continuity	MoPH Healthcare providers IT vendors
		Reduced wait times Improved patient experience Higher patient satisfaction	Healthcare facilities Administrative staff IT vendors
AI & Automation	Deploy AI-based triage, decision support, and administrative task automation	Reduced administrative burden More time for direct patient care Lower physician burnout	Healthcare providers IT departments Clinical administrators
		Improved diagnostic accuracy Reduced medical errors Evidence-based treatment selection	MoPH Academia Clinical specialists Private sector AI partners
		More appropriate care allocation Reduced waiting times Better resource utilization	Emergency departments Primary care centres MoPH
Telehealth Expansion	Scale teleconsultation and remote follow-up capabilities nationwide	Greater healthcare equity Reduced geographical barriers Timely specialist access	MoPH NGOs Telecom providers Rural health facilities
		Lower patient out-of-pocket costs Reduced travel time Less work/school absence	Patients Healthcare providers Payers
		Resilient healthcare delivery Continuous care during crises System adaptability	MoPH Hospitals Emergency response agencies

Initiative	Description	Expected Value	Key Stakeholders
Interoperability & Standards	Adopt HL7/FHIR and unify coding systems for cross-network exchange	Seamless information exchange Reduced manual data entry Enhanced data access	e-Health governance council Healthcare IT teams Standards specialists
		Lower redundant testing Improved patient experience Cost savings	Healthcare providers Payers Patients
		Complete longitudinal records Better informed clinical decisions Enhanced care coordination	Healthcare providers Health information exchanges Clinical informaticists
Self-Management Platform	Develop digital tools for chronic disease self-management	Better medication compliance Enhanced treatment fidelity Improved clinical outcomes	MoPH Patient groups Clinical specialists Digital health vendors
		Greater patient activation Enhanced health literacy Improved self-efficacy	Patient advocacy groups Healthcare educators Digital health vendors
		Fewer emergency visits Reduced hospital admissions Lower healthcare costs	MoPH Hospitals Payers Primary care providers
Shared Decision-Making Tools	Create digital decision aids for treatment options and care planning	More informed patient choices Greater decision ownership Enhanced patient autonomy	Clinicians Patient advocates Academia
		Better alignment with patient values More evidence-based choices Reduced unwanted treatments	Clinical teams Quality improvement specialists Patient representatives
		Improved decision experience Stronger therapeutic relationship Higher satisfaction	Patients Healthcare providers Health system administrators

Initiative	Description	Expected Value	Key Stakeholders
Clinical Workflow Solutions	Redesign systems to reduce documentation burden and improve efficiency	More time for direct patient care Reduced provider burnout Enhanced productivity	MoPH Clinical leaders UX specialists Health IT teams
		Enhanced user experience Lower training requirements Fewer user errors	Healthcare providers UX researchers IT vendors
		More efficient care delivery Reduced process variation Enhanced team collaboration	Clinical departments Process improvement specialists Health IT teams
Patient Feedback Platform	Implement comprehensive system for collecting and acting on patient experience data	Timely feedback collection Representative patient perspectives Comprehensive experience data	Patients Healthcare facilities Patient experience specialists
		Responsive service adjustments Closed feedback loops Patient-driven enhancements	Healthcare administrators Quality improvement teams Patient representatives
		Enhanced patient confidence Stronger provider-patient relationships Greater system transparency	Healthcare leadership Communications specialists Patient communities
Health Literacy Enhancement	Develop adaptive education content for diverse patient needs	Better patient knowledge Enhanced treatment comprehension Informed consent	Patient educators Clinical specialists Health communication experts
		More inclusive health communication Reduced disparities in understanding Culturally appropriate information	Cultural adaptation specialists Linguists Community representatives
		Targeted information delivery Improved relevance of education Enhanced information retention	Educational technologists Clinical educators Data scientists

Initiative	Description	Expected Value	Key Stakeholders
Remote Monitoring Integration	Implement systems to incorporate patient-generated health data into care	Early intervention opportunities Proactive care management Better condition control	Clinical specialists Device manufacturers Health IT teams
		More efficient care delivery Lower patient burden Resource optimization	Healthcare providers Patients Healthcare administrators
		More informed clinical decisions Better trend analysis Personalized treatment adjustments	Physicians Clinical informaticists Data analysts

Key Indicators examples

Initiative	Objectives	Suggested KPIs
National e-Health Portal	Empower patients through digital access to their health information	% of patients accessing their records Patient knowledge assessment scores
	Unify fragmented patient data across healthcare settings	% of healthcare entities contributing data Completeness of patient records
	Streamline administrative processes for patients	% reduction in administrative call volume Wait time reduction Patient satisfaction scores
AI & Automation	Ease clinician workload through intelligent automation	% reduction in documentation time Provider satisfaction measures Time allocation analysis
	Enhance clinical decision accuracy with AI support	Diagnostic accuracy improvement Error reduction rate Clinical outcome improvements
	Optimize patient flow through intelligent triage	Wait time reduction Appropriate referral rate Resource utilization metrics

Initiative	Objectives	Suggested KPIs
Telehealth Expansion	Increase access to care in underserved and rural areas	# of tele consults per quarter in rural areas % of population with telehealth access Geographic coverage metrics
	Reduce travel burden and associated costs for patients	Average travel distance saved Patient cost savings Time savings metrics
	Enhance care continuity during disruptions	Service continuity metrics during disruptions # of care interruptions prevented System availability measures
Interoperability & Standards	Enable efficient data flow between systems	# of successful data exchanges Data transfer speed metrics Reduction in manual entry (time saved)
	Reduce duplication of patient information	% reduction in duplicate tests Cost savings from reduced duplication Patient satisfaction with information sharing
	Create coherent patient histories across care settings	Completeness of patient records # of care settings contributing data Provider satisfaction with data access
Self-Management Platform	Improve treatment adherence among patients with chronic conditions	Medication adherence rates Treatment plan compliance Clinical outcome improvements
	Empower patients with knowledge and skills	Patient Activation Measure scores Health literacy assessments Self-efficacy measures
	Reduce complications and hospitalizations	Emergency visit rate for chronic conditions Hospitalization rates Cost savings metrics

Initiative	Objectives	Suggested KPIs
Shared Decision-Making Tools	Increase meaningful patient participation in care decisions	Patient-reported decision participation Decision Conflict Scale scores Patient satisfaction with decision process
	Improve appropriateness of care decisions	Appropriate care metrics Alignment of care with guidelines Reduction in unwanted interventions
	Enhance patient and provider satisfaction with decision process	Patient satisfaction scores Provider satisfaction ratings Relationship quality measures
Clinical Workflow Solutions	Minimize time spent on administrative tasks	% reduction in documentation time Task distribution metrics Provider time allocation
	Improve usability of clinical systems	System Usability Scale scores User error rates Training time requirements
	Streamline clinical processes	Process cycle time reduction Standardized process adoption Team communication metrics
Patient Feedback Platform	Gather real-time patient experience insights	Feedback response rates Demographic representation Volume and quality of insights
	Enable rapid service improvements based on feedback	Time from feedback to action # of implemented improvements Patient satisfaction change
	Build trust through demonstrated responsiveness	Trust measurement scores Perceived responsiveness ratings Transparency assessments
Health Literacy Enhancement	Improve understanding of health conditions and treatments	Health knowledge assessment scores Comprehension improvements Informed consent quality
	Address diverse literacy, language, and cultural needs	Cultural appropriateness metrics Language accessibility measures Diversity of materials
	Deliver personalized education based on individual needs	Content personalization metrics Information relevance ratings Knowledge retention measures

Initiative	Objectives	Suggested KPIs
Remote Monitoring Integration	Enable continuous monitoring of chronic conditions	Data continuity metrics Clinical parameter stability Early intervention rates
	Reduce unnecessary in-person visits	% reduction in routine visits Virtual care substitution rate Resource utilization improvement
	Improve clinical decision-making with continuous data	Data-influenced decision rate Treatment adjustment appropriateness Clinical outcome improvements

5.2.5. Priority Summary

Human-centred care is a vital pillar for Lebanon's digital health transformation. By treating patients and providers as co-creators, engaging stakeholders from inception, and anchoring solutions in local contexts, Lebanon can align with global best practices (WHO, UNICEF, World Bank).

The current state assessment reveals both significant strengths to build upon and critical gaps to address. Lebanon has established robust platforms in specific domains like medication management and disease surveillance, but lacks integrated clinical systems, patient engagement platforms, and standardized administrative tools. The prioritized digital solutions, from foundational infrastructure to patient engagement tools, directly address these gaps while building upon existing strengths to create an ecosystem that puts human needs at the centre.

By implementing these solutions through co-design approaches, robust testing, and local champion networks, Lebanon can ensure technology truly serves its people. This approach will transform the current fragmented landscape into a cohesive, human-centred digital health ecosystem.

With data analytics embedded into all initiatives, and systematically monitoring KPIs, supporting iterative prototyping, and aligning with both national strategies and the other transformation priorities, the e-Health governance council can monitor and enable tangible improvements in the quality, accessibility, and sustainability of its healthcare ecosystem.

5.3. Workforce Development

Lebanon's public health workforce faces significant challenges amid overlapping crises. The country suffers from chronic shortages of healthcare professionals, particularly in the public sector, with an uneven distribution heavily favouring urban centres over rural areas. This imbalance has created healthcare deserts in many regions, especially in the north and Bekaa Valley. The healthcare system has experienced substantial brain drain, with an estimated 30-40% of physicians and nurses having emigrated since 2019 due to the economic crisis, political instability, and the Beirut port explosion. Those remaining often work across multiple facilities to compensate for staffing gaps and to supplement declining incomes.

The public sector particularly struggles to maintain adequate staffing levels due to uncompetitive salaries compared to private institutions or international opportunities. Critical shortages exist in specialized areas including emergency medicine, critical care, psychiatric care, and increasingly in health informatics and digital health roles. The remaining workforce faces overwhelming patient loads, contributing to burnout and further attrition.

5.3.1. Rationale

The health professional education system, once a regional leader, has struggled to adapt to emerging health technology needs. Medical and nursing education largely follows traditional curricula with limited integration of digital health competencies, data science, or emerging technologies. While Lebanese universities produce high-quality graduates in terms of clinical knowledge, there is a significant gap in practical technology skills and experience with modern health information systems.

Continuing professional development opportunities in health informatics and digital health are fragmented and primarily available through expensive private programs or international organizations. The public health sector lacks up-to-date tools, equipment and a systematic approach to upskilling its workforce in technological competencies. What training does exist tends to focus on immediate operational needs rather than strategic capacity building for future healthcare models.

Some promising initiatives exist through international partnerships with organizations like WHO and UNICEF, but these programs typically reach only a small percentage of the workforce and struggle with sustainability once external funding ends. The absence of a national digital health competency framework further complicates efforts to standardize training and assess workforce readiness.

5.3.2. Retention Strategies

Lebanon's public health workforce continues to face significant retention challenges, exacerbated by ongoing economic instability and limited institutional support. The erosion of public sector salaries due to inflation has compelled many healthcare professionals to seek supplementary income sources or consider opportunities abroad. This trend is particularly concerning in underserved regions, where staffing shortages are most acute.

In response, the Ministry of Public Health (MoPH) has outlined several measures within its National Health Strategy: Vision 2030 to address workforce retention. These include improving compensation structures, establishing a national task force with key stakeholders, and promoting international collaboration through staff rotations with foreign healthcare facilities. However, the implementation of these strategies has been challenging, and their impact remains limited due to funding constraints and systemic challenges.

Efforts to enhance non-financial incentives, such as flexible scheduling, professional development opportunities, and improved workplace conditions, have been initiated in some hospitals. Nonetheless, these initiatives lack uniformity across institutions, leading to disparities in workforce satisfaction and retention. The absence of clear career advancement pathways, especially for professionals with specialized digital and informatics skills, further exacerbates attrition rates. Consequently, many skilled workers transition to the private sector or international organizations where their expertise is better recognized and rewarded.

To align with the Transformation Priorities outlined, particularly this priority, it is imperative to establish structured career progression frameworks and continuous professional development programs. Moreover, integrating digital health competencies into training curricula and leveraging e-learning platforms can enhance workforce capabilities, in line with Priority 5.6 on e-Health Innovation Ecosystem. Such initiatives not only can improve retention but also ensure that the workforce is equipped to meet the evolving demands of a modern healthcare system. Hence, all efforts should be considered towards adopting standardized policies and regulations, as emphasized in Priority 5.5, to create a more supportive environment for healthcare professionals and promote a culture of human-centred care (Priority 5.2).

5.3.3. Future Workforce Needs

Looking ahead, Lebanon needs a health workforce that can function effectively in increasingly digital and technologically sophisticated environments. The country requires not just more healthcare workers but professionals with fundamentally different skill sets than those currently being developed.

Future needs include specialists in clinical informatics, health data analysts, digital health implementation specialists, and healthcare AI specialists. Additionally, all healthcare professionals will need baseline competencies in digital health tools, data literacy, and technology-enabled care models. The aging population and changing disease burden toward chronic conditions further necessitate professionals skilled in remote monitoring, telehealth, and digital patient engagement.

Lebanon must develop capacity for workforce planning that anticipates technological change rather than merely responding to it. This requires closer collaboration between educational institutions, health employers, and technology sectors to align curriculum with emerging workforce needs. Without strategic investment in developing these future-focused capabilities, Lebanon risks falling further behind in health system modernization and may face increasingly severe workforce shortages as the gap between required and available skills continues to widen.

This forward-looking plan outlines MoPH's opportunity for developing a healthcare workforce equipped with the digital skills needed for healthcare delivery through 2040. By taking a long-term, multi-generational approach to capacity building, Lebanon can prepare for the profound technological changes that will reshape medicine and health system in the coming decades. This strategy emphasizes building digital fluency from early education through professional practice, ensuring Lebanon's healthcare system can harness emerging technologies to improve health outcomes, enhance efficiency, and deliver personalized care for all citizens.

5.3.4. Towards 2040

By 2040, healthcare delivery may be fundamentally transformed by technologies that are at the development stages today. Artificial intelligence, genomic based vaccines, advanced robotics, the Internet of Medical Things (IoMT), and data intelligence, population health surveillance and ambient clinical intelligence. Healthcare environments may bear little resemblance to current practice. In Lebanon's case, it is anticipated that the private sector will explore some of these technologies hence the importance of building a national innovation ecosystem that can benefit all (Priority 5.6.). Some examples:

IN PRIMARY CARE CLINICS

Dr. Nour enters the examination room where the ambient clinical intelligence system has already recorded the patient's vital signs, analysed their gait, vocal patterns, and facial expressions through passive sensors, and prepared a preliminary assessment based on their health record and recent data from home monitoring. As she speaks with the patient, the AI assistant transcribes and analyses their conversation, flagging potential concerns and suggesting relevant questions. When Dr. Nour orders treatment, the system automatically checks the patient's genomic profile for potential adverse reactions and adjusts dosing accordingly, while scheduling personalized digital therapeutic interventions to complement the medication.

IN HOSPITAL SETTINGS

Surgeon Dr. Haddad prepares for a complex procedure by reviewing the patient's digital twin—a highly accurate virtual model of their anatomy created from multiple imaging sources and enhanced with physiological simulation capabilities. During surgery, he uses mixed-reality visualization that overlays critical structures and surgical navigation guidance onto his field of view. Robotic assistants stabilize instruments and perform precise manoeuvres under his direction, while AI systems monitor the patient's physiological responses in real-time, predicting potential complications before they manifest clinically. After surgery, the hospital's learning health system will analyse the procedure data to improve future surgical approaches.

IN HOME CARE

Mrs. Khoury, an 85-year-old with multiple chronic conditions, lives independently thanks to an integrated home health ecosystem. Unobtrusive sensors throughout her home monitor her movement patterns, medication adherence, sleep quality, and subtle changes in daily activities that might indicate health deterioration. Her smart bathroom conducts daily urinalysis, and her mirror performs brief cognitive assessments during her morning routine. When potential issues are detected, an AI triage system determines whether to provide self-care guidance through her health companion robot, schedule a virtual visit with her care team, or alert emergency services. Her care coordinator receives prioritized daily summaries and trends, intervening only when human judgment is required.

IN COMMUNITY SETTINGS

Community health worker Yasmin uses a handheld multi-diagnostic device that can perform 30 different tests from a single drop of blood or scan, with results immediately analysed by AI and connected to the national health record. Her augmented reality glasses provide discreet guidance for procedures and highlight risk factors specific to each patient she visits. For complex cases, she can instantly connect with specialists through telepresence, who can virtually "examine" the patient through her smart glasses and haptic gloves that transmit tactile sensations. The community health platform automatically identifies vulnerable individuals who need proactive outreach based on environmental, social, and health data integration.

5.3.5. Workforce Agility and Readiness

The Evolving Healthcare Landscape

In light to accelerating technological advancements, Lebanon's healthcare workforce must be prepared not only to adapt to these changes but to lead in their implementation. Public and private hospitals, clinical and specialty centres will need to upskill their workforce's digital literacy to fully leverage the benefits of digital health tools.

The successful healthcare systems of 2040 will also depend on professionals who seamlessly integrate technology into compassionate, patient-centred care. From AI-assisted diagnostics in primary care to robotic surgery and home-based continuous monitoring, technology will become an essential partner in healthcare delivery rather than just a tool.

Given the constraints, prioritizing an initial set of skills through an adaptive learning approach could create a workforce capable of both implementing current technologies and driving innovation for future healthcare needs. This includes digital health concepts, standards and tools such as:

5.3.5.1. For healthcare professionals

Introduction to Health Information Systems

- Architecture of solutions.
- Composition of modules.
- Management of systems.
- Standards and interoperability.

Electronic Health Record Proficiency

- Effective documentation practices.
- Data retrieval and knowledge management.
- Order entry and results management.
- Communication with other providers and patients.
- Interoperability and information exchange concepts.

Data Literacy and Analysis

- Understanding healthcare data types and structures.
- Basic statistical analysis and interpretation.
- Visualization of health data for decision-making.
- Quality assessment and management tools.

Clinical Decision Support Systems

- Integration of evidence-based guidelines into practice.
- Alert and reminder system interpretation.
- Understanding algorithm-based recommendations.
- Critical evaluation of AI-generated insights.

Digital Patient Engagement

- Patient portal.
- Telehealth and virtual care delivery.
- Digital health literacy promotion.
- Patient-generated health data integration.
- Disease education.
- Communication with providers.
- Remote monitoring technology utilization.

Privacy, Security and Ethics

- Data protection principles and practices.
- Personal Identifiable Information (PII) de-identification for research.
- Ethical considerations in digital health.
- Security measures for health information.
- Compliance with regulatory frameworks.

Systems Thinking

- Understanding healthcare IT ecosystems.
- Workflow analysis and optimization.
- Change management in technology implementation.
- Sociotechnical systems perspective.

5.3.5.2. For technology professionals in health

Emerging Technology Adaptation

- AI/ML applications in healthcare.
- Robotics and automation in clinical settings.
- Genomic data storage and interpretation.
- Sensor and Internet of Medical Things integration.

Health Information Exchange

- Standards for health data interoperability.
- Information sharing across care settings.
- Population health data management.
- Continuity of care documentation.

Quality Improvement and Informatics

- Data-driven quality measurement.
- Clinical decision support for quality improvement.
- Registry development and utilization.
- Outcome measurement and reporting.

Implementation Science

- Technology adoption strategies.
- User-centred design principles.
- Project management for health IT.
- Evaluation methodologies for digital interventions.

5.3.5.3. Future Skills Development

Additionally, as 2040 approaches, healthcare professionals will need a sophisticated set of digital competencies alongside their clinical skills. These could include:

Data and Information Skills

- AI-powered health data analytics and pattern recognition.
- Predictive modelling for population and individual health.
- Visualization of complex multimodal health data.
- Management of continuous remote monitoring data streams.
- Genomic and multi-omics data interpretation.

- Management of digital twins and triplets.
- Clinical knowledge management in learning health systems.

Digital Communication and Collaboration Skills:

- Telepresence and virtual consultation mastery.
- Digital patient engagement across diverse platforms.
- Virtual team coordination and collaboration.
- Digital health coaching and behaviour change.
- Cross-cultural digital communication.
- Management of AI-mediated patient interactions.
- Digital therapeutic alliance building.

Technical Systems Skills:

- Human-AI collaborative workflow design.
- Interoperability management across systems.
- Digital privacy and security implementation.
- Biometric and environmental sensing systems.
- Brain-computer interface applications.
- Quantum computing applications in healthcare.
- Blockchain and distributed ledger applications.

Human-centred Technology Skills:

- Ethical application of algorithms in clinical care.
- Human-centred design of care processes.
- Digital equity and inclusion practices.
- Technology-induced error prevention.
- Augmentation of human capabilities with technology.
- Digital cognitive offloading strategies.
- Compassionate technology mediation.

5.3.6. Future-Ready Workforce Development

BUILDING CAPABILITIES IN A CONSTRAINED ENVIRONMENT

Lebanon's healthcare system requires professionals who can bridge clinical practice with technological expertise, individuals who understand both patient care and digital systems. Without a strategic approach to developing these skills, the adoption of digital health solutions will be hampered, healthcare inequities may widen, and the potential efficiency gains of technology will remain unrealized.

With ongoing healthcare worker shortages, financial constraints, and a rapidly evolving technological landscape, traditional approaches to workforce development may not be sufficient to meet the demands of a modern healthcare system. The development of robust national public health informatics skills should become a strategic imperative that cannot be addressed through conventional education alone.

Health informatics capabilities should serve both public and private sectors simultaneously, supporting not only implementation of existing technologies but also fostering innovation and systems thinking. These capabilities must be developed despite resource limitations and traditional training programs that are difficult to scale.

This section aims to start the discussion with suggested approaches for building partnerships to build health informatics skills through methods that can be integrated into existing workflows, educational pathways, and clinical environments. By reimagining how, when, and where learning occurs, Lebanon can overcome resource constraints to develop a digitally capable healthcare workforce that drives both implementation and innovation across the healthcare ecosystem.

These approaches should be developed in partnership with the ministry of education and leading public and private academic institutions. The aim is to maximizing learning efficiency, creating incentives, and developing next generation learning infrastructure that can promote innovation, research and education opportunities. This is something Lebanon has always been good at doing.

DEVELOPMENT OBJECTIVES

- Partner with multisectoral stakeholders, to gradually build a dynamic framework of core and emerging digital competencies needed for healthcare 2040. Build skills for technologies that are emerging, not just those currently deployed.
- Rebuild educational pathways from primary school through professional practice to develop future-ready healthcare professionals. Develop capacity across current professionals, students, and future generations.
- Promote the establishment of specialized training infrastructure for advanced health technologies. Foster continuous adaptation to technological change throughout careers.
- Develop learning systems for rapid workforce adaptation to emerging technologies. Focus on how humans and technology can complement each other's strengths.
- Prepare patients and communities for future healthcare technologies. Ensure technology enhances human connection and promotes equity.
- Cultivate innovations in local health technology development and implementation.

STARTING WITH YOUNG GENERATIONS

In addition to building up the skills of the active healthcare professionals, preparing for healthcare 2040 requires a multi-generational approach beginning with today's children who will become the healthcare workforce of the future.

By the time today's elementary school children enter healthcare practice, many technologies currently considered cutting-edge will be standard. Building comfort with technology, computational thinking, and digital literacy must begin early and continue throughout education. The healthcare professionals of 2040 are in primary schools today, and their preparation for future practice must begin by fostering digital fluency, problem-solving skills, and adaptive learning capabilities from an early age.

Similarly, today's medical, nursing, and allied health students will practice through this transformative period. Their education must go beyond current technologies to prepare them for rapid adaptation to new tools and techniques. And current healthcare professionals must continuously evolve their skills throughout their careers as the pace of technological change accelerates.

A national approach to workforce development must therefore span from elementary education through continuing professional development, creating a pipeline of digitally prepared healthcare talent that can meet the evolving needs of Lebanon's healthcare system.

5.3.7. Early Education Integration (Primary and Secondary Schools)

Key Activities:

- Develop age-appropriate health technology curriculum modules for K-12 education.
- Create healthcare technology exploration programs and clubs in schools.
- Implement "Future Healers" programs connecting students with healthcare professionals and technology teams.
- Establish healthcare technology competitions and challenges for students.
- Incorporate computational thinking and health data concepts into science education.
- Create teacher training programs on future healthcare technologies.

Implementation Partners:

- Ministry of Education (Lead)
- Ministry of Public Health
- Technology companies
- Healthcare organizations
- Educational technology providers
- Partners: UNICEF, WHO, World bank, EU and others

Timeline:

- Curriculum development: 2025-2026
- Teacher training programs: 2026-2027
- Initial school implementation: 2027-2028
- Nationwide integration: 2028-2031

5.3.8. Healthcare Professional Education

Key Activities:

- Integrate future health technologies into medical, nursing, and allied health curricula.
- Establish advanced simulation centres for emerging healthcare technologies.
- Develop specialized tracks in AI, robotics, genomics, and other future domains.
- Create faculty development programs focused on emerging technologies.
- Implement technology innovation practicums in clinical education.
- Establish exchange programs with global centres of healthcare technology innovation.
- Create cross-disciplinary programs combining health, engineering, and data science.

Implementation Partners:

- Universities and academic medical centres (Lead)
- Ministry of Education and Higher Education
- Ministry of Public Health
- International academic partners
- Health technology industry
- Partners: UNICEF, WHO, World bank, EU and others

Timeline:

- Curriculum redesign: 2026-2027
- Faculty development: 2025-2027
- New educational models: 2028-2032

5.3.9. Professional Transition and Adaptation Programs

Key Activities:

- Develop specialized upskilling pathways for current healthcare professionals.
- Create mid-career fellowship programs in emerging health technologies.
- Implement "Technology Immersion" experiences for practicing clinicians.
- Establish mentor programs pairing technology-savvy professionals with peers.
- Develop modular micro-credentials in specific future technologies.
- Create "Future Practice" simulation environments for skill development.
- Implement dedicated protected time models for future skills development.

Implementation Partners:

- Professional associations and syndicates (Lead)
- Ministry of Public Health
- Healthcare employers
- Health technology companies
- Continuing education providers

Timeline:

- Program design: 2025-2027
- Pilot implementation: 2027-2028
- Scaled professional transition programs: 2028-2032
- Continuous evolution of content: 2032-2040

5.3.10. Health Technology Specialist

Key Activities:

- Create specialized programs in clinical informatics like the one started at the American University of Beirut, faculty of public health. "Certified Health Information Systems Analyst"
- Include health AI, and emerging technologies in parentship with engineering faculties.
- Establish clinical innovation fellowships at academic medical centres.
- Foster learning from global health technology events.

- Implement applied research opportunities in healthcare technology.
- Create accelerated pathways for health technology entrepreneurs. (Priority 5.6)
- Establish “Health Technology” leadership development programs.
- Develop specialized certification programs for health technology roles.

Implementation Partners:

- Academic institutions (Lead)
- Health technology companies
- Ministry of Public Health
- Innovation hubs and incubators
- International partners

Timeline:

- Program development: 2025-2027
- Initial cohorts and implementation: 2027-2029
- Scaling and diversification: 2029-2031
- Advanced specialization: 2031-2040

5.3.11. Community and Patient Digital Readiness

Key Activities:

- Develop accessible patient focused digital solutions (Priority 5.2).
- Promote the use of digital health applications.
- Use media channels to share future healthcare technologies.
- Implement intergenerational digital health skills transfer programs.
- Engage municipalities to spread knowledge in communities.
- Establish patient involvement in technology design and implementation (Priority 5.2).
- Implement targeted programs for vulnerable and underserved populations.

Implementation Partners:

- Ministry of Public Health (Lead)
- Municipalities
- Community organizations
- Patient advocacy groups
- Technology companies
- Media partners

Timeline:

- Program design: 2025-2027
- Pilot implementation: 2026-2027
- Evolve and expand: 2026-2040

5.3.12. Learning Methodologies

In the context of busy healthcare environments, learning methodologies must also be designed to integrate seamlessly into clinical workflows without compromising patient care. Collaboration with academic medical centres who have implemented solution could be an effective ways of building knowledge transfer programs.

Initiative	Description	Impact
Microlearning Ecosystem	Partner with university public health faculties to develop < 10 minutes learning modules that deliver short introduction to concepts and best practices.	**High**
Established trainings	Partner with healthcare facilities that have non-solution specific trainings. Learning from peers and on-stie is four times more effective.	**High**
On-Demand Training	Develop content that can be placed on a national online platform for on-demand consumption. Content can include mixed reality content. Partner with academic organisations that have leaning management systems.	**Medium**
AI Learning Companions	Build AI chatbots that can answer questions and adapt to individual learning patterns and provide tailored guidance on specific applications.	**High**

5.3.13. Incentive Structures

In an environment where resources are limited incentives may not be possible. However, incentives are crucial for healthcare professionals to invest time in developing future-focused skills.

Incentives	Description	Impact
Skills Compensation Program	Establish incentives for facilities or providers that implement advanced solutions that improve their patient care or experience.	**High**
Protected Innovation Time	Implement dedicated paid time (20% model) for exploration of emerging technologies.	**High**
Technology Fellowship Sabbaticals	Create funded breaks from clinical practice for immersive technology training.	**Medium**
Technology Career Advancement Pathways	Develop specialized advancement tracks for technologically skilled clinicians.	**Medium**
Education Loan Forgiveness	Implement loan forgiveness programs for specialization in high-need future technologies. This could be done in collaboration with public and private universities.	**High**
Certification Premium System	Provide financial bonuses for achieving advanced technology certifications.	**Medium**
Innovation Credits Framework	Establish professional recognition system for technology implementation and improvement.	**Low**

5.3.14. Innovative Learning

Building the physical and digital infrastructure to support future skills development. This could be fostered under the e-health innovation ecosystem (Priority 5.6).

Initiative	Description	Impact
24/7 Virtual Simulation Centres	Create always-available virtual environments for practicing with emerging technologies	**High**
Adaptive Learning Platforms	Implement systems that continuously adjust to individual learning needs and pace	**Medium**
Healthcare Social Learning Networks	Develop peer-to-peer platforms for sharing experiences with new technologies	**Medium**
Gamified Skill Development	Create competitive and collaborative learning experiences with game mechanics	**Low**
Learning Health Systems	Implement clinical systems that provide feedback and learning opportunities	**High**

Key Indicators Examples

Tracking the effectiveness of adaptive learning approaches.

Category	Metrics	Target 2030	Target 2040
Workforce Readiness	• % of workforce proficient in emerging health technologies • Implementation rates of new technologies • Innovation contribution metrics	40% of workforce 40% implementation 25% of staff contributing	90% of workforce 90% implementation 60% of staff contributing
Learning Infrastructure	• Utilization rates of learning platforms • Accessibility metrics • User satisfaction scores • Cross-disciplinary engagement	60% regular utilization 75% accessibility 75/100 satisfaction 40% cross-disciplinary	90% regular utilization 95% accessibility 90/100 satisfaction 80% cross-disciplinary

5.3.15. Implementation Partners

Partner	Key Entities	Roles
Government	Ministry of Public Health Ministry of Education Ministry of Telecommunications Municipalities	Program development Policy framework Coordination Core funding
Healthcare Institutions	Teaching hospitals Primary care networks Specialty centres	Implementation sites Clinical integration Best practices User feedback
Academic Institutions	Ministry of Education Medical schools Nursing faculties Technology institutes	Content development Research Evaluation
Technology Sector	Health IT companies Telecommunications providers International bodies	Technology provision Infrastructure Innovation expertise
Professional Associations	Syndicate of hospitals Order of Nurses Allied health organizations	Professional standards Member engagement Certification
International Partners	UNICEF, WHO, WB, EU Academic medical centres Global health technology leaders	Fundings Technical assistance Best practices Quality assurance

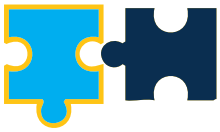
5.3.16. Priority summary

Lebanon's approach to workforce development must expand beyond immediate needs to prepare for a rapidly evolving future. By investing in a multi-generational strategy that builds digital capacity from early education through professional practice, Lebanon can create a healthcare workforce ready not only to adapt to technological change but to lead it.

The healthcare professionals of 2040 will practice in environments transformed by artificial intelligence, robotics, genomics, and technologies not yet imagined. They will need to seamlessly integrate human compassion with technological capability, ensuring that advances in technology translate to improvements in patient care and outcomes.

By starting now to build this future workforce, Lebanon positions itself at the forefront of healthcare innovation in the region. The future-focused approach outlined in this strategy recognizes that the most important healthcare technology is the human professionals who will harness its potential for the benefit of all Lebanese citizens.

This strategy acknowledges that the pace of technological change will only accelerate, and that workforce development must become more anticipatory and adaptive. By building systems for continuous evolution of skills and competencies, Lebanon can ensure its healthcare workforce remains prepared for whatever technological futures emerge, creating a resilient, innovative, and human-centred healthcare system prepared for 2040 and beyond.



5.4. Standards and Interoperability

5.4.1. Rationale

Lebanon's digital health landscape is characterized by fragmentation, with multiple disconnected systems operating in silos across public and private healthcare settings. This fragmentation creates critical challenges limit the extent to which the NHS will achieve its goals.

The weak use of international standards can create a complex digital ecosystem that can undermines quality care services, waste valuable resources, prevent the effective use of health data for individuals or population health improvement and benchmarking internationally.

DATASETS

Different healthcare facilities use varied data formats, terminologies, and structures, making information exchange virtually impossible between systems.

LIFE-SAVING CARE COORDINATION

Without the ability to access complete patient information across settings, clinicians make decisions based on incomplete data, potentially leading to medical errors, duplicative testing, and missed treatment opportunities.

DATA GROWTH

The volume of health data is growing exponentially through EHRs, diagnostic imaging, genomics, and consumer health devices, yet remains trapped in disconnected silos.

RESOURCE UTILIZATION

Fragmented systems lead to duplicate development efforts, wasted resources, and higher long-term costs for maintenance and integration.

5.4.2. Importance of Interoperability

Interoperability in the ability of different information systems to connect, exchange data, and use the information that has been exchanged. This is the foundation of a coherent digital health ecosystem. Its importance is illustrated through critical use cases:

EMERGENCY CARE

When a patient arrives unconscious at an emergency department, clinicians can immediately access their complete medical history, including allergies, medications, and chronic conditions from other facilities, potentially saving lives.

CHRONIC DISEASE MANAGEMENT

For patients with diabetes, blood pressure readings, medication changes, and lab results from primary care, specialists, and hospitals can be consolidated into a single view, enabling better care coordination.

ENABLING CONTINUITY OF CARE

Moving from the private sector to the public sector or vice versa, interoperability facilitates the exchange of patient records making them accessible by the healthcare professionals anywhere they are needed. This is also valuable when patients are referred to different specialty care centres.

PUBLIC HEALTH SURVEILLANCE

During disease outbreaks, automated reporting from all healthcare facilities enables real-time monitoring and faster response, as demonstrated by the COVID-19 pandemic.

CLINICAL DECISION SUPPORT

When systems can exchange standardized information, advanced analytics and AI tools can provide evidence-based recommendations to healthcare providers at the point of care.

SUPPLIES CHAIN

With distributed systems management of medication and supplies can be critical in order not to waste materials that may have expiry dates, communication across systems can help eliminate that.

Standards-based messaging enables systems to exchange information using agreed-upon formats and terminologies. This ensures that data retains its meaning and context across different settings. This approach has successfully implemented in countries worldwide to create a unified health information ecosystem while allowing individual facilities to maintain their preferred internal systems while reducing the burden on the health professionals and patients.

5.4.3. National Longitudinal Health Record

Universal Health Coverage this particularly facilitated when information is accessible. Similarly, continuity of care requires a highly integrated ecosystem. Allowing patients to participate in their own care also requires them to have access to their health information that may have been captured in multiple facilities and settings. A key objective of the national digital transformation strategy is to establish a comprehensive national longitudinal health record for every Lebanese citizen and resident through a standards-based interoperable digital health ecosystem will transform how the future of healthcare is provided in Lebanon.

Longitudinal records:

- Compile health information from all care settings throughout an individual's lifetime
- Make relevant information available to authorized providers at the point of care
- Enable patients to access and contribute to their own health information
- Support population health analytics while protecting individual privacy
- Support population health planning and crisis management.

Benefits to Patients Include

IMPROVED CARE QUALITY

When healthcare providers have access to complete, accurate patient information from all care settings, they can make better-informed diagnoses and treatment decisions. For example, a specialist seeing a patient for the first time can review their entire medical history, including primary care visits, hospitalizations, and previous treatments, leading to more precise and effective care plans.

ENHANCED SAFETY

Medication errors and adverse events are significantly reduced when providers can access comprehensive medication histories. A study in the United States found that electronic medication reconciliation through interoperable systems reduced adverse drug events by 30%. In emergency situations, knowing a patient's allergies, current medications, and underlying conditions can prevent potentially fatal errors.

CARE CONTINUITY

Patients experience seamless transitions between providers, from primary care to specialists, from outpatient to inpatient settings, and back to community care, with no information loss at each transition point. This is particularly valuable for vulnerable populations such as the elderly, those with chronic conditions, and pregnant women who often see multiple providers.

REDUCED BURDEN

Patients no longer need to repeatedly provide the same information to different healthcare providers, fill out multiple forms with identical information, or remember complex medical histories. This reduces frustration, saves time, and ensures more accurate information sharing, especially for those with complex health conditions or limited health literacy.

PATIENT EMPOWERMENT

Access to personal health information enables patients to become active participants in their care decisions. When patients can view their own health records, test results, and care plans, they can better understand their health conditions, monitor their progress, and engage in informed discussions with their healthcare providers about treatment options.

TIME AND COST SAVINGS

Elimination of duplicate tests and procedures saves patients time, money, and discomfort. When previous test results are available to all providers, unnecessary repetition of laboratory tests, imaging studies, and other diagnostic procedures can be avoided. For patients paying out-of-pocket expenses, this translates to direct financial savings.

EQUITABLE ACCESS

Rural and underserved populations gain the same benefits of information continuity as those in urban centres. Interoperability helps bridge geographic barriers by ensuring that a patient's health information is available wherever they seek care, reducing disparities in healthcare quality and outcomes. For Lebanon's diverse population, including refugee communities with often fragmented care, interoperable systems can help ensure appropriate care regardless of location.

PREVENTIVE CARE OPPORTUNITIES

With comprehensive health records, providers can identify gaps in preventive care such as missed vaccinations, overdue cancer screenings, or needed health assessments. This proactive approach shifts the focus from treating illness to maintaining health, potentially preventing serious conditions before they develop.

EMERGENCY PREPAREDNESS

In crisis situations, particularly relevant given Lebanon's history of emergencies, interoperable health records ensure that vital information remains accessible. Patients can receive appropriate care even when displaced from their usual healthcare providers or when healthcare facilities are disrupted.

SUPPORT FOR CHRONIC DISEASE MANAGEMENT

For the growing number of Lebanese citizens managing cancer or chronic conditions like diabetes, hypertension, and heart disease, interoperable systems enable coordinated care across multiple providers. Patients benefit from consistent treatment approaches, medication management, and monitoring, leading to better disease control and fewer complications.

MENTAL HEALTH INTEGRATION

Interoperability supports the integration of mental and physical healthcare, historically separated in many health systems. When mental health information is included in the comprehensive health record (with appropriate privacy protections), providers can deliver more holistic care that addresses both physical and psychological needs.

These patient benefits extend beyond individual healthcare experiences to improve public health outcomes and healthcare system efficiency. By placing patients at the centre of information flow and enabling their active participation, interoperability directly supports the goals of Human-centred Care (Priority 5.2) while creating the foundation for a more effective healthcare system.

5.4.4. Standards Framework

Standards and interoperability form the essential foundation for Lebanon's digital health transformation, enabling the secure exchange of health information across the care continuum to improve individual outcomes and population health. Without this foundation, digital health initiatives will remain isolated, duplicative, and unable to deliver their full potential value. By fostering data consistency, reusability, and system connectivity, standards and interoperability drive efficiency, improve clinical decision-making, and support scalable, integrated service delivery across diverse health settings.

The framework includes three interrelated levels that enable meaningful interoperability.

SEMANTIC STANDARDS

Semantic standards define what the data means and ensure that clinical concepts maintain consistent meaning across systems, addressing the fundamental challenge of healthcare communication: ensuring that medical terminology is interpreted identically by all participants in the health information exchange. Standards include:

SNOMED CT (Systematized Nomenclature of Medicine -- Clinical Terms) is a comprehensive, multilingual clinical healthcare terminology that provides a standardized way to represent clinical phrases captured by clinicians. For example, rather than having one system record “Type 2 diabetes” and another record “adult-onset diabetes” or “non-insulin dependent diabetes mellitus,” SNOMED CT assigns a unique concept identifier that represents this specific condition across all systems, regardless of how it might be displayed to users.

ICD-11 (International Classification of Diseases, 11th Revision) provides standardized codes for diagnoses, enabling consistent disease classification for epidemiology, health management, and clinical purposes. Unlike previous versions, ICD-11 is designed to work in digital environments and links to other terminologies like SNOMED CT. This classification system is essential for consistent public health reporting, reimbursement, and international health statistics.

LOINC (Logical Observation Identifiers Names and Codes) standardizes laboratory test and clinical observation identification. When a patient has a blood glucose test performed at different facilities, LOINC ensures that the results are comparable by specifying exactly what was measured, using what method, in what specimen. This precision enables accurate trending of lab values across care settings and time.

RxNorm/ATC (Anatomical Therapeutic Chemical Classification) provides standard identifiers for medications at various levels including ingredient, strength, and form. This standardization prevents dangerous misinterpretations of medication information between systems and enables accurate medication reconciliation across care settings.

DICOM (Digital Imaging and Communications in Medicine) standardizes the handling, storage, printing, and transmission of medical imaging information. This ensures that an X-ray or MRI taken at one facility can be correctly interpreted by systems at another facility, preserving critical diagnostic information.

Implementation of these semantic standards creates a “common language” for healthcare communication, ensuring that even when different facilities use different local terms, the underlying clinical meaning remains consistent in data exchange. Without semantic standards, misinterpretations can lead to medical errors, inappropriate treatments, and flawed analytics.

SYNTACTIC STANDARDS INCLUDE

Syntactic standards define the structure and format of data exchange between health information systems, specifying how information should be organized, sequenced, and packaged for transmission. These standards act as the “grammar” of healthcare data exchange.

HL7 / FHIR (Fast Healthcare Interoperability Resources) is a modern standard that represents clinical data as a collection of resources (patients, encounters, observations, etc.) using web technologies like JSON or XML. FHIR’s modular approach allows for flexible implementation while maintaining consistency, making it particularly well-suited for mobile applications and web-based exchanges. For example, a FHIR “Patient” resource has a consistent structure with defined elements for demographics, contact information, and key identifiers, ensuring all systems know exactly where to find specific data points.

HL7 v2 is a mature messaging standard that defines how clinical and administrative data should be packaged and sent between systems. While older than FHIR, HL7 v2 remains widely implemented in healthcare systems worldwide and provides a reliable mechanism for specific transactions like laboratory orders and results, admission/discharge/transfer notifications, and billing information.

OpenEHR is an open standard specification that defines a comprehensive information model for electronic health records. Unlike transaction-focused standards, OpenEHR provides a framework for representing the entire patient record with a two-level modelling approach: a stable reference model and flexible archetypes that can be adapted to different clinical domains. This approach enables standards compliance while accommodating the diverse and evolving nature of clinical documentation. It can also enable more comprehensive information exchange without the loss of meaningful content.

CDA (Clinical Document Architecture) specifies the structure and semantics of clinical documents for exchange, ensuring that documents like discharge summaries, progress notes, and consultation reports maintain their integrity and meaning when shared between systems. CDA documents can vary in complexity from simple human-readable text to highly structured and machine-processable content that retains its clinical context.

These syntactic standards create consistent data structures that enable systems to correctly parse, and process received information. The analogy to international shipping containers is apt: just as standardized containers revolutionized global trade by creating a uniform way to handle diverse cargo, syntactic standards allow health data to move seamlessly between systems regardless of their internal architectures.

TECHNICAL STANDARDS INCLUDE

Lastly, technical standards establish the infrastructure and protocols for secure, reliable communication between systems, addressing the mechanics of how data moves from one system to another.

REST/SOAP APIs (Application Programming Interfaces) define the methods by which systems request and receive information from each other. RESTful APIs, which have become prevalent in modern health data exchange, use simple HTTP methods to interact with data resources, while SOAP provides a more structured protocol with formal contracts between systems. These APIs create standardized “doors” through which systems can access each other’s capabilities and data.

OAuth 2.0/OpenID Connect are security frameworks that enable secure authorization and authentication without sharing passwords. When a patient uses a health portal that needs to access data from another system, OAuth allows them to grant permission without revealing their credentials to the portal. This standards-based approach ensures consistent security practices across the healthcare ecosystem.

TLS/HTTPS (Transport Layer Security/Hypertext Transfer Protocol Secure) provides encrypted communication channels to protect health data during transmission. This prevents unauthorized access to sensitive information as it moves between systems, a critical requirement for maintaining patient privacy and complying with data protection regulations.

IHE Profiles (Integrating the Healthcare Enterprise) are implementation frameworks that define how to use existing standards together to accomplish specific clinical tasks. Rather than creating new standards, IHE defines detailed implementation guides for scenarios like sharing patient records, ordering medications, or coordinating radiology workflows. These profiles reduce ambiguity and variation in how standards are applied, increasing the likelihood of successful interoperability.

SMART on FHIR combines the FHIR data standard with OAuth security to create a framework for health apps that can be securely launched from within electronic health records. This enables a marketplace of compatible applications that can be added to existing systems without custom integration work.

The implementation of these technical standards creates a secure, reliable infrastructure for health information exchange, ensuring that systems can establish connections, authenticate users, protect data in transit, and manage the technical aspects of communication. Like the rules of air traffic control, these standards ensure that diverse systems can interact safely and efficiently despite their different origins and designs.

By guiding the implementation of these standards in national digital health policies, this three-tiered standards approach can enable MoPH to establish a digital health ecosystem where systems can connect securely (technical), exchange information in consistent formats (syntactic), and preserve the precise clinical meaning of that information (semantic). This layered approach addresses the significant interoperability challenges and creates the foundation for a truly connected health system.

Additionally, by implementing standards, public and private sectors in Lebanon can reduce implementation costs by a factor of three to five compared to custom integration approaches. Systems that conform to these standards can be connected more quickly, with less custom development, and maintained more efficiently over time.

5.4.5. State of Standards Adoption in Lebanon

There is partial use of ICD-10 for disease classification in some public health reporting, but no nationwide implementation of SNOMED CT or LOINC. Various healthcare facilities use different terminologies and coding systems and versions, creating semantic inconsistencies when information needs to be exchanged. The MoPH has begun some work on standardized terminology in specific disease surveillance programs, but comprehensive semantic standardization remains a significant gap.

A few advanced healthcare institutions, primarily in the private sector, have implemented limited HL7 / FHIR messaging for internal system integration, but there is no widespread adoption for exchange across institutions. The PHENICS platform used in primary healthcare centres has its own data structures that need to be aligned with international standards. Document exchange between facilities typically occurs via unstructured formats.

Basic security protocols like TLS/HTTPS are used for web applications, but comprehensive API standards for health data exchange are largely absent. There are weaknesses authentication and

authorization across health systems, resulting in isolated security implementations. The existing Unique Health ID (UHID) system provides a foundation for patient identification but requires a technical infrastructure if it is to be used for secure cross-system authentication. The national digital strategy provides a framework for addressing this.

This current state of limited standards adoption reinforces the fragmentation described in section 5.4.1 and highlights the importance of a coordinated national approach to standards implementation. Moving toward the comprehensive standards framework described above will require significant investment in technical infrastructure, professional capacity building (Priority 5.3), and governance mechanisms (Priority 5.1), but will yield substantial benefits in terms of improved care coordination, data quality, and system efficiency.

This standards framework will be closely aligned with the e-Health Governance and IT Leadership (Priority 5.1), which will establish the governance mechanisms for standards adoption, and the Policies & Regulations (Priority 5.5), which will provide the regulatory framework for implementation.

HEALTH INFORMATION EXCHANGE

A Health Information Exchange (HIE) provides the technical infrastructure for secure information sharing among healthcare organizations. An HIE framework is a core component of the proposed national health information systems platform. HIEs are internationally recognized and have been successfully deployed in multiple countries.

Key characteristics to consider for Lebanon:

- Modular Architecture: The possibility to implemented components incrementally based on priority needs.
- Standards-Based: Built on established global standards for maximum interoperability.
- Open-Source Options: Reduces dependency on proprietary solutions and lowers costs.
- Global Community: Access to implementation best practices and shared resources.

Key components of the HIE will include:

- Client Registry: Links patient identities across systems using the existing Unique Health ID (UHID).
- Shared Health Record: Aggregates and maintains longitudinal patient records.
- Terminology Service: Manages standard code sets and translations.
- Facility Registry: Maintains an authoritative list of healthcare facilities.
- Provider Registry: Manages healthcare provider information and authentication.
- Interoperability Layer: Facilitates communication between different systems.

By leveraging an HIE framework, Lebanon can significantly reduce implementation costs and timeframes. Experience from other countries shows that standards-based approaches can reduce effort by a factor of four compared to custom integration projects, while providing greater flexibility for future expansion.

This HIE approach should be implemented in coordination with the e-Health Innovation Ecosystem (Priority 5.6), leveraging innovative solutions and public-private partnerships to accelerate development and adoption.

5.4.6. Challenges

Despite the clear benefits of standards-based interoperability, significant challenges must be considered:

- Even with standardization, information may be incomplete, inaccurate, or inconsistent data across sources. This requires robust data governance, validation mechanisms, and provider training to ensure that information exchange adds value rather than propagating errors.
- Many healthcare facilities in Lebanon operate older systems that were not designed for standards-based interoperability, requiring additional middleware or system upgrades.
- Standards themselves can be complex to implement correctly, requiring specialized expertise that may be limited in the current health IT workforce. The e-health innovation ecosystem and vitals knowledge base could serve as central point to facilitate adoption.
- Healthcare providers may resist changes to workflows, especially if interoperability implementations create additional documentation burden or disrupt established practices. National need to move towards a national health information stems platform needs to be strengthened with related Policies (Priority 5.5).
- Initial implementation of standards and interoperability frameworks requires significant investment at a time when Lebanon faces economic challenges. Open and commercial solutions need to be explored through the e-health governance council with experts and partners (Priority 5.1).

Coordinating standards adoption across diverse stakeholders (public facilities, private providers, vendors) requires robust governance mechanisms and core components such as the adoption of a national the unique ID that can be used across systems for identifying individuals. These challenges highlight the importance of coordination with the Workforce Development (Priority 5.3) to build necessary technical capacity, and the Human-Centred Care (Priority 5.2) to ensure that implementations enhance rather than detract from the care experience.

5.4.7. Standardization Efforts

To address these challenges, the e-health governance council needs to establish an inclusive and collaborative approach to standardization activating a technical workgroup and the e-health innovation ecosystem.

Initiatives include:

- Creating a dedicated Standards Technical Working Group under the e-Health Governance Council (Priority 5.1) responsible for standards selection, profile development, and evolution over time.
- Agreeing on the specific standards, implementation guides, and profiles to be adopted nationally, with clear versioning and conformance criteria.
- Prioritising standards for initial implementation based on clinical impact and feasibility, with a

clear roadmap for expanding the standards portfolio.
- Implementing a testing tools and certification processes to verify that systems properly implement required standards before they are connected to the national HIE.
- Leveraging the e-health innovation ecosystem and proposed e-vitals knowledgebase (e-health library) implementation guides, data models, and reusable assets to facilitate adoption.
- Engage partners to ensure Lebanon's standards approach aligns with global best practices while addressing local needs, participating in international standards development where appropriate.
- Creating clear timeline and incentives for local health IT vendors and institutions with procured solutions to implement required standards in their facilities.

These standardization efforts should be coordinated through the governance structures established in the e-Health Governance and IT Leadership (Priority 5.1), supported by the regulatory framework developed under the Policies & Regulations (Priority 5.5) and the e-health innovations ecosystem.

5.4.8. Integration Strategies

Achieving interoperability also requires practical integration strategies that recognize the diversity of Lebanon's health IT landscape:

- Prioritize modern, API-based integration using HL7 FHIR to enable flexible, secure, and scalable information exchange.
- Begin with high value use cases (medication history, laboratory results, basic clinical summaries) before expanding to more complex information exchange.
- Combine centralized components (patient registry, terminology services) with distributed data exchange to balance security, performance, and privacy concerns.
- Deploy integration engines (middleware) and adapters to connect legacy systems that cannot directly implement modern standards.
- Ensure that integration approaches support mobile healthcare delivery, particularly important in remote or underserved areas where communication bandwidth may not be available.
- Design interoperability solutions to maintain basic functionality even with limited connectivity or during infrastructure disruptions.
- Coordinate with OMSAR for hosting integration services where appropriate, balancing cost, performance, and data sovereignty requirements.

These integration strategies can be implemented in partnership with the e-Health Innovation Ecosystem (Priority 5.6) to leverage emerging technologies and innovative approaches.

5.4.9. Recommended Initiatives

Initiative	Description	Expected Value	Key Stakeholders
National Standards Profile	Define and publish Lebanon's health data standards framework	Legal clarity enhanced trust streamlined operations	MoPH IT Department Professional organizations Health IT vendors Academic institutions
Terminology Services	Implement national terminology servers for SNOMED CT, ICD-11, LOINC and other code systems	Consistent clinical documentation improved analytics	MoPH Standards Working Group Health IT vendors Clinical specialists
		Improved data quality for analytics and research	MoPH Standards Working Group Health IT vendors Clinical specialists
Health Identity Management	Implement identity management system to identify and control access to sensitive health information	Data security patient privacy protection	MoPH OMSAR Healthcare facilities Health IT vendors
		Reduced unauthorized access risks	MoPH OMSAR Healthcare facilities
Client Registry Enhancement	Expand the UHID system to support comprehensive patient matching across systems	Coherent patient histories across facilities	MoPH OMSAR Public and private healthcare facilities
		Comprehensive patient matching	MoPH Public and private healthcare facilities
Provider Directory	Develop or update an authoritative registry of healthcare providers with credentialing information	Streamlined provider verification	MoPH Professional Syndicates Healthcare facilities Health IT vendors
		Reliable provider lookups for systems	MoPH Health IT vendors
HIE Core Infrastructure	Implement core Health Information Exchange components	Seamless health information sharing	MoPH OMSAR Private sector partners international partners
		Increased clinical data availability	MoPH OMSAR Private sector partners

Initiative	Description	Expected Value	Key Stakeholders
Interoperability Standards Enforcement	Mandate compliance with national interoperability standards (e.g., HL7/FHIR, unique health IDs)	Enhanced care coordination reduced duplicative testing	e-Health governance council Payers Healthcare providers
Standards Certification Program	Develop testing and certification processes for standards compliance	Assured quality of health IT implementations	MoPH Standards Working Group Health IT vendors Healthcare facilities
		Comprehensive interoperability ecosystem	MoPH Standards Working Group Health IT vendors
National FHIR Implementation Guides	Develop Lebanon-specific FHIR profiles and implementation guides	Standardized context-appropriate implementations	MoPH Standards Working Group Health IT vendors Clinical specialists
National OpenEHR CDR Implementation	Implement OpenEHR based Clinical Data Repository for longitudinal records	Longitudinal patient data access	MoPH Standards Working Group Health IT vendors
Legacy System Integration	Develop adapters and interfaces for existing systems	Preservation of existing investments	Healthcare facilities Health IT vendors MoPH IT Department
		High-quality data from legacy systems	Healthcare facilities Health IT vendors
Advanced Interoperability Services	Implement clinical decision support, analytics, and population health services leveraging standardized data	Improved clinical decisions population health insights	MoPH Academic research partners Healthcare facilities Health IT vendors
		Widespread use of clinical decision support	Healthcare facilities Health IT vendors
		Better patient outcomes	MoPH Academic research partners Healthcare facilities
Digital Health Innovation Sandbox	Regulatory sandbox frameworks to pilot digital innovations safely before full deployment	Accelerated innovation reduced barriers to entry	MoPH Ministry of Justice Private sector innovators

Key Indicators Examples

Initiative	Objectives	Suggested KPIs
National Standards Profile	Establish standardized national health data exchange foundations	% of priority standards defined with implementation guides
Terminology Services	Create unified medical language across systems	# of terminology servers operational
	Ensure consistent medical terminology usage across facilities	% of standard code systems available
Health Identity Management	Secure and control access to health information	System implementation status
	Establish proper user authentication and authorization	% of users with proper identity credentials
Client Registry Enhancement	Enable reliable patient identification	# of patients with validated unique identifiers
	Achieve widespread adoption of UHID system	% of healthcare facilities using the registry
Provider Directory	Create single source of truth for provider information	% of licensed providers accurately represented
	Ensure high availability of provider information	Directory uptime and query response performance
HIE Core Infrastructure	Establish foundational data exchange capabilities	% of facilities connected to HIE
	Enable high-volume health data exchange	# of transactions processed
Interoperability Standards Enforcement	Ensure system-wide standards adoption	% of facilities adhering to interoperability standards
Standards Certification Program	Verify systems meet interoperability requirements	# of certified systems
	Achieve broad market adoption of certified systems	% of market covered by certified systems
National FHIR Implementation Guides	Localize international standards for Lebanese context	# of implementation guides published
National OpenEHR CDR Implementation	Create comprehensive patient record repository	# of records in OpenEHR CDR

Legacy System Integration	Integrate existing systems with new standards	% of legacy systems with standards-based interfaces
	Ensure data completeness in integration	Data completeness across interfaces
Advanced Interoperability Services	Leverage standardized data for advanced use cases	# of advanced services deployed
	Drive adoption of advanced services	Clinical utilization rates
	Improve care outcomes through data-driven services	Measurable impact on care quality
Digital Health Innovation Sandbox	Test interoperability innovations in controlled environment	Number of successful sandbox pilot projects

5.4.10. Priority Summary

The implementation of international standards, customized to Lebanon's specific context, will:

- Create a longitudinal health record accessible across care settings
- Improve care quality and patient safety through better information
- Reduce waste and inefficiency through elimination of duplicate tests and procedures
- Enable advanced analytics for population health management and research
- Support innovation by providing a stable foundation for new applications and services

While implementing standards and interoperability presents significant challenges, particularly in the current economic context, the long-term benefits far outweigh the initial investment. Countries that have prioritized interoperability have demonstrated substantial returns through improved care coordination, reduced waste, and enhanced population health management capabilities.

Furthermore, delaying investment in standards and interoperability will ultimately increase costs, as more isolated systems are developed and later require complex integration. A proactive, strategic approach now will set Lebanon on a sustainable path toward a truly connected health system.

By prioritizing standards and interoperability, Lebanon will build a digital health ecosystem that is greater than the sum of its parts, one that truly serves the needs of patients, providers, and the healthcare system.

5.5. Policies & Regulations

5.5.1. Rationale

In any government-led digital transformation, a robust legal and regulatory framework is a cornerstone for success, providing the essential foundation for effective policies, governance mechanisms, accountability structures, and decision-making processes. In the field of digital health, this becomes even more critical as systems deal with sensitive personal health data, patient rights, clinical safety, cross-border data flows, and rapidly evolving technologies such as AI, telemedicine, and wearable devices.

Global experience underscores that in the absence of clear regulations, digital health systems risk deepening existing inequities, undermining public trust, and compromising data privacy and system security. Conversely, countries with proactive and adaptive regulatory environments, such as Estonia, Singapore, and Denmark, have succeeded in building inclusive and interoperable digital health ecosystems that foster innovation, ensure equity, and enable citizens to confidently engage with health services.

This transformation priority focuses on defining and updating laws and policies to responsibly support digital health for Lebanon while ensuring equity, security, and innovation. This Priority identifies critical gaps within Lebanon's digital health policy framework and governance structures. These gaps must be addressed to enable the successful integration of digital health into the national healthcare system and to build a resilient, future-ready digital health ecosystem. Below is a summary of the key gaps and areas to prioritize for the national digital health strategy.

5.5.2. Current Policy and Regulatory Landscape

In Lebanon, laws and regulations are adopted by the legislative branch (Parliament), while the executive branch (Council of Ministers and line ministries) enacts decrees, ministerial decisions, and circulars to operationalize and enforce these laws. The broader digital transformation in Lebanon is governed by a patchwork of legal instruments, some general, others sector-specific, most of which remain nascent, fragmented, or outdated, particularly when applied to the digital health domain.

To date, very few digital health, specific laws or decrees have been formally adopted, and those that do exist tend to be narrow in scope, primarily focused on public health data collection and specific digital initiatives within the MoPH. Examples include ministerial decisions related to the use of electronic health information systems in public primary healthcare centres, and pilot initiatives in telehealth. These foundational efforts, while important, do not constitute a comprehensive regulatory framework and often lack enforceability, scalability, or intersectoral alignment.

Lebanon's digital health policy environment is still in its formative stage, characterized by institutional fragmentation, limited cross-sector coordination, and weak regulatory oversight. Existing frameworks do not yet address the full spectrum of issues introduced by digital transformation, including interoperability, data protection, AI governance, patient rights, and emergency preparedness.

The table below highlights the most pressing policy and regulatory gaps that must be addressed to enable a secure, inclusive, and future-ready digital health ecosystem in Lebanon.

Thematic Area	Gaps and Challenges
Narrow and Outdated Policy Frameworks	Narrow, health-focused policy frameworks lacking cross-sector alignment; outdated provisions and terminology hinder responsiveness to emerging technologies.
Ambiguity in Regulatory Roles and Oversight	Roles and responsibilities among stakeholders are unclear, leading to overlaps, weak accountability, and absence of independent oversight for digital health governance.
Lack of Comprehensive Legal Framework for Digital Health	Lebanon lacks an overarching legal framework that governs digital health, including provisions for liability, ethics, AI regulation, and emerging technologies.
Insufficient Data Protection and Privacy Regulations	Existing laws do not adequately safeguard personal health data or define patient rights, particularly in the context of electronic health records (EHRs) and telehealth.
Absence of Standards for Interoperability and Data Exchange	There is no enforceable national policy mandating data standards, coding systems, or interoperability requirements across digital health systems.
Lack of Legal Mandates for Policy Enforcement	Policies and decisions often lack binding legal authority, making implementation and compliance across public and private health actors inconsistent and unenforceable.
Limited Regulatory Support for Public-Private Innovation	There are no formalized regulatory pathways or partnership frameworks to guide private sector involvement or innovation pilots in digital health.
No Legal Provisions for Digital Health Emergency Response	Current legal and policy frameworks do not include contingency measures or regulatory guidance for the use of digital health tools in emergency or crisis situations.

5.5.3. Strategic Objectives for Policy & Regulation

As digital health technologies evolve rapidly, Lebanon must adopt a comprehensive, future-oriented policy and regulatory framework that both enables innovation and safeguards the public interest. The goal is not only to legislate for today's technologies but to establish a legal foundation that can adapt to emerging tools such as AI, telehealth, and health data platforms, while also protecting citizen rights, patient safety, and data privacy.

This transformation priority aims to support Lebanon's national digital health strategy by establishing clear legal mandates that:

- Define digital health-specific rights and responsibilities.
- Harmonize regulatory approaches across sectors.
- Align with international standards such as the GDPR and WHO digital health frameworks.
- Enable secure, interoperable, and patient-centred data exchange systems.

The policy framework must extend beyond the health sector to include justice, telecommunications, education, and finance, ensuring legal coherence across Lebanon's digital transformation. Additionally, legal provisions should enable innovation through regulatory sandboxes and formal public-private partnership mechanisms.

In alignment with the National Health Strategy 2020–2030 and the OMSAR-led Digital Transformation Strategy, these objectives support the creation of a trustworthy and future-ready digital health ecosystem rooted in equity, resilience, and responsiveness.

5.5.4. Key Focus Areas & Actions

To effectively address Lebanon's existing regulatory and policy gaps and foster a sustainable and inclusive digital health transformation, targeted strategic actions across several key policy areas are required. Drawing upon global best practices, national policy reviews, and the identified local gaps, the following comprehensive actions form a robust roadmap toward a coherent and future-ready regulatory framework.

Develop a Comprehensive Digital Health Legislation Framework

- Draft and enact overarching legislation explicitly tailored to digital health, covering areas such as patient rights, data governance, cybersecurity standards, telehealth services, AI-driven healthcare solutions, and professional liability.
- Align national laws with international guidelines (e.g., WHO Digital Health Strategy, GDPR, OECD principles) to ensure global compatibility and trust.

Enhance Data Protection, Privacy, and Patient Rights

- Operationalize Law No. 81/2018 (law on "Electronic Transactions and Personal Data Protection) by introducing specialized decrees for healthcare, including strict privacy standards for electronic health records (EHRs) and mobile health applications.
- Establish clear patient rights frameworks addressing data ownership, informed consent, privacy safeguards, data portability, and legal recourse in case of breaches.
- Create or designate an independent regulatory authority responsible for healthcare data privacy and patient rights oversight.

Implement and Enforce Interoperability and Data Exchange Standards

- Issue binding regulations requiring compliance with national interoperability standards, including unique health identifiers, data coding frameworks (e.g., ICD-11, SNOMED-CT), and secure digital verification mechanisms.
- Mandate interoperability as a prerequisite for licensing digital health solutions across public and private healthcare providers to ensure seamless data flow and coordinated care.

Establish Robust Telehealth and Virtual Care Regulations

- Develop a detailed regulatory framework for telemedicine, covering provider licensing, technology certification standards, ethical practices, cross-border service provision, liability, reimbursement models, and patient safety protocols.
- Embed telehealth services within national insurance and reimbursement policies, facilitating equitable access to virtual healthcare.

Strengthen Legal Frameworks for Emerging Health Technologies

- Introduce adaptable regulatory mechanisms (such as regulatory sandboxes) that enable safe testing, evaluation, and adoption of innovative digital health technologies like AI-driven diagnostics, clinical decision support systems, and mobile health solutions.
- Create clear ethical guidelines and transparent approval processes for the use and scaling of new digital health innovations, ensuring safety, efficacy, and equity.

Establish Mandatory Monitoring, Evaluation, and Compliance Mechanisms

- Integrate mandatory monitoring and evaluation (M&E) obligations into digital health policies, requiring clearly defined indicators, targets, and periodic reviews for policy effectiveness.
- Link continued funding, licensing, and operational approval of digital health initiatives to adherence to established M&E criteria, ensuring accountability and continuous improvement.

Foster Regulatory Frameworks for Public-Private Partnerships (PPPs)

- Develop and implement transparent, accountable PPP legislation specifically designed to foster sustainable private sector investment and innovation in digital health infrastructure, services, and research.
- Ensure that PPP frameworks clearly outline roles, responsibilities, funding models, intellectual property rights, and governance mechanisms to protect public interest and promote private-sector innovation.

Embed Digital Health into Emergency Preparedness and Response Regulations

- Legislate the mandatory integration of digital health tools (telehealth, digital triage, real-time disease surveillance) into national emergency and disaster preparedness plans.
- Develop clear legal mandates for leveraging digital health infrastructure to rapidly mobilize healthcare resources and coordinate response efforts during public health crises or emergencies.

5.5.5. Implementation Framework for Policies and Regulations

CHALLENGE MANAGEMENT

Given Lebanon's complex legal landscape and fragmented regulatory environment, successfully implementing digital health policies requires proactive challenge management. Clear and coherent communication with stakeholders—including policymakers, healthcare providers, the technology sector, and patients—is vital. Robust legal capacity-building and awareness programs must accompany the roll-out of new regulations, ensuring all stakeholders understand compliance expectations clearly from inception.

Efforts should also focus on change management within regulatory and implementing bodies (e.g., MoPH, Ministry of Justice, Parliament), addressing resistance through ongoing stakeholder consultations, targeted education, and phased implementation. Continuous feedback loops, built through periodic stakeholder dialogues, will be critical for adapting regulations flexibly to evolving technologies, challenges, and user needs, rather than waiting until systemic policy failures occur.

Oversight and implementation should be centrally coordinated through the governance mechanisms detailed in e-Health Governance and IT Leadership (Priority 5.1), particularly via the e-Health Governance Council, to ensure cross-priority alignment and coherence.

RECOMMENDED APPROACH

- **Phased Legislative Roll-out:** Prioritize adoption of foundational laws followed by targeted regulatory decrees addressing specific domains like telehealth and data protection.
- **Intersectoral Regulatory Coordination:** Facilitate joint committees involving health, telecommunications, finance, justice, and education sectors to achieve legal coherence and effective implementation.
- **Capacity Building for Regulatory Compliance:** Integrate legal literacy and compliance training within workforce development programs in coordination with Workforce Development (Priority 5.3).
- **Evidence-Based Monitoring:** Implement transparent, measurable KPIs to monitor regulatory effectiveness, stakeholder adherence, and inform periodic policy adjustments.

5.5.6. Key Priority Initiatives and Practices

Initiative	Description	Expected Value	Key Stakeholders
Comprehensive Digital Health Law	Develop overarching legislation governing digital health, data privacy, interoperability, and liability	Legal clarity, enhanced trust, streamlined enforcement	Parliament, MoPH OMSAR Ministry of Justice
		Streamlined enforcement, operational clarity	MoPH, Council of Ministers Ministry of Justice
Health Data Privacy Framework	Operationalize Law No. 81/2018 with decrees tailored for digital health and patient data protection	Data security, patient rights, increased public trust	MoPH, Ministry of Justice OMSAR
Telehealth Regulatory Framework	Establish standards for telemedicine licensing, reimbursement, technology, liability, and ethics	Increased access, clarity for providers, patient safety	MoPH, healthcare providers Telecom authorities Order of Physicians
		Increased accessibility to healthcare services	MoPH, healthcare providers Telecom authorities
Interoperability Standards Enforcement	Mandate compliance with national interoperability standards (e.g., HL7/FHIR, unique health IDs)	Coherent patient histories, consistent analytics	e-Health governance council Payers MoPH

Initiative	Description	Expected Value	Key Stakeholders
Digital Health Innovation Sandbox	Regulatory sandbox frameworks to pilot digital innovations safely before full deployment	Accelerated innovation, reduced barriers to entry	MoPH, Ministry of Justice Private sector innovators OMSAR
Public-Private Partnership (PPP) Regulation	Frameworks for clear, accountable public-private collaborations in digital health projects	Sustainable innovation funding, improved accountability	MoPH, Ministry of Finance Private sector OMSAR
Emergency Response Regulatory Integration	Legal mandates integrating digital tools into national emergency preparedness strategies	Enhanced crisis response capability, resilience	MoPH, Disaster Management Authorities Disaster Risk Management Unit (PCM) Relief Coordination Unit

Key Indicators Examples

Initiative	Objectives	Suggested KPIs
Comprehensive Digital Health Law	Provide a legal foundation for digital health, covering data, liability, and governance	Number of digital health provisions enacted
	Translate the law into actionable mandates via decrees, circulars, and bylaws	Number of operational decrees issued
Health Data Privacy Framework	Implement health-specific data protection provisions	% of healthcare providers compliant with privacy regulations
Telehealth Regulatory Framework	Define specific licensing, reimbursement, and ethical standards for telemedicine	Number of licensed telehealth providers
	Expand telehealth coverage across the healthcare system	Teleconsultation rates
Interoperability Standards Enforcement	Mandate compliance with national data exchange protocols and unique identifiers	% of facilities adhering to interoperability standards
Digital Health Innovation Sandbox	Pilot and test digital solutions under temporary regulatory relaxations	Number of successful sandbox pilot projects
Public-Private Partnership (PPP) Regulation	Enable structured, transparent collaboration models between MoPH and private sector	Number and financial value of active PPPs in digital health
Emergency Response Regulatory Integration	Include digital tools in emergency protocols for real-time response and coordination	% of emergency response plans incorporating digital health provisions

5.5.7. Priority Summary

By systematically addressing policy and regulatory gaps through robust legislation, clear standards, and strategic stakeholder alignment, Lebanon can build an adaptive regulatory environment. This structured implementation approach, closely coordinated with interconnected transformation priorities—such as governance (5.1), workforce development (5.3), interoperability (5.4), and innovation (5.6)—will ensure Lebanon's digital health transformation is comprehensive, resilient, and sustainable, firmly anchored in international best practices and responsive to national needs.

5.6. e-Health Innovation Ecosystem

5.6.1. Rationale and Current State

Lebanon's health innovation landscape shows significant potential despite challenging economic conditions. The idea of a digital health innovation hub has been discussed and shared by his excellency former health minister Dr. Abiad and is mentioned in multiple reports published by the MoPH and the National Digital Transformation Strategy. This priority aims to strengthen the idea and provide frames to support its formation. The hub would be a collaborative effort between the MoPH and other relevant stakeholders. To enable a thriving digital health innovation hub, Lebanon should prioritize the exchange of health system performance data, anonymized patient outcomes, digital solution effectiveness, regulatory updates, and innovation ecosystem insights among public institutions, private sector actors, academia, and development partners.

Lebanon has several key assets that can form the foundation of a vibrant e-health innovation ecosystem:

Existing Stakeholders and Community:

- A resilient private healthcare sector with entrepreneurial orientation.
- Several established innovation hubs and incubators (Beirut Digital District (Berytech), Smart ESA, AUB Innovation Park).
- Academic institutions with medical, engineering, and computer science programs.
- Well established local digital health solution provides.
- A growing startup community with some health-focused ventures.
- International NGOs and development partners with digital health expertise.
- Highly organized professional associations (Order of Physicians, Order of Pharmacists) with interest in digital transformation.

Human Knowledge and Capabilities:

- Highly educated local IT workforce in public and private sectors with demonstrated ability to develop homegrown solutions.
- A strong healthcare professional community with high a high level of clinical expertise.

- Knowledge and consensus of what needs to be done to strengthen Lebanon's health system.
- Multilingual capabilities enabling both regional and global collaborations.
- A growing diaspora network of Lebanese professionals with international digital health experience.

Despite these strengths, current challenges must also be acknowledged:

- Fragmented digital health initiatives without coordinated national direction.
- Limited collaboration between public health authorities, private sector, and academia.
- Resource constraints affecting sustainability of innovation efforts.
- Regulatory uncertainty hampering investment in digital health solutions.
- Brain-drain of technical talent due to economic and political conditions.
- Limited mechanisms for testing and scaling promising local innovations.

Building a digital health hub requires frames and structured mechanisms for collaboration, knowledge sharing, and acceleration of locally relevant digital health solutions.

5.6.2. Importance for Lebanon

A thriving e-health innovation ecosystem is particularly important for Lebanon for several compelling reasons:

Economic Development and Resilience:

- Creates high-value jobs in the knowledge economy.
- Develops exportable digital health solutions for regional markets.
- Reduces dependency on imported health technologies.
- Builds economic resilience and sustainability through diversification.

Healthcare System Transformation:

- Supports the NHS and goals such as universal health coverage through innovative delivery models.
- Develops solutions tailored to Lebanon's unique healthcare challenges.
- Accelerates adoption of digital tools by engaging local stakeholders.
- Creates pathways for testing and implementing new approaches.
- Bridges gaps between public and private healthcare sectors.
- Maximizes impact of limited healthcare resources through innovative approaches.
- Reduces redundant development efforts and costs through collaboration.
- Leverages local expertise to develop cost-effective solutions.
- Attracts additional investment from private sector and international partners.

Crisis Preparedness and Response:

- Leverages Lebanon's unique position to build agile digital solutions that can function during infrastructure disruptions.
- Builds agility for rapid deployment of digital tools during emergencies.
- Creates local platform for managing external support.
- Enhances system resilience through diversified approaches.
- Creates effective solutions for addressing vulnerable populations and share knowledge globally.

By fostering an e-health innovation ecosystem, Lebanon can transform current constraints into opportunities for creative problem-solving while building sustainable capacity for ongoing digital health evolution.

5.6.3. Objectives

The primary purpose of building an e-Health Innovation ecosystem is to establish a sustainable environment that catalyses, nurtures, and scales digital health innovations addressing Lebanon's healthcare challenges with the future in mind. Building such an ecosystem complements the broader digital health transformation strategy by creating an engine for accelerating improvement and adaptation, ensuring Lebanon's digital health remains dynamic and responsive to evolving needs. It is essential that this ecosystem be developed gradually, prioritizing alignment with local healthcare system needs, resource capacities, and contextual realities.

While laying the groundwork for future scalability, resilience, and innovation. A phased, locally relevant approach incentivises stakeholder ownership, ensures relevance, and increases the likelihood of long-term sustainability and impact. This ecosystem would need to:

Foster Collaboration

Create structured mechanisms for cooperation between healthcare stakeholders, technology developers, academia, investors, and policymakers.

Accelerate Innovation

Provide resources, expertise, and support mechanisms to speed the development of locally relevant digital health solutions.

Build Capacity

Develop knowledge, skills, and experience in digital health innovation among Lebanese professionals and organizations.

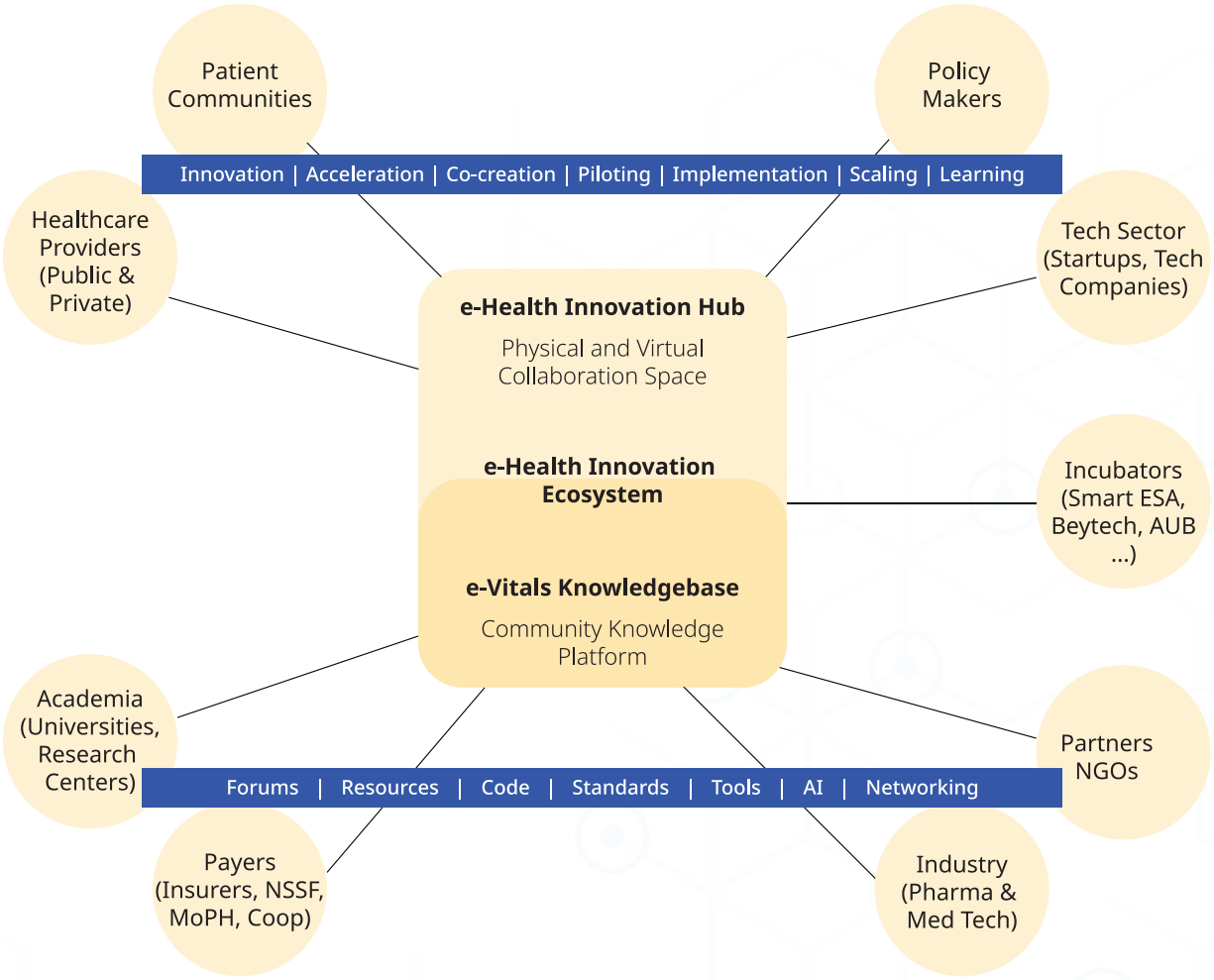
Drive Implementation

Create pathways for testing, validating, and implementing promising innovations in real healthcare settings.

Enable Sustainability

Establish business models and funding mechanisms that ensure long-term viability of valuable digital health solutions.

5.6.4. What Should the e-Health Innovation Ecosystem Have?



5.6.4.1. e-Health Innovation Hub

At the heart of an e-Health Innovation Ecosystem, a dedicated e-health Hub with a physical and virtual space can serve as the focal point for activities that stimulate, support, and scale digital health innovations. This hub would:

Facilitate Connections

- Build networks between healthcare professionals, patient organisations, health-tech, entrepreneurs, investors, and policymakers.
- Foster cross-sector partnerships between public and private healthcare stakeholders.
- Link Lebanese innovators with regional and global digital health communities.
- Bridge gaps between academic research and practical implementation.
- Connect complementary initiatives to maximize synergies and reduce duplication.

Drive Innovations (Inspire, Ideate, and Orchestrate)

- Identify critical healthcare challenges that could benefit from digital solutions.
- Organize innovation challenges and hackathons focused on specific health needs.
- Support validation and refinement of promising concepts.

- Provide technical expertise and mentorship to innovation teams.
- Facilitate access to data, standards, and interoperability APIs, and development resources.
- Host events, workshops, and knowledge-sharing forums to stimulate creative thinking.
- Showcase successful implementations and their impact.
- Facilitate design thinking sessions to generate human-centred solutions.
- Coordinate resources and efforts across multiple partners.
- Manage innovation pipelines from concept to implementation.

Engage All Stakeholders

- Define challenges identified by all stakeholders.
- Ensure clinician and patient perspectives inform innovation priorities.
- Involve health administrators in defining requirements for practical implementation.
- Create partnerships with providers, hospital / medical centres, primary care centres, specialty clinics, pharmacies, and allied health professionals.
- Create partnerships with the local health technology industry.
- Create partnerships with academia.
- Engage policymakers to test policies in a “regulatory sandbox” to assess and plan regulatory updates early in support of innovations.
- Incorporate payer perspectives to ensure sustainability of new solutions.
- Create opportunities for multi-stakeholder co-creation and feedback.

Facilitate Pilots

- Establish pathways for testing promising solutions in controlled environments.
- Ensure connection and adaptability with the existing systems.
- Create a “regulatory sandbox” in partnership with national bodies (Priority 5.5).
- Develop evaluation frameworks to measure impact objectively.
- Document and disseminate learnings from pilot implementations in e-vitals Hum.
- Support transition from successful pilots to broader implementation.

Accelerate Development

- Provide access to key opinion leaders and other stakeholders (e.g. patients and clinicians)
- Facilitate access to technical infrastructure and development environments.
- Offer business development support and go-to-market strategies in coordination with local incubators.
- Provide a platform to pitch and raise funding for different stages of innovation in coordination partners and local incubators.
- Streamline and support procurement and contracting for national health system integration components.
- Support with solutions validations.
- Support scaling of validated solutions to reach more patients and providers.

The hub should operate in alignment with the governance structures established through Priority 5.1 (e-Health Governance and IT Leadership), ensuring innovations support national digital health objectives while maintaining the agility needed for creative problem-solving.

In practical terms, the hub can be developed by establishing a multi-stakeholder steering group, setting up a hybrid physical-virtual platform, launching small-scale pilot projects with public-private partners, enabling secure data sharing, supporting startups with funding and mentorship, and gradually scaling through local talent, diaspora engagement, and donor support.

5.6.4.2. e-Vitals Knowledgebase (Resources Library)

A critical enabler for Lebanon's e-Health Innovation Ecosystem will be the e-Vitals Knowledgebase, a community library of resources, tools, code, and expertise that accelerates digital health development and implementation.

It will act like a shared toolbox for everyone working on digital health, from software developers to healthcare professionals. Whether someone is starting a new project or improving an existing one, they'll be able to find guidance, examples, and tools all in one place. This knowledge repository would:

Store Collective Knowledge

- Technical documentation of existing systems and standards.
- Case studies of successful implementations.
- Lessons learned from challenges and failures.
- Best practices for digital health development.
- Implementation guidelines and methodologies.

Provide Reusable Resources

- Open-source code libraries and components.
- Reference architectures and design patterns.
- User interface templates and design systems.
- Testing frameworks and validation tools.
- Implementation toolkits and checklists.

Enable Standards Compliance

- Reference implementations of interoperability standards (Priority 5.4).
- Validation tools for standards conformance.
- Simplified guidance / videos for implementing complex standards.
- Sample code for common integration scenarios.
- Documentation of national data models and terminologies.

Support Capability Building

- Self-paced learning resources.
- Training materials and curricula.
- Assessment tools for organizational readiness.
- Mentorship connections and expert directories.
- Communities of practice for specific domains.

Accelerate Solution Development

- AI chatbots that can provide answers to e-health questions.
- Pre-approved technical components.
- Playbooks for implementing standards and interoperability.
- Templates for common regulatory submissions.
- Decision support for technology selection.
- Project management frameworks and tools.

Evaluation methodologies for digital health solutions.

The e-Vitals Knowledgebase would be developed incrementally, starting with high-priority resources that address immediate needs. It will be maintained through a combination of curated contributions from the community and dedicated resources from the e-Health Innovation Hub, with governance mechanisms to ensure quality and relevance of content.

This knowledge repository directly supports Priority 5.3 (Workforce Development) by providing practical learning resources, and Priority 5.4 (Standards and Interoperability) by making standards more accessible to implementers.

5.6.4.3. Who Should Be Engaged?

The e-Health Innovation Ecosystem must engage diverse stakeholders to succeed, creating a collaborative environment where different perspectives and expertise converge to create effective solutions. Everyone must unite around common vision that aims to strengthen Lebanon's health system.

Healthcare Providers

- **Public Sector:** Ministry of Public Health, public hospitals, primary healthcare centres.
- **Private Sector:** Private hospitals, clinics, laboratory networks, pharmacies.
- **Healthcare Professionals:** Physicians, nurses, pharmacists, allied health professionals.
- **Healthcare Administrators:** Hospital managers, healthcare operations experts.

Academia & Research

- **Medical Schools:** Faculty and students from Lebanese medical education institutions.
- **Engineering & Computer Science Departments:** Technical expertise from universities.
- **Research Centres:** Dedicated health and technology research units.
- **Academic Medical Centres:** Institutions combining clinical care, teaching, and research.

Startups & Technology Sector

- **Health-Focused Startups:** Entrepreneurial teams developing digital health solutions.
- **Local Technology Companies:** Established firms with relevant technical capabilities.
- **Technology Service Providers:** Consultancies and development shops.
- **International Technology Partners:** Global companies with complementary expertise

Associations & Professional Bodies

- **Medical Associations**: Order of Physicians, specialized medical societies.
- **Health IT Organizations**: Groups focused on healthcare technology.
- **Entrepreneurship Networks**: Startup support organizations and mentorship programs.
- **Industry Associations**: Representing healthcare, technology, and related sectors.

Patients & Communities

- **Patient Advocacy Groups**: Organizations representing patient perspectives.
- **Community Representatives**: Leaders from diverse communities across Lebanon.
- **Public Health Organizations**: Groups focused on population health needs.
- **User Experience Specialists**: Experts in human-centred design.

Payers

- **Insurance Companies**: Private health insurers operating in Lebanon.
- **National Social Security Fund**: Lebanon's public health insurance program.
- **NGOs**: Organizations funding or providing healthcare services.
- **International Donors**: Development partners supporting health initiatives.

Pharmaceutical & Medical Technology Companies

- **Pharmaceutical Manufacturers**: Companies developing and distributing medications
- **Medical Device Companies**: Producers of healthcare equipment and devices
- **Diagnostic Companies**: Firms providing laboratory and imaging technologies
- **Wellness Product Suppliers**: Companies offering health and wellness solutions

Policy & Regulatory Stakeholders

- **Ministry of Public Health**: Regulatory authority for healthcare
- **Ministry of Telecommunications**: Oversight of digital infrastructure
- **Data Protection Authorities**: Entities responsible for privacy and data security
- **Professional Licensing Bodies**: Organizations overseeing professional standards

Partners

- **Development Organizations**: WHO, UNICEF, World Bank, EU and other partners.
- **NGOs**: International and local non-governmental organizations.
- **Innovation Hubs & Incubators**: Existing support structures for innovation.
- **Investors**: Venture capital, impact investors, and funding entities.

Engaging this diverse ecosystem requires deliberate governance and coordination mechanisms that balance inclusive participation with efficient decision-making. The e-Health Innovation ecosystem will require structured engagement approaches aligned with the governance frameworks established in Priority 5.1 (e-Health Governance and IT Leadership) but should have the ability to operate autonomously.

5.6.4.4. Possible Framework

VISION STATEMENT

A dynamic, collaborative ecosystem that drives continuous digital health innovation to improve healthcare quality, accessibility, and efficiency for all people in Lebanon and beyond.

MISSION STATEMENT

To establish sustainable mechanisms for networking, collaboration, and knowledge sharing that enable Lebanese stakeholders to accelerate the development, validation, and implementation of locally relevant digital health solutions addressing critical healthcare needs.

STRATEGIC PILLARS

Networking and Collaboration: Foster meaningful connections between diverse stakeholders in healthcare and technology to stimulate innovation through cross-domain expertise.

Knowledge and Skills Development: Build local digital health capabilities through structured learning opportunities, mentorship, and knowledge sharing.

Innovation Acceleration: Provide resources, methodologies, and support to rapidly develop promising digital health concepts into viable solutions.

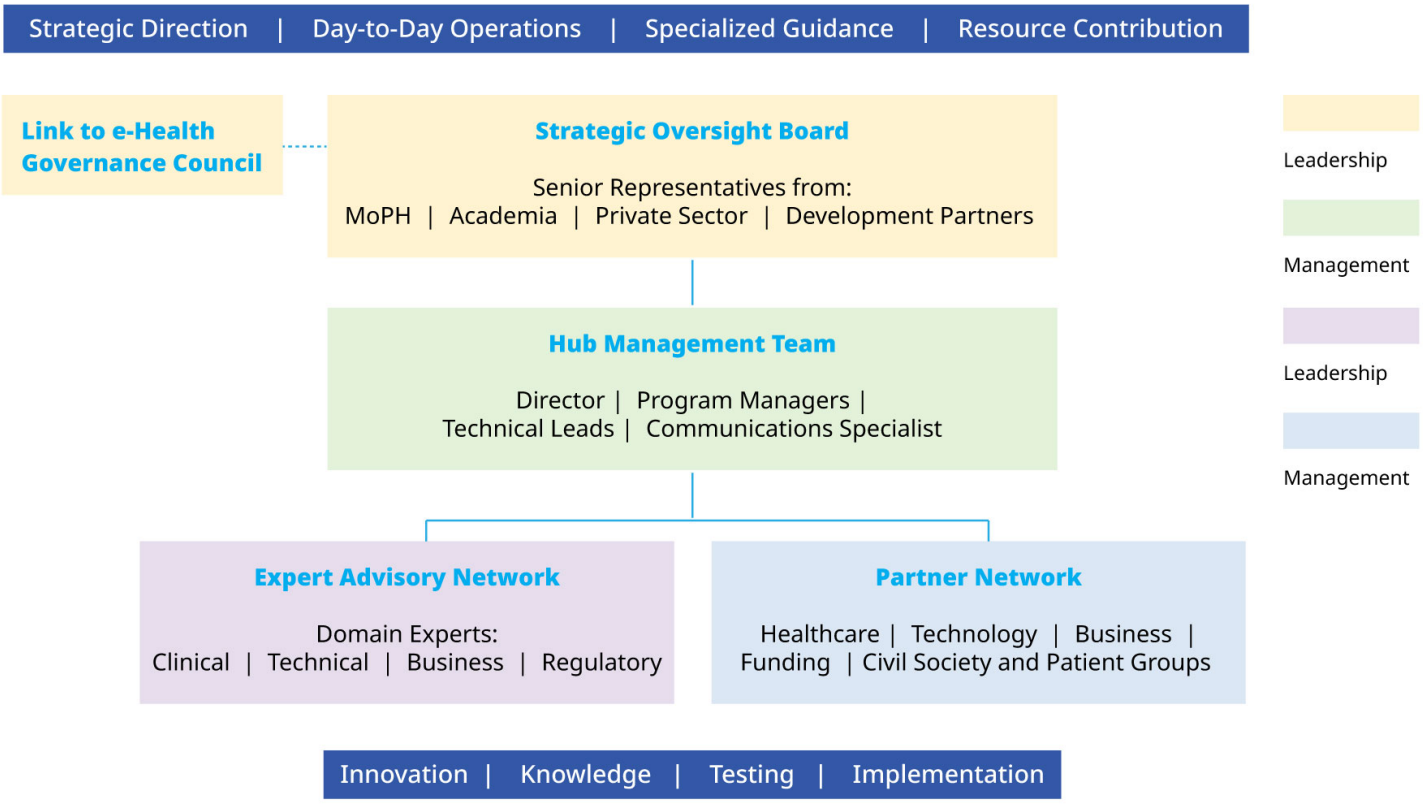
Implementation Support: Engage and leverage academic institutions capacities to host and support initiatives. Cocreate pathways for testing, validating, and scaling digital health innovations within the Lebanese healthcare system.

Ecosystem Sustainability: stablish mechanisms for long-term sustainability of both the innovation ecosystem and the solutions it produces.

5.6.4.5. Suggested Structure and Model of Operation

The e-Health Innovation Ecosystem proposed follows a hybrid model that combines elements of an innovation lab, incubator, and knowledge network, structured to maximize impact with available resources.

Organizational Structure



Strategic Oversight Board

- **Composition:** Senior representatives from key stakeholder groups (MoPH, academia, private sector, development partners).
- **Role:** Set strategic direction, ensure alignment with national priorities, oversee resource allocation.
- **Connection:** Linked to the e-Health Governance Council (Priority 5.1) for coordination across transformation priorities.

Hub Management Team

- **Composition:** Director, program managers, technical leads, communications specialist.
- **Role:** Day-to-day operation, program implementation, stakeholder engagement.
- **Structure:** Small core team 2-3, augmented by experts from partner organizations.

Expert Advisory Network

- **Composition**: Domain experts across clinical, technical, and business domains.
- **Role:** Provide specialized guidance to innovation teams, mentorship.
- **Model:** Part-time involvement based on expertise needs.

Partner Network

- **Composition**: Organizations providing resources, funding, technical support.
- **Role:** Contribute to hub activities according to their capabilities and interests.
- **Engagement:** Formalized through partnership agreements with clear expectations.

Operational Model

The operational model can be implemented incrementally, starting with core functions and expanding as the ecosystem matures. The approach leverages existing resources and capabilities while building new capacity where needed.

Funding Mechanisms

- Dedicated innovation fund managed through transparent and competitive processes to support the ecosystem's sustainability and growth.
- Seed funding and micro-grants for early-stage digital health initiatives.
- Co-financing models or grants from public, private, and international development partners.
- Outcome-based financing tied to validated health and system impact metrics.

Innovation Programs

- Innovation challenges focused on specific healthcare needs.
- Accelerator programs for promising digital health startups.
- Collaborative research and development initiatives.
- Hackathons and ideation events.

Knowledge Services

- Management of the e-Vitals Knowledgebase.
- Educational workshops and seminars.
- Technical assistance and advisory services.
- Documentation and dissemination of learnings.

Testing and Validation

- Living lab environments in healthcare settings.
- User testing and feedback collection.
- Technical validation of solutions.
- Evidence generation for promising innovations.

Implementation Support

- Pilot project facilitation.
- Scaling and deployment assistance.
- Procurement advisory services.
- Implementation monitoring and evaluation.

COLLABORATION APPROACHES

Co-creation Model

- Multi-stakeholder teams address specific challenges.
- Clinicians paired with technical experts.
- Users involved throughout the development process.
- Iterative design and testing cycles.

Hub-and-Spoke Structure

- Central hub providing coordination and core services.
- Specialized nodes at universities, hospitals, or existing innovation centres.
- Virtual collaboration tools connecting distributed teams.
- Rotating physical events across different locations (incubators).

Public-Private Partnership

- Clear mechanisms for collaboration between public and private entities.
- Intellectual property and commercialization agreements.
- Risk and resource sharing approaches.
- Transparent governance processes.

5.6.4.6. Resource and Funding Strategies

Developing a sustainable e-Health Innovation Ecosystem requires diverse and reliable funding sources, particularly given Lebanon's economic challenges. The following funding strategies could be employed:

START-UP PHASE (YEARS 1-2)

International Development Partners

- Dedicated project funding from health-focused development organizations.
- Technical assistance grants for establishing core functions.
- Capacity building programs for ecosystem development.
- Example: UNICEF, WHO, World Bank, EU or bilateral donor digital health initiatives.

Public Sector Seed Funding

- Allocation from MoPH digital health transformation budget.
- Contributions from other relevant ministries (e.g., Telecommunications).
- Staff secondments to reduce direct personnel costs.
- In-kind contributions (space, equipment, expertise).

Private Sector Founding Partners

- Corporate sponsorships from healthcare and technology companies.
- In-kind contributions of technology, expertise, and services.
- Staff participation in advisory roles and working groups.
- Joint funding of initial pilot projects.

GROWTH PHASE (YEARS 3-5):

Diversified Partner Funding

- Expanded partner network with tiered membership/contribution levels.
- Project-specific funding for innovation challenges.
- Consortium-based funding for larger initiatives.
- Contributions from professional associations and academia.

Revenue-Generating Activities

- Fee-based technical advisory services.
- Educational programs and specialized training.
- Licensing of tools and resources developed by the hub.
- Event hosting and conference revenues.

Innovation Investment Fund

- Pooled funding for investing in promising digital health ventures.
- Blended finance involving public, private, and impact investors.
- Returns from successful investments supporting ecosystem activities.
- Structured as separate legal entity with professional management.

SUSTAINABILITY PHASE (YEAR 6+):

Value-Based Funding Models

- Success fees based on measurable outcomes of implemented solutions.
- Health system cost savings sharing arrangements.
- Performance-based contracting with healthcare providers.
- Risk sharing partnerships with implementation partners.

Ecosystem Service Offerings

- Comprehensive innovation support packages for organizations.
- Certification and validation services for digital health solutions.
- Consulting services for digital health strategy and implementation.
- International knowledge exchange and collaboration programs.

Diversified Business Model

- Balanced portfolio of grant funding, commercial activities, and investments.
- Endowment development for long-term stability.
- Cross-subsidization between profitable and public benefit activities.
- Strategic partnerships with international innovation networks.

RESOURCE OPTIMIZATION APPROACHES

Leveraging Existing Infrastructure

- Co-location with existing innovation hubs or academic institutions.
- Shared services agreements to reduce overhead costs.
- Virtual collaboration to minimize physical infrastructure requirements.
- Phased development of specialized facilities based on demonstrated need.

Collaborative Resource Utilization

- Shared technical infrastructure across partner organizations.
- Pooled procurement of specialized equipment and services.
- Coordinated access to international expertise and resources.
- Joint fundraising efforts for major initiatives.

Value Creation Measurement

- Monitoring and evaluation framework to demonstrate impact.
- Return on investment analysis for key activities.
- Documentation of system-level benefits and cost savings.
- Quantification of economic development outcomes.

This multifaceted funding strategy recognizes the challenging economic context while creating a pathway toward sustainability. Initially, the hub will rely more heavily on development partner and public sector support, gradually transitioning to a model where value creation generates resources for continued operation and growth.

TABLE OF INITIATIVES AND STAKEHOLDERS

Initiative	Description	Expected Value	Key Stakeholders
e-Health Innovation Hub Establishment	Create the core infrastructure, team, and processes for the innovation hub	Centralized innovation support	MoPH Lead Academic Partner Private sector tech companies Development partners
		Collaborative innovation ecosystem	MoPH Lead Academic Partner
		Transparent, effective hub management	MoPH Lead Academic Partner
e-Vitals Knowledgebase Development	Build and populate the community knowledge repository	Shared knowledge foundation	Innovation Hub Team Healthcare institutions Tech companies, Academia
		Community engagement	Innovation Hub Team
		User satisfaction and retention	Innovation Hub Team
National Digital Health Challenge Program	Annual challenges focused on priority healthcare problems	Pipeline of innovations	Innovation Hub MoPH Healthcare providers Patients Tech developers
		Tested innovations	Innovation Hub MoPH
		Strategic relevance	Innovation Hub MoPH
Digital Health Living Lab Network	Establish test environments in healthcare settings	Real-world innovation testing	Selected healthcare facilities Tech developers Academia Patient groups
		Evidence-based innovation	Selected healthcare facilities Tech developers
		Proven solutions	Selected healthcare facilities MoPH
Innovation Skills Development Program	Training and mentorship for digital health innovators	Skilled innovation workforce	Academic partners Innovation Hub Professional associations International experts
		Enhanced skills	Academic partners Innovation Hub
		Sustainable innovation ecosystem	Academic partners Innovation Hub

Initiative	Description	Expected Value	Key Stakeholders
e-Health Investment Network	Build relationships with potential investors	Financial sustainability	Innovation Hub Private sector partners Financial institutions Impact investors MoPH
		Commercialization pathway	Innovation Hub Private sector partners
		Sustainable ventures	Innovation Hub Private sector partners
	Support for scaling validated solutions	Widespread adoption	Innovation Hub MoPH Healthcare providers Tech companies
		Faster adoption cycles	Innovation Hub MoPH
		Systemic impact	Innovation Hub MoPH
Regulatory Innovation Collaborative	Working group to address regulatory barriers	Reduced barriers	MoPH Regulatory authorities Legal experts Healthcare providers Tech developers
		Faster innovation adoption	MoPH, Regulatory authorities
		Collaborative regulation	MoPH Regulatory authorities
International Innovation Partnerships	Collaborate with global digital health networks	Knowledge exchange	Innovation Hub Development partners Academia MoPH Private sector
		Collaborative innovation	Innovation Hub Development partners
		Best practice adoption	Innovation Hub Development partners

Key Indicators examples

Initiative	Objectives	Suggested KPIs
e-Health Innovation Hub Establishment	Establish operational innovation hub	Hub operational with core team
	Develop partnership network	# of active partnerships
	Create governance structure	Governance framework established
e-Vitals Knowledgebase Development	Create comprehensive resource library	# of resources available
	Drive user adoption	# of active users
	Ensure high-quality user experience	User satisfaction rating
National Digital Health Challenge Program	Generate innovative solution proposals	# of submissions per challenge
	Advance solutions to pilot stage	# of solutions reaching pilot stage
	Align with national health priorities	% of challenges addressing national priorities
Digital Health Living Lab Network	Create network of testing facilities	# of participating facilities
	Enable solution testing and refinement	# of solutions tested
	Transition successful innovations to implementation	% of tested solutions advancing to implementation
Innovation Skills Development Program	Build innovation capacity	# of individuals trained
	Improve innovation competencies	Skill improvement scores
	Retain talent in digital health	# of trained individuals active in digital health
e-Health Investment Network	Secure innovation funding	Investment capital available
	Support venture funding	# of ventures receiving investment
	Enable significant investments	Average deal size
Implementation Acceleration Program	Scale proven innovations	# of solutions in program
	Accelerate implementation	Time from validation to implementation
	Achieve scaled implementations	% of solutions achieving scale
Regulatory Innovation Collaborative	Resolve regulatory challenges	# of regulatory issues addressed
	Streamline regulatory processes	Avg time to regulatory clarity
	Ensure stakeholder engagement	Stakeholder satisfaction with process

Initiative	Objectives	Suggested KPIs
International Innovation Partnerships	Establish global partnerships	# of active international partnerships
	Implement joint innovation initiatives	Joint initiatives implemented
	Facilitate knowledge sharing	Knowledge exchange events/ activities

5.6.4.7. Priority Summary

The e-Health Innovation Ecosystem represents a crucial investment in Lebanon's digital health future, one that will enable the country to develop locally appropriate solutions while building sustainable capacity for ongoing transformation. All local stakeholders would need to put short-term compositeness aside and collaborate for long term gains. Despite current economic challenges and resource constraints, establishing this ecosystem offers multiple benefits:

CAPACITY BUILDING

Developing local expertise and experience in digital health innovation reduces dependency on external solutions and builds resilience against brain drain by creating opportunities for talented professionals.

RESOURCE MAXIMIZATION

Collaborative approaches reduce duplication of efforts across organizations while enabling more efficient use of limited resources through shared infrastructure and knowledge.

SUSTAINABILITY

Creating mechanisms for continuous innovation ensures the digital health transformation remains responsive to evolving needs rather than becoming a one-time implementation that quickly becomes outdated.

HEALTHCARE IMPROVEMENT

Patient-centred innovations can address specific gaps in Lebanon's healthcare system, improving access, quality, and efficiency of services even within resource constraints.

ECONOMIC DEVELOPMENT

A vibrant digital health innovation ecosystem creates jobs, attracts investment, and potentially develops exportable solutions, contributing to economic recovery.

Key challenges that must be addressed include:

RESOURCE LIMITATIONS

The economic situation constrains available funding, requiring creative approaches to resource mobilization and efficient use of existing assets.

STAKEHOLDER COORDINATION

Effective collaboration across diverse stakeholders requires strong governance and communication mechanisms aligned with Priority 5.1 (e-Health Governance).

REGULATORY UNCERTAINTY

Innovation often outpaces regulation, necessitating close coordination with Priority 5.5 (Policies & Regulations) to create appropriate frameworks.

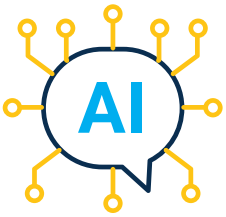
IMPLEMENTATION PATHWAYS

Creating clear routes from innovation to implementation requires alignment with healthcare delivery organizations, international standards and requirements e.g. FDA or EMD and integration with existing systems.

SUSTAINABLE FUNDING

Transitioning from initial donor support to sustainable business models presents a significant challenge requiring dedicated attention.

Despite these challenges, the potential benefits of a functioning e-Health Innovation Ecosystem far outweigh the investments required. By creating structured mechanisms for collaboration, knowledge sharing, and acceleration of promising solutions, Lebanon can transform current constraints into opportunities for locally driven digital health transformation.



6. AI-NATIE APPROACH

6.1. Rationale

As healthcare systems worldwide undergo digital health transformation, the integration of artificial intelligence has evolved from an optional enhancement to a fundamental requirement for modern healthcare delivery. AI-native design represents a paradigm shift from traditional approaches where AI capabilities are retrofitted into existing systems, to a comprehensive strategy where intelligence is embedded into the core architecture from inception.

Despite Lebanon's health system unprecedented challenges, economic crisis, infrastructure constraints, brain drain, and increased demand for healthcare services, the MoPH has demonstrated innovation through solutions like PHENICS, MERA, MediTrack, Sohatona and others. This shows the potential capabilities that can be augmented with AI. As such AI is not a transformation priority. It is a catalyst that can be used in all priority initiatives where it can provide value. Having said that, it is important to create a foundation for using AI more broadly in health with proper governance regulatory oversight (Priority 5.1, 5.5). Globally, many countries have established national digital health strategies with AI playing increasingly central roles, but they are also working on AI Legislation and national coordination of AI resources.

The applications outlined represent a starting point rather than definitive solutions, recognizing that AI technology is evolving at an unprecedented pace. The dynamic nature of AI development means that new capabilities, applications, and use cases will continuously emerge. Therefore, Lebanon's use of AI in health must be agile and adaptive balancing systematic planning with the flexibility to integrate emerging technologies and respond to evolving healthcare needs.

Successful AI implementation requires collaborative engagement with all key stakeholders, from healthcare providers and patients to policymakers and technology partners. This collaborative approach ensures that AI solutions are not only technically sound but also clinically relevant, culturally appropriate, and aligned with Lebanon's broader digital health transformation strategy and e-Health Governance (Priority 5.1).

As AI capabilities continue to expand, Lebanon's healthcare system will need to be prepared to evolve its implementation approach, always keeping human-centred care and population health improvement as the guiding priorities for technological adoption. The transformation journey can be facilitated with existing AI-enabled solutions starting with foundational applications but must remain flexible to adapt to emerging AI developments.

6.2. Design Principles

The use of AI-Native design principles helps address the unique challenges of healthcare environments, where patient safety, regulatory compliance, and ethical considerations are balanced with the need for innovation, efficiency, and scalability. Unlike generic AI applications, healthcare AI systems must operate within stringent quality and privacy frameworks, maintain transparent decision-making processes, and augment rather than replace human clinical expertise.

The following synthesizes best practices from leading healthcare organizations, international standards bodies, and cutting-edge research to provide actionable guidance for implementing AI-native digital healthcare transformation. These principles are selected to help create intelligent, trustworthy, and effective digital health solutions that improve patient outcomes while maintaining the highest standards of safety and ethics.

For the e-health governance stakeholders (Priority 5.1), healthcare leaders, technology teams, and policy makers, these principles serve as both a strategic roadmap and a practical checklist for ensuring that AI implementations deliver meaningful value while preserving the human-centred nature of healthcare delivery.

By following such principles, Lebanon's public and private healthcare communities can build or implement systems that not only leverage AI-Native capabilities effectively but also maintain the trust, safety, and ethical standards essential for healthcare delivery.

HUMAN-CENTRED DESIGN

AI shall amplify and augment, rather than replaces, human intelligence, focusing on improving the efficiency and effectiveness of human interaction with patients. Healthcare AI must enhance clinical decision-making while maintaining the autonomy of medical professionals.

TRANSPARENCY AND EXPLAINABILITY

Transparency requires that sufficient information be published or documented before the design or deployment of an AI technology. Healthcare providers and patients shall understand AI recommendations, functionality and limitations.

EVIDENCE-BASED CLINICAL VALIDATION

Human experts with appropriate clinical knowledge and experience shall conduct rigorous, evidence-based reviews prior to validating AI systems for clinical use. This may include clinical trials, real-world evidence studies, and peer reviews by qualified healthcare professionals to ensure safety, efficacy, and clinical relevance before deployment.

PRIVACY-BY-DESIGN

Patient data shall be tightly controlled, and internal processes shall be designed to ensure that the privacy, safety, and security of individuals is protected. AI systems must incorporate security and privacy protections from inception, not as an afterthought.

EQUITY AND ACCESSIBILITY

AI shall be purposely designed to improve longstanding, systemic challenges in healthcare and alleviate health disparities. Systems shall serve diverse populations and reduce healthcare inequities.

AI-FIRST DESIGN

Every application shall include AI capabilities from inception, rather than retrofitting AI into existing systems. New applications are designed from the ground up with AI as an integral part of their core functionality, built to consume, process, and generate data at scale using AI/ML models for decision-making and automation.

AUTOMATED WORKFLOW OPTIMIZATION

Automated workflows shall reduce manual tasks by at least 70%, focusing on augmenting rather than replacing human intelligence. AI systems should reduce administrative burdens while enhancing the human elements of healthcare interaction.

CONTINUOUS LEARNING SYSTEMS

Systems shall improve with usage through feedback loops and real-time data processing. AI-native applications consume, process, and generate data at scale, using AI/ML models for continuous improvement.

PREDICTIVE CORE FUNCTIONS

Predictive capabilities shall be built into core functions, enabling proactive healthcare delivery rather than reactive treatment. Systems should anticipate patient needs, resource requirements, and potential health risks.

QUALITY AND SAFETY

Health AI tools shall offer excellence in safety and performance, with alignment to industry standards and leading practices. Continuous monitoring and validation are essential for healthcare applications.

REGULATORY COMPLIANCE

Designers of Health applications with AI technologies shall satisfy regulatory requirements for safety, accuracy and efficacy for well-defined use cases. Healthcare AI enabled solutions shall meet stringent regulatory standards for medical devices.

6.3. Intelligent Applications Layer

The healthcare applications layer ensures that Lebanon's existing digital health investments are maximized through intelligent enhancement while introducing AI-native capabilities that address specific healthcare delivery challenges. The architecture prioritizes interoperability, security, and scalability while maintaining the core functions that have served Lebanon's healthcare system.

This layer provides the suite of applications needed across Lebanon's healthcare system, building upon established foundations like HIS, EHR, PHENICS, MediTrack, DHIS2 and the many others while addressing their future potential through intelligent enhancements or selective replacements.

6.4 outlines sample features that can reduce workload, improve quality of care and reduce costs in the long term. They aim was to provide ideas and suggested additions to the RFP templates provided as part of the 2019 EHR consensus report. These initiatives would be overseen by the e-health governance council and innovations groups (Priority 5.1 and 5.6)

HOSPITAL INFORMATION SYSTEMS (HIS)

Patient flow may be enhanced in existing public hospitals with AI to reduce workload and costs.

Enhancements:

- Integration with national health ID through Self-Sovereign Identity (SSI) layer.
- Patient self-registration and admission capabilities.
- AI-assisted pre-hospitalization planning and risk assessment.
- Intelligent bed management with real-time occupancy tracking and predictive availability.
- Optimized operating theatre scheduling integrating healthcare professionals, devices, and resource availability.
- Emergency department management with automated bed availability communication for incoming cases.
- AI-enhanced triage and patient flow optimization reducing wait times and improving outcomes.
- Multi-language support (Arabic, English, French) ensuring accessibility across Lebanon's diverse population.
- AI-coding of bills and Electronic Data Interchange (EDI) interfaces for coverage and claims with MoPH or third-party payers.

ELECTRONIC HEALTH RECORDS (EHR)

Transforming clinical documentation from burden to asset through AI-powered automation calming back time for clinical professionals.

Documentation:

- Use of Electronic Health Records with patient-centred care coordination.
- AI-powered clinical documentation summarising charts to reduce administrative burden on medical professionals.
- Ambient AI assistants for ambulatory clinical documentation during patient encounters addresses workforce challenges (5.3) by enabling doctors to spend more time with patients. Ambient listening during consultations automatically generates structured clinical notes, potentially reducing documentation burden by 70%.
- AI-driven clinical decision support with intelligent problem identification and care plan suggestions.
- Closed-loop medication management with automated reconciliation and interaction checking.
- Seamless interoperability through standardized data exchange protocols.
- Integration with OpenEHR Clinical Data Repository for longitudinal patient records.

PRIMARY HEALTHCARE ENHANCEMENT (PHENICS EVOLUTION)

Transforming Lebanon's 326 connected primary healthcare centres into intelligent care delivery points.

Predictive Capabilities:

- Enhanced data entry with intelligent validation and error prevention
- Local AI predictive health analytics for capacity planning and supply management
- Augmented population health management dashboards with trend analysis
- Integration with national disease registries for comprehensive health monitoring
- Containerised applications for offline availability addressing Lebanon's connectivity challenges
- Patient apps self-service integration for appointment scheduling, results access, and prescription management
- Real-time integration with hospital systems for seamless referrals and care coordination

LABORATORY INFORMATION SYSTEMS (LIS)

Enhancing independent and hospital-based laboratories with integration and automation.

Automation:

- Seamless integration with EHR orders from requesting organizations.
- Direct interfacing with diagnostic equipment for automated data capture.
- AI-assisted result interpretation with pattern recognition and anomaly detection.
- Automated quality control algorithms ensuring result accuracy.
- Critical value alerts with intelligent routing to appropriate clinical teams.
- Standardized coding implementation regardless of language used.
- Integrated results transmission to EHRs and patient portals.

RADIOLOGY/PACS SYSTEMS

Diagnostic assistance with bandwidth-optimized sharing for Lebanon's infrastructure.

AI-Enhanced Imaging:

- Use of vendor-neutral archive for enterprise medical imaging storage.
- AI-powered diagnostic assistance with pattern recognition and preliminary analysis.
- Automated report generation with structured findings.
- Advanced 3D reconstruction capabilities for complex cases.
- Tele-radiology support enabling remote specialist consultation.
- Bandwidth-optimized image sharing with intelligent compression for remote viewing.

PATIENT PORTAL INTEGRATION

Empowering patients as active participants in their healthcare journey. Recognizing Lebanon's mobile phone penetration, AI health companions can be securely used through instant messaging solutions making healthcare accessible even on low feature phones. This aligns with Human-Centred Care (5.2) by meeting citizens where they are rather than requiring new app downloads. Virtual health assistants show high efficacy in promoting healthy lifestyles (40%), smoking cessation (27%), and treatment adherence (13%). The MoPH and Sohatona app could provide a foundation for AI-powered health literacy tools.

Patient Empowerment:

- National health ID integration through SSI layer.
- Delegated access management for family members and caregivers.
- Intelligent appointment booking based on conversational AI-symptom checkers.
- Secure results access with explanatory information and education material.
- Wearable device integration for continuous health monitoring.
- AI-enabled personalized health recommendations and prevention strategies.
- Conversational AI for non-communicable disease education and support.
- Medication adherence tracking with digital tools and IoT device integration.

HOME CARE MANAGEMENT SYSTEMS

Reducing hospital admissions through intelligent community-based care.

Predictive Home Care:

- Integration with hospital discharge planning for seamless patient enrolment.
- Automated follow-up with AI-powered care plan education.
- Automated patient check-in systems with escalation protocols.
- AI-powered visit scheduling and route optimization for healthcare workers.
- Caregiver task management with intelligent documentation support.
- Remote vital signs monitoring with anomaly detection.
- Predictive analytics for hospitalization risk assessment.
- Family portal for coordinated care and support activities.

MEDITRACK EVOLUTION

Further transforming medication management from management to intelligent prediction.

Predictive Supply Management:

- Evolution into AI-powered national orders / prescription repository system with analytics.
- AI-enhanced medication tracking with predictive stock management.
- Automated reordering systems preventing stockouts.
- Advanced counterfeit detection algorithms protecting patient safety.
- Integration with EHR order entry systems for real-time demand tracking.
- Supply chain optimization with demand forecasting across the healthcare network.

TRANSACTIONS AND WORKFLOW SYSTEM (TWFS)

Workflow automation:

AI-assisted requests processing, accelerating verifications and validations with other stakeholders to achieve significant workflow enhancements.

- AI-Enabled responses or an interactive chatbot to assist users / requesters.
- AI-Processing of multilingual documents submitted with OCR and content verification.
- Advanced tracking and worklist generation of activities that require human attention.
- Automated validation with multisectoral stakeholders.
- Fater automated responses to standard requests allowing time to deal with special ones.
- Fraud detection and prevention algorithms.

FINANCIAL MANAGEMENT SUITE

Automating financial processes while ensuring transparency and fraud prevention.

Financial Operations:

- AI-powered request processing with automated approval workflows.
- Integration with NSSF and insurance systems for claims processing.
- Real-time financial performance monitoring with predictive analytics.
- Advanced cost analysis and predictive national budgeting for planning.
- Fraud detection algorithms protecting public resources.

HUMAN RESOURCES MANAGEMENT

Optimizing workforce deployment through intelligent scheduling and competency tracking.

Workforce:

- Blockchain-based credential verification ensuring professional standards.
- Competency tracking with AI-driven training recommendations.
- Performance analytics identifying improvement opportunities.
- Scheduling optimization with self-scheduling capabilities for clinical professionals.
- Integration with payroll systems for streamlined operations.

SURVEILLANCE WITH AI

Transforming surveillance from reactive reporting to proactive population health management.

Outbreak Prevention:

- AI-powered data collection and validation from public and private organisations.
- AI-analytics for outbreak prediction with algorithms analysing multiple data streams.
- Real-time epidemiological analysis with automated pattern recognition.
- Automated report generation reducing manual surveillance burden.
- Geographic information system integration for spatial analysis.
- Mobile data collection optimization for field workers.
- Enabled secondary use of data for research and fund raising.

MERA AND MERA PRO

Optimizing immunization coverage through predictive analytics.

Immunization:

- Integration with PHC and EHR child health records for comprehensive care coordination.
- Predictive analytics identifying coverage gaps before they become problems.
- Automated reminder systems improving vaccination compliance.
- Cold chain failure prediction preventing vaccine waste.
- Offline synchronization capabilities ensuring rural area connectivity.

DISEASE REGISTRIES PLATFORM

Automated data extraction transforming registry maintenance from burden to asset.

Registries:

- Cancer registry with AI staging assistance improving accuracy.
- Automated data extraction from EHRs reducing manual entry burden.
- Predictive modelling for disease progression supporting clinical decisions.
- Quality of care indicators enabling continuous improvement.
- Research dataset generation supporting evidence-based policy making.

EMERGENCY OPERATIONS CENTRE

Real-time health system monitoring with intelligent resource allocation.

Crisis Response:

- Realtime updates of facilities and availability.
- AI-powered resource allocation optimizing emergency response.
- Hospital capacity prediction enabling proactive planning.
- Ambulance dispatch optimization reducing response times.
- Multi-agency communication platform for coordinated response.
- Real-time health system monitoring with predictive alerts.

TELEMEDICINE PLATFORM

AI-powered triage and bandwidth-adaptive streaming for Lebanon's infrastructure.

Virtual Care:

- AI-powered triage and routing matching patients with appropriate providers.
- Automated visit documentation reducing administrative burden.
- Bandwidth-adaptive streaming or platform use optimizing reach across Lebanon's varied connectivity.
- Remote monitoring integration enabling continuous care.
- Prescription management with automated verification and dispensing coordination.

MENTAL HEALTH PLATFORM

Enhancing Step-by-Step programs with AI-supported interventions.

Mental Health:

- Crisis intervention routing ensuring immediate response.
- AI-supported therapy sessions with outcome tracking supporting evidence-based treatment adjustments.
- Provider matching algorithms optimizing therapeutic relationships.
- Integration with primary care and specialty care for holistic patient management.

MATERNAL AND CHILD HEALTH SUITE

Sohatona integration with risk prediction and optimization.

Maternal Care:

- Prenatal care tracking with AI-powered risk assessment.
- Growth monitoring with intelligent alerts for intervention.
- Vaccination schedule optimization based on individual risk factors.
- High-risk pregnancy identification enabling proactive management.
- Integration with MERA for comprehensive child health coordination.

CLINICAL QUALITY ASSURANCE

Transforming quality measurement from manual processes to intelligent continuous improvement.

Automated Quality Assessments:

- Automated quality indicator calculation eliminating manual data collection.
- AI-powered chart reviews identifying improvement opportunities.
- Adverse event detection with pattern recognition and prevention recommendations.
- Performance benchmarking against national and international standards.
- AI-Powered review of treatment plans with evidence-based knowledge.
- Chart access and privacy reviews.

BUSINESS INTELLIGENCE PLATFORM

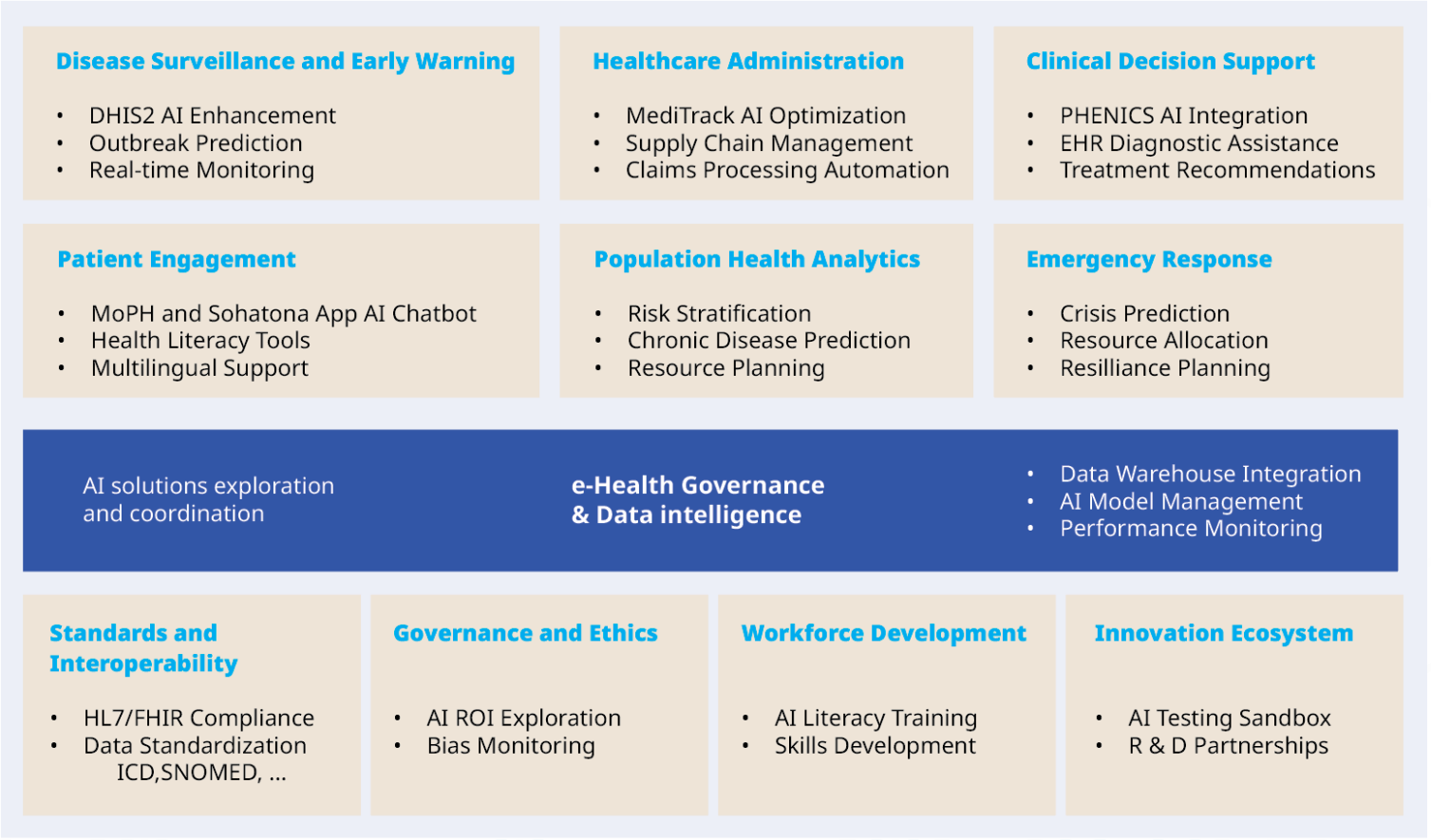
Predictive analytics enabling proactive planning rather than reactive management.

Strategic Intelligence:

- Real-time operational dashboards with performance improvement insights.
- Provider performance monitoring for augmenting support and trainings.
- Financial performance monitoring with trend analysis.

- Clinical outcome analysis supporting evidence-based decision making.
- Population health metrics enabling targeted interventions.
- Custom report generation supporting diverse stakeholder needs.

6.4. Future Capabilities



6.5. Leveraging AI through with the Transformation Priorities

e-Health Governance and IT Leadership (Priority 5.1)

AI governance should be overseen by the e-Health Governance Council and in coordination with national digital transformation initiatives. The Health Data Intelligence Lab outlined in Priority 5.1 provides the ideal framework for AI utilisation, ensuring impactful deployment and performance monitoring.

Human-Centred Care (Priority 5.2)

AI chatbots can enhance patient engagement through the National e-Health Portal, providing 24/7 health guidance and triage. Lebanon's unique multilingual context (Arabic, French, English) requires culturally adapted AI solutions. This can be explored through the e-Health Innovation Hub (Priority 5.6)

Workforce Development (Priority 5.3)

AI literacy can be integrated into Lebanon's health informatics capacity building programs. The WHO has trained over 1,600 government officials in over 100 countries on digital health and AI implementation, providing a model for Lebanon's workforce development.

Standards and Interoperability (Priority 5.4)

Lebanon's standards and interoperability priority can leverage AI to build a framework that establish the national standards for implementation accelerating stakeholder engagement. AI can also be used to analyse gaps and enhance standards adoption.

Policies & Regulations (Priority 5.5)

AI-specific healthcare regulations will be needed to address ethical use of data, bias detection, transparency, and accountability. The WHO's six core principles including, autonomy, well-being, transparency, responsibility, inclusiveness, and responsiveness can help guide Lebanon's AI health regulatory use.

e-Health Innovation Ecosystem (Priority 5.6)

Lebanon's e-Health innovation hub can serve as an AI testing ground for health solutions, creating a validation and regulatory sandboxes for safe AI use in health before rolling out to users nationwide.

6.6. Challenges and Enablers

INFRASTRUCTURE LIMITATIONS

With limited internet connectivity in rural areas, inadequate computing power for AI model training, and unreliable electricity affecting system operations. These technical barriers can be surmounted by collaborating with the academic sector and using cloud computing.

HUMAN CAPITAL

The healthcare workforce faces a significant AI skills gap, with limited exposure to machine learning concepts and data science applications. Brain drain has exacerbated this challenge, as skilled professionals have emigrated seeking better opportunities, leaving behind an underpaid overextended workforce with limited capacity for technology adoption.

REGULATORY AND GOVERNANCE

The lack of AI-specific healthcare regulations addressing bias detection, transparency requirements, and accountability frameworks. This regulatory vacuum affects healthcare providers and technology vendors, potentially slowing adoption and implementation.

LEVERAGING STRATEGIC ENABLERS

Despite these challenges, Lebanon possesses enablers that position the country for successful AI implementation. Lebanon has the capacity to build skills and knowledge through close collaboration and a dynamic, young, capable population.

INTERNATIONAL PARTNERSHIPS

Organizations like WHO, UNICEF, and the World Bank provide not only funding but also technical expertise, capacity building programs, and knowledge transfer opportunities. These partnerships can accelerate Lebanon's AI Health journey through shared learning and resource mobilization.

ACADEMIC AND INSTITUTIONAL CAPACITY

Lebanese universities have strong medical and engineering programs that can drive AI research and development while training the next generation of health informaticians. The proposed workforce development and e-Health Innovation Hub priorities create an opportunity to build public-private collaboration, enabling local innovation while leveraging global expertise. Lebanon's multilingual workforce and cultural adaptability also position the country to develop AI solutions that serve diverse populations effectively.

REGIONAL CONTEXT

Successful AI implementations in countries like UAE, Saudi Arabia and Rwanda demonstrate that financial and technology partners are willing to invest in innovative solutions. Lebanon can adapt proven models while building on its strengths in healthcare delivery and technological innovation.

6.7. AI Health Implementation Requirements

Technical Infrastructure	Human Resources	Governance Framework	Financial Strategy
Cloud computing capabilities for AI model training and deployment	AI specialists within the expanded Health Informatics Team	AI oversight committee within e-Health Governance Council	Phased implementation starting with high-impact applications
Enhanced data warehouse supporting real-time analytics	Training programs for healthcare professionals on AI tools	Performance monitoring and bias detection protocols	Public-private partnerships for AI development
API management platform for AI service integration	Data scientists for model development and validation	Patient consent mechanisms for AI-powered services	International donor support for capacity building
Cybersecurity framework protecting AI systems	Ethics review board for AI applications	Risk base national AI regulations	Revenue generation through AI-enabled efficiency gains

6.8. Elements and Sequence to Consider

Foundation Requirements	Capacity Building	Oversight & Compliance	Sustainability
Health AI regulations	**Create incentives for h**ealth informaticians with AI skills	Use WHO AI ethics framework adoption	Cost-benefit and Impact analysis for each AI application
Collaborative national health AI resources / infrastructure	Build cross-functional AI teams	Apply and monitor regulatory compliance	ROI tracking and measurement
Clinical staff AI literacy programs	Data science recruitment strategy to fill gaps	Patient privacy protection protocols	Self-funding model development
Multi-layered cybersecurity		Bias auditing and mitigation	Partnership revenue sharing if commercialised

6.9. Resource Dependencies

Infrastructure Dependencies	Skills Dependencies	Regulatory Dependencies	Funding Dependencies
Reliable internet connectivity	AI/ML technical expertise	Personal data protection legislation	Initial capital investment
Computing power for model training	Healthcare domain knowledge	Clinical validation requirements	Ongoing operational costs
Availability of quality data, authorisation to use the data, data storage capacity	Collaboration and needs assessment skills	Ethical review processes	Technology licensing fees
Integration with existing systems	Multilingual capabilities	International compliance standards	Training and development budgets

6.10. AI-Native Approach as Catalyst for Healthcare Transformation

Despite facing significant economic challenges, infrastructure constraints, and workforce pressures, Lebanon stands at a unique inflection point where artificial intelligence can serve as a powerful catalyst for healthcare system transformation. This e-Health Governance structure can enable opportunities for streamlining the use of AI in Health in coordination with other national initiatives.

Rather than following incremental improvement approaches that require substantial resource investments, Collaboration around the use of AI can enable the country to achieve dramatic efficiency gains and quality improvements through intelligent automation and predictive analytics.

Global evidence demonstrates that AI implementations can reduce administrative workloads by 40-70%, improve diagnostic accuracy by over 90%, and decrease healthcare costs by 15-20%, outcomes that directly address Lebanon's most pressing healthcare challenges.

Starting with high-value, low-risk applications like automating administrative solutions, disease surveillance and supply chain optimization, Lebanon can demonstrate early wins that build stakeholder confidence and generate resources for more advanced AI capabilities. This can be done in partnership with the strong academic institutions and established international partnerships. By leveraging existing relationships with local stakeholders and international partners, WHO, UNICEF, EU, the World Bank and others, combined with potential diaspora engagement and regional collaboration opportunities, Lebanon can access the technical expertise and financial resources necessary for successful AI implementation.

Lebanon has demonstrated that it can transform current constraints into competitive advantages, hence creating a more efficient, effective, and equitable healthcare system that serves as a model for the region and beyond is possible through local consensus, commitment and collaboration around human-centred care principles.

AI can help Lebanon not merely recover its healthcare system but elevate it to new standards of excellence that benefit all citizens and establish the country as a reference in health innovation despite challenging circumstances.

7. NATIONAL HEALTH INFRASTRUCTURE ARCHITECTURE

Lebanon stands at a critical juncture in healthcare digitization, requiring a national health infrastructure that balances technical sophistication with economic constraints while accommodating its unique public-private healthcare mix. Based on successful deployments in countries facing similar challenges, this section outlines a pragmatic path forward that leverages international best practices while addressing Lebanon's specific connectivity, infrastructure, and resource limitations.

7.1. Rational

Research reveals that countries investing ~$5-10 per capita over 3-5 years can achieve digital health transformation, with returns of 10-15% through operational efficiencies. The most successful implementations combine strong government leadership with incremental deployment strategies, emphasizing interoperability from the outset while building local technical capacity.

The implementation of OpenEHR at national scale in Catalonia's represents Europe's largest OpenEHR implementation covering 7.5 million patients. The €40 million investment, launched in production in November 2023, demonstrates the viability of vendor-neutral, open-standard approaches. Slovenia's national implementation since 2015 achieved HIMSS EMRAM Stage 6 certification, proving world-class performance is achievable in smaller countries. The UK and Nordic countries have also taken step to build longitudinal records based on OpenEHR standards.

In resource-constrained settings, Rwanda's implementation demonstrates successful scaling from pilot facilities to nationwide coverage serving 11 million people. Starting with HIV/AIDS tracking in 2005, Rwanda adopted a mobile-first strategy leveraging 98% mobile coverage, achieving 5,000+ daily virtual consultations with total investment of $32 million. The phased rollout over 5 years integrated seamlessly with community-based health insurance, reducing reimbursement processing from 93 to 23 days.

7.2. AI-Native Architecture

DIGITAL TRUST INFRASTRUCTURE LAYER

A unique health ID was established by the Ministry of Public Health, providing a foundational element to connect systems and maintain coherent records for individuals. Building upon this foundation, a Self-Sovereign Identity (SSI) platform needs to be created at the national level for citizens to maintain a unified identity for all services, including health. Unlike traditional identity management systems, SSI uses blockchain technology with zero-knowledge proofs, enabling authentication without exposing personal data.

An AI-powered consent management system can address implementation complexity by using natural language processing to interpret consent preferences and smart contracts to automate privacy rule enforcement. This approach protects user privacy while reducing administrative burden across systems, aligning with the Policies & Regulations priority (Priority 5.5) by creating programmatically enforceable privacy rules that adapt to user preferences.

INTELLIGENT DATA LAYER

Supporting the Standards and Interoperability objectives (Priority 5.4), a federated learning infrastructure can enable AI model training without centralizing sensitive data. Models can be deployed at each public healthcare facility, addressing Lebanon's bandwidth constraints while preserving privacy. This approach enables advanced analytics without compromising security.

A semantic data lake that uses AI to automatically tag unstructured clinical data with standardized terminologies including ICD, SNOMED CT, LOINC, and other international coding systems, would support true semantic interoperability. A multi-language natural language processing capabilities can handle Arabic, English, and French content seamlessly, ensuring comprehensive data understanding across Lebanon's linguistic landscape.

A Clinical Data Repository (CDR) built on OpenEHR archetypes, would enable the construction of longitudinal health records for every citizen. This enhances the public health system's national disease management capabilities through predictive modelling and population health analytics, directly supporting the Health Data Intelligence Lab outlined in Priority 5.1.

INTELLIGENCE LAYER

Conversational AI models can facilitate Human-Centred care solutions (Priority 5.2) by providing voice-first interfaces that reduce literacy barriers and improve healthcare accessibility. Fine-tuned on Lebanese health data and cultural contexts, they handle symptom assessment, appointment scheduling, and health education in Arabic, French and English, ensuring culturally appropriate healthcare guidance for all citizens.

AI in clinical settings can augment healthcare workforce capabilities (Priority 5.3) by automating administrative tasks including clinical coding, documentation, and billing processes. Real-time clinical decision support and adverse event prediction algorithms improve care quality while reducing provider burden, enabling healthcare professionals to focus on direct patient care.

INTEGRATION AND INTEROPERABILITY LAYER

National Health Identity Management:

- AI-powered duplicate detection ensuring patient safety and data integrity
- Integration with civil registry for authoritative demographic data and SSI
- Demographic data standardization ensuring consistency
- Cross-reference management maintaining relationships across organisations

Health Information Exchange (HIE):

- HL7 and FHIR-based architecture ensuring semantic interoperability across Lebanon's healthcare ecosystem
- Automated data transformation ensuring semantic consistency across languages
- Consent management integration protecting patient privacy
- Cross-facility care coordination improving continuity
- Integration with private sector expanding network coverage

Self-Organizing Mesh:

- AI-Powered integration hub advances standards and interoperability goals with self-learning data mappings and automatic conflict resolution.
- New systems can self-integrate without lengthy and complex manual configuration, dramatically reducing implementation timelines.

7.3. Architecture Governance

The technical architecture implementation is managed through the established e-Health Governance council structure outlined in Priority 5.1:

The council provides strategic direction for national digital health infrastructure, ensuring alignment with the National Health Strategy and broader national digital transformation agenda. Technical architecture decisions require council approval, particularly those affecting interoperability standards, data governance, and multi-stakeholder integration.

The Health Data Intelligence lab serves as the central coordinating entity for implementing Lebanon's health data analytics strategy, operating under the oversight of the e-Health Governance Council and managed by specialized data intelligence teams within the MoPH. The technical architecture directly supports the Lab's mandate to establish intelligent national health data layer that support advanced data intelligence capabilities.

The Health Informatics Team makes 65% of decisions, focusing on technical implementation, system design, configuration of standards, best practices, data management, interoperability, operations and support. This team leads the day-to-day technical architecture implementation, working closely with Stakeholder-Led Workgroups for requirements definition and validation.

Stakeholder-Led Groups make 25% of decisions, involving input from healthcare providers, patients, policymakers, and industry partners to ensure administrative and care standards are harmonized, inclusivity and based on consensus. Technical workgroups for Standards & Coding, Data Governance, and Innovation & Ecosystem Development provide domain-specific guidance for architecture components.

7.4. Deployment Architecture

Given local constraints and the governance established in Priority 5.1, the recommended approach in the short-term (2025-2030) is to leverage an intelligently distributed architecture:

Multi-Tier Deployment:

- **On-Premises:** Core HIS, PHC (PHENICS), EHR, PACS, and clinical data requiring maximum security
- **Private Cloud:** Credentialing, accreditation, supply chain and administrative systems
- **Government Cloud:** Multi-sectoral integration bus, SSI, public registries, and public health applications
- **Public Cloud:** Patient mobile apps and public analytics enabling broad accessibility

Intelligent Interconnectivity:

- All applications integrate through a self-organizing mesh layer
- Authentication managed via Digital Trust Infrastructure
- AI services consumed from centralized Intelligence Layer coordinated by the Health Data Intelligence Lab
- Semantic interoperability through Intelligent Data Layer following standards established by the Standards & Coding workgroup

7.5. Architecture components

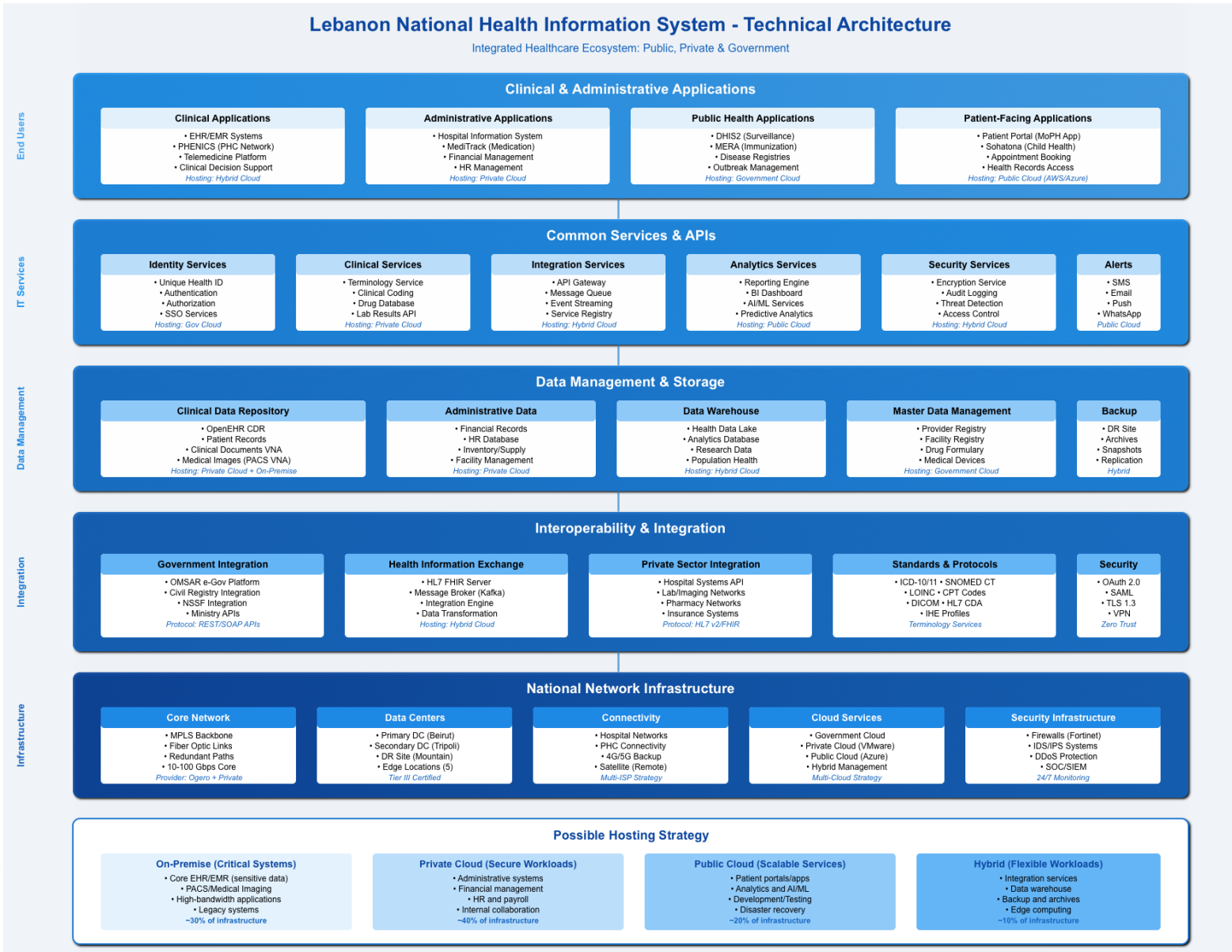
A microservices architecture enables healthcare applications to be decomposed into autonomous, loosely coupled services that can evolve independently, enhancing scalability and flexibility when handling varied workloads.

Interoperability and APIs by design can expose functionality of each component, enabling interoperability across diverse healthcare systems and technologies at the data and applications layers.

Cloud native applications can fully utilize cloud computing power, leveraging elastic scaling, automated recovery, and multi-region deployment for efficiency and resilience.

Software code and dependencies packaged into lightweight containers can ensure consistency across development, testing, and production environments, particularly important for locations prone to disconnections.

Automated deployment, repair, and scaling capabilities with comprehensive logging for all activities, ensuring high availability and self-healing capabilities essential for healthcare systems.


Lebanon National Health Information System - Technical Architecture
Integrated Healthcare Ecosystem: Public, Private & Government
End Users
Clinical & Administrative Applications
Clinical Applications
• EHR/EMR Systems
• PHENICS (PHC Network)
• Telemedicine Platform
• Clinical Decision Support
Hosting: Hybrid Cloud
Administrative Applications
• Hospital Information System
• MediTrack (Medication)
• Financial Management
• HR Management
Hosting: Private Cloud
Public Health Applications
• DHIS2 (Surveillance)
• MERA (Immunization)
• Disease Registries
• Outbreak Management
Hosting: Government Cloud
Patient-Facing Applications
• Patient Portal (MoPH App)
• Sohatona (Child Health)
• Appointment Booking
• Health Records Access
Hosting: Public Cloud (AWS/Azure)
IT Services
Common Services & APIs
Identity Services
• Unique Health ID
• Authentication
• Authorization
• SSO Services
Hosting: Gov Cloud
Clinical Services
• Terminology Service
• Clinical Coding
• Drug Database
• Lab Results API
Hosting: Private Cloud
Integration Services
• API Gateway
• Message Queue
• Event Streaming
• Service Registry
Hosting: Hybrid Cloud
Analytics Services
• Reporting Engine
• BI Dashboard
• AI/ML Services
• Predictive Analytics
Hosting: Public Cloud
Security Services
• Encryption Service
• Audit Logging
• Threat Detection
• Access Control
Hosting: Hybrid Cloud
Alerts
• SMS
• Email
• Push
• WhatsApp
Public Cloud
Data Management
Data Management & Storage
Clinical Data Repository
• OpenEHR CDR
• Patient Records
• Clinical Documents VNA
• Medical Images (PACS VNA)
Hosting: Private Cloud + On-Premise
Administrative Data
• Financial Records
• HR Database
• Inventory/Supply
• Facility Management
Hosting: Private Cloud
Data Warehouse
• Health Data Lake
• Analytics Database
• Research Data
• Population Health
Hosting: Hybrid Cloud
Master Data Management
• Provider Registry
• Facility Registry
• Drug Formulary
• Medical Devices
Hosting: Government Cloud
Backup
• DR Site
• Archives
• Snapshots
• Replication
Hybrid
Integration
Interoperability & Integration
Government Integration
• OMSAR e-Gov Platform
• Civil Registry Integration
• NSSF Integration
• Ministry APIs
Protocol: REST/SOAP APIs
Health Information Exchange
• HL7 FHIR Server
• Message Broker (Kafka)
• Integration Engine
• Data Transformation
Hosting: Hybrid Cloud
Private Sector Integration
• Hospital Systems API
• Lab/Imaging Networks
• Pharmacy Networks
• Insurance Systems
Protocol: HL7 v2/FHIR
Standards & Protocols
• ICD-10/11 • SNOMED CT
• LOINC • CPT Codes
• DICOM • HL7 CDA
• IHE Profiles
Terminology Services
Security
• OAuth 2.0
• SAML
• TLS 1.3
• VPN
Zero Trust
Infrastructure
National Network Infrastructure
Core Network
• MPLS Backbone
• Fiber Optic Links
• Redundant Paths
• 10-100 Gbps Core
Provider: Ogero + Private
Data Centers
• Primary DC (Beirut)
• Secondary DC (Tripoli)
• DR Site (Mountain)
• Edge Locations (5)
Tier III Certified
Connectivity
• Hospital Networks
• PHC Connectivity
• 4G/5G Backup
• Satellite (Remote)
Multi-ISP Strategy
Cloud Services
• Government Cloud
• Private Cloud (VMware)
• Public Cloud (Azure)
• Hybrid Management
Multi-Cloud Strategy
Security Infrastructure
• Firewalls (Fortinet)
• IDS/IPS Systems
• DDoS Protection
• SOC/SIEM
24/7 Monitoring
Possible Hosting Strategy
On-Premise (Critical Systems)
• Core EHR/EMR (sensitive data)
• PACS/Medical Imaging
• High-bandwidth applications
• Legacy systems
~30% of infrastructure
Private Cloud (Secure Workloads)
• Administrative systems
• Financial management
• HR and payroll
• Internal collaboration
~40% of infrastructure
Public Cloud (Scalable Services)
• Patient portals/apps
• Analytics and AI/ML
• Development/Testing
• Disaster recovery
~20% of infrastructure
Hybrid (Flexible Workloads)
• Integration services
• Data warehouse
• Backup and archives
• Edge computing
~10% of infrastructure

8. ROLES AND RESPONSIBILITIES

Clearly defining accountability and responsibility builds trust and transparency. The below can be used to jump-start discussions among stakeholders. It designates which entities are Responsible for specific actions, which are Accountable, who must be Consulted, and who needs to be Informed. While this matrix provides a helpful baseline to map responsibilities across the six digital health transformation priorities, it is only a sample. The e-Health Governance council needs to review, refine, and update the roles and assignments to ensure the RACI fully aligns with evolving priorities, available resources, and Lebanon's broader health strategy. By collaboratively revisiting and validating each designation, the council can promote transparency and clear responsibilities to minimize overlaps or gaps, and ensure greater ownership of each initiative, paving the way for faster progress.

Stakeholder Priority	MoPH	Other Government Entities (OMSAR, Interior, Finance, etc.)	Healthcare Providers	Professional Associations & Academia	Development Partners & NGOs	Private Sector & Industry	Patient Groups & Civil Society
5.1 e-Health Governance & IT	A/R*	R	C	C	C	C	I
5.2 Human-Centred Care	A/R*	I	R	C	C	C	C
5.3 Workforce Development	A/R	R	R*	R	C	C	I
5.4 Standards & Interoperability	A/R*	R	R	C	C	R	I
5.5 Policies & Regulations	A/R	R*	I	C	C	I	C
5.6 e-Health Innovation Ecosystem	A/R	C	R	R*	R	R	C

R*: Primary Responsible to implement **R**: Shares Responsibility

A: Accountable (Ultimately answerable for completion and success)

C: Consulted (Provides input before and during implementation)

I: Informed (Kept updated on progress and decisions)

8.1. Stakeholders

Ministry of Public Health (MoPH)

- Lead digital health policy formation
- Enforce regulations and standards
- Chair governance council
- Coordinate nationwide e-health rollouts

Other Government Entities

- OMSAR: National digital transformation strategy
- Ministry of Interior: Provide national digital identity framework
- Ministry of Finance: Facilitate budget allocations
- Ministry of Telecommunications: Support nationwide broadband expansion
- Ministry of Education: Support digital health education programs
- Municipalities
- Others

Healthcare Providers

- Implement digital health solutions
- Adhere to national Standards and Interoperability Priority 5.4)
- Provide feedback on clinical workflows
- Participate in standards development
- Support staff training and adoption

Professional Associations and Academia

- Lead capacity-building programs
- Contribute to standardizing clinical protocols
- Promote local-driven innovations

Development Partners and NGOs

- Provide technical expertise and funding
- Support program implementation
- Facilitate knowledge transfer

Private Sector and Industry

- Develop and maintain technical solutions
- Ensure compliance with national standards
- Support innovation and scalability

Patient Groups and Civil Society

- Provide input on user experience
- Advocate for privacy and transparency
- Ensure patient-centred design

Considerations

- This matrix emphasizes collaboration while recognizing resource limitations
- Implementation is phased to allow for resource planning and prioritization
- Primary responsibilities (R*) indicate leadership role, while shared responsibilities (R^) indicate specific contribution areas
- The e-Health Governance Council should review this matrix annually and adjust based on progress and evolving context

8.2. Priority Quick Wins and Resource-Sharing Opportunities

e-Health Governance & IT

- **Quick Win:** Establish a lightweight coordination committee using existing meeting structures.
- **Resource Sharing:** OMSAR to provide IT expertise while MoPH contributes health domain knowledge.

Human-Centred Care

- **Quick Win:** Conduct user research with providers and Patient Groups to inform needs and design principles.
- **Resource Sharing:** Healthcare Providers offer clinical settings for testing; Patient Groups provide user feedback.

Workforce Development

- **Quick Win**: Inventory of existing digital skills training programs across all sectors and opportunities to integrate new programs in professional healthcare education.
- **Resource Sharing:** Ministry of education and academic institutions provide educational frameworks; Development Partners contribute to building training programs.

Standards & Interoperability

- **Quick Win**: Adopt internationally recognized core standards rather than creating new ones. Identify opportunities to pilot.
- **Resource Sharing:** Development Partners provide technical guidance; Private Sector contributes implementation expertise.

Policies & Regulations

- **Quick Win**: Prioritize 2-3 critical policy areas that can support interoperability based on stakeholder consensus.
- **Resource Sharing:** MoPH leads policy development; Other Government Entities support with legal framework expertise.

e-Health Innovation Ecosystem

- **Quick Win**: Create showcase of existing digital health innovations in Lebanon
- **Resource Sharing:** Private Sector leads with technology solutions; Academia contributes evaluation methods; Development Partners provide seed funding

8.3. Consultation Mechanisms

Ensuring Efficient Consultation Without Creating Additional Burdens

- Quarterly stakeholder forums for each priority area
- Online feedback platform for continuous input
- Biannual review of RACI effectiveness and adjustments as needed
- Knowledge-sharing webinars led by different stakeholder groups

9. CONCLUSION

Lebanon's Digital Health Transformation Strategy represents a pivotal moment in the nation's healthcare evolution, offering a roadmap that transforms current constraints into catalysts for innovation that enable the NHS 2030 and beyond. Despite facing unprecedented economic challenges, infrastructure limitations, and workforce pressures, this strategy elaborates that meaningful transformation is not only possible but essential for Lebanon's future.

9.1. Strategic Achievements and Vision

The strategy provides a framework through six interconnected transformation priorities that address Lebanon's unique healthcare challenges while aligning with global best practices. By prioritizing e-Health Governance and IT Leadership as the foundational element, the strategy ensures coordinated implementation across all initiatives. The emphasis on Human-Centred Care places citizens at the heart of digital transformation, while robust Standards and Interoperability frameworks proposes an end to the fragmentation that has slowed Lebanon's healthcare ecosystem evolution.

The inclusion of an AI-native approach positions Lebanon to leapfrog traditional development pathways, following successful models from other resource-constrained nations, Lebanon can build a world-class digital health ecosystems. The strategy's vision for 2040, where AI-powered health assistants, integrated care delivery, and predictive analytics has become more plausible with recent advances icon health technologies. It is both ambitious and achievable given the phased implementation approach.

9.2. Addressing Critical Gaps

The strategy attempts to addresses heads-on Lebanon's most pressing healthcare challenges. The proposed Health Data Intelligence Lab provides critical evidence-based decision-making, while the e-Health Innovation Ecosystem creates pathways for sustainable local innovation. By establishing clear Policies & Regulations and investing in Workforce Development, the strategy tackles systemic barriers that have historically impeded progress.

It is particularly important to note, the strategy recognises that digital tools are a means to an end, as health transformation extends beyond technology adoption. The emphasis is on people, processes and the importance of change management for transparent trust and stakeholder engagement. This cultural transformation reflects international best practices identified by WHO's Global Strategy on Digital Health 2020-2025.

9.3. Implementation Realities

The strategy formulation was based on acknowledged constraints and strength through its scenario-based approach. By preparing for multiple futures, from the optimistic "Progressive" scenario to the more challenging "Grassroots" reality, the strategy priorities selected ensure resilience regardless of external circumstances. The phased implementation timeline, spanning from 2025 to 2040, allows for incremental progress while building toward transformative outcomes.

The governance structure, with its hybrid model balancing centralized oversight and decentralized implementation, reflects lessons learned from successful implementations globally. The 65% operational decisions delegated to the Health Informatics Team, balanced with 25% stakeholder-led decisions, creates an agile yet accountable framework aligned with OECD recommendations for digital government

9.4. Transformative Potential

Successfully implemented, this strategy can position Lebanon to transform to an integrated, proactive, and intelligent health ecosystem. The potential benefits are substantial:

- **Reduced administrative burden by 40-70%** through AI automation, freeing healthcare professionals to focus on patient care.
- **Improved diagnostic accuracy by over 90%** through AI-assisted clinical decision support.
- **Healthcare cost reductions of 15-20%** through operational efficiencies and preventive care.
- **Enhanced care coordination** through interoperable systems ensuring complete patient information at every point of care.
- **Strengthened public health response** through real-time surveillance and predictive analytics.
- **Enhanced care continuity** though interoperability and a national longitudinal CDR based on OpenEHR standards.

9.5. Critical Success Factors

The strategy's success relies on several key factors that require commitment:

1. **Political will and leadership**: The e-Health Governance Council must maintain unwavering commitment to digital transformation despite political changes and competing priorities.
2. **Financial sustainability**: While the strategy outlines diverse funding mechanisms, securing sustainable resources beyond initial donor support remains crucial. The estimated initial $5-10 per capita investment over 3-5 years must be mobilized through creative public-private partnerships. This excludes workforce augmentation.
3. **Stakeholder engagement**: The emphasis on "it takes a village" reflects the necessity of broad-based collaboration. Private sector innovation, academic excellence, and public sector must work together around shared objectives.
4. **Workforce transformation**: The ambitious workforce development plans, particularly the integration of digital health competencies from primary education through professional practice, require sustained investment, cultural change and multisectoral engagement.
5. **Trust and transparency:** Building public trust through transparent governance, robust data privacy, protection, and demonstrated value delivery is essential for widespread adoption.

9.6. Regional and Global Significance

This strategy aims to reposition Lebanon as a regional leader in healthcare excellence. By leveraging its multilingual capabilities, strong medical education tradition, and entrepreneurial spirit, Lebanon can leverage digital health solutions with regional and global relevance. The emphasis on creating an innovation ecosystem could transform Lebanon into a digital health hub for the Middle East, generating economic opportunities while improving health outcomes.

9.7. Call to Action

This Digital Health Transformation Strategy is a roadmap; it is an opportunity to re-imagine the vision for Lebanon's healthcare through innovation. Its success requires every stakeholder to move beyond traditional boundaries and embrace collaborative transformation. Healthcare providers must champion new workflows, technology partners must prioritize interoperability over proprietary interests, policymakers must create enabling environments, and citizens must actively engage with digital health tools.

The journey from crisis to transformation will not be easy, but the strategy provides a path that can be adapted. By starting with achievable quick wins while building toward long-term transformation, Lebanon can demonstrate that even in the face of significant challenges, visionary leadership and collaborative action can create a healthcare system that serves as a model for the region and beyond.

Finally, this strategy represents a call to action directed at policymakers, healthcare professionals, digital experts, innovators, and global partners to invest, collaborate, and actively participate in shaping a future-ready healthcare system that intelligently adapts to evolving health needs, promotes inclusivity, and ensures accessibility for all.

Recognizing that there may be varying perspectives on priorities and implementation approaches, efforts should focus on building consensus by adapting and enhancing existing initiatives and augmenting them with new ones. By leveraging and refining what has already been initiated, stakeholders can provide continuity and accelerate progress, maximize resources efficiency, and maintain continuity in healthcare transformation. This foundational roadmap should be seen as a living document, continuously evolving through ongoing engagement, iterative refinements, and the collective expertise of stakeholders committed to strengthening and sustaining Lebanon's healthcare system.

10. APPENDIX

10.1. Glossary & Abbreviations

Glossary

Access Control: Implementing policies and mechanisms to restrict or permit access to health information systems, ensuring that sensitive data is available only to authorized personnel.

AI diagnostics: The use of artificial intelligence to analyse medical data, detect diseases, and assist in diagnosing conditions.

AI-driven decision making: The use of artificial intelligence to analyse data and identify patterns to support informed decision-making processes.

AI-triage: Artificial intelligence-powered systems that determine the priority of patients' treatments based on the severity of their condition.

Artificial Intelligence (AI): Machines or software that learn from data and perform tasks requiring human intelligence.

Audit and Monitoring: Continuously tracking and reviewing access and activities within health information systems to detect and respond to unauthorized access or anomalies.

Authorization: Determining and granting appropriate access levels to users based on their roles and responsibilities within the healthcare organization. This ensures that individuals can only access information pertinent to their duties.

Backcasting: Planning method that starts with a desired future and works backwards to identify policies and programs that connect that future to the present.

Biomedical Data: Data collected in biological and medical contexts, used for research, diagnosis, and treatment.

Blockchain-based audit logs: Tamper-proof, decentralized records of transactions or activities stored on a blockchain ensuring data integrity, transparency, and security.

Change management: Approach to transition individuals, teams, and organizations to a desired future state, particularly in adopting new technologies.

Clinical Data Repository (CDR) or Clinical Data Warehouse (CDW): A real time database that consolidates data from a variety of clinical sources to present a unified view of a single patient.

Cloud computing: Delivery of services through the Internet, including data storage, servers, databases, networking, and software.

Co-creation labs: Structured sessions where stakeholders, including end-users, developers, clinicians, and policymakers, collaboratively design or refine digital health solutions in real time.

Costing roadmap: A strategic plan that outlines the steps, timeline, and resources required to estimate, track, and manage costs throughout a project.

Data analytics: The process of collecting, processing, and analysing data to uncover patterns, insights, and trends.

Data governance: The set of policies, standards, and processes ensuring data's availability, quality, consistency, and security throughout its lifecycle.

Digital governance: Frameworks, policies, and processes that guide the use, management, and security of digital technologies to ensure transparency, accountability, and effective decision-making.

Digital health (tools): Use of digital technologies to improve health, healthcare services, and wellness.

Digital health ecosystem: The integrated network of health-related digital services, policies, and ICT capabilities within a specific context.

Digital health infrastructure: The foundational technology systems, including networks, data centres, cloud computing, and software, that support digital connectivity and services.

Digital health literacy: The ability to access, understand, evaluate, and use digital health information and technologies to make informed health decisions.

Digital health readiness: The capacity of a healthcare system to adopt and effectively use digital health technologies.

Digital identity: A method for obtaining authentication and accessing online services.

Digital inclusion: The practice of ensuring that all individuals, regardless of their background or circumstances, have access to and can effectively use digital technologies and services.

Digital literacy: The capacity to locate, utilise, create and share content responsibly via information technologies and the Internet, encompassing not just basic navigation but also critical thinking regarding online risks.

eGovernement (health) services: Digital government platforms and systems that facilitate healthcare administration, public health management, and citizen access to medical services.

eHealth: Using information and communications technology (ICT) to support various health-related fields, including healthcare services, health surveillance, health education, literature and research, including mHealth.

Electronic Health Records (EHRs): Digital versions of patients' paper charts, real-time, patient-centred records.

End-to-end encryption: A security method that ensures data is encrypted on the sender's device and only decrypted on the recipient's device, preventing third parties (including service providers) from accessing it.

Governance: Frameworks, policies, and rules managing data and system use within digital health initiatives.

Healthcare system: A healthcare system refers to the organized network of institutions, resources, policies, and people that deliver health services to meet the health needs of a population. It includes all public and private sector entities involved in the financing, management, provision, and regulation of health care, from primary care to specialized services. A well-functioning healthcare system ensures equitable access to quality services, protects individuals from financial hardship, and improves population health outcomes, while adapting to demographic, technological, and epidemiological changes.

Health Information Systems (HIS): Digital systems, networks, and technologies that support the storage, processing, and exchange of information.

Health promotion: Process of enabling people to increase control over and improve their health.

Identification and Authentication: Verifying the identity of users (such as healthcare providers, patients, and administrative staff) through credentials like usernames, passwords, biometric data, or multi-factor authentication methods.

Information and Communication Technologies (ICT) infrastructure: Digital systems, networks, and technologies that support the storage, processing, and exchange of information.

Interoperability: The ability of diverse IT systems to communicate and exchange data across different platforms.

Longitudinal care: Supports individuals throughout their entire care journeys.

Longitudinal records: A longitudinal record, in the context of healthcare, is a single, comprehensive patient record that captures and stores a patient's health information over time, providing a holistic and continuous view of their medical history.

mHealth (Mobile Health): Medical and public health practice supported by mobile devices and apps.

National Health Information System: NHIS is an organized network of resources and processes that collect, process, and disseminate health-related information to support evidence-based decision-making and improve population health.

Non-communicable diseases (NCDs): Chronic conditions that cannot be transmitted between individuals and typically require long-term management.

Patient App / Portal: Healthcare frameworks and technologies designed to prioritise individual patient needs.

Patient-centred systems: Healthcare systems or technologies designed to prioritise patient needs, preferences, and experiences.

Personal health records (PHR): Health records maintained by patients, detailing their health histories and treatments.

Preventive healthcare: Medical care focused on disease prevention and health maintenance.

Provider Directory: A comprehensive list of healthcare professionals, facilities, and services associated with a specific health insurance plan or healthcare network. It typically includes detailed information such as provider names, specialties, practice locations, contact details, hospital affiliations, and their acceptance of new patients.

Real-time data analytics: The process of analysing data as it is generated or received, providing immediate insights to support timely decision-making and actions.

Regulatory compliance tools: Digital solutions that help organizations adhere to laws, operational standards and guidelines.

Regulatory sandbox: A framework that allows live testing of innovations in a controlled setting with regulatory oversight, enabling regulators and innovators to assess risks, compliance needs, and benefits before full-scale deployment.

Remote patient monitoring: The use of digital technologies to track patients' health data, such as vital signs, outside of traditional healthcare settings, enabling continuous care and early detection of potential issues.

Risk management: Process of identifying, assessing, and controlling threats to an organisation's resources and earnings.

Sandbox: a framework that allows live testing of innovations in a controlled setting with regulatory oversight, enabling regulators and innovators to assess risks, compliance needs, and benefits before full-scale deployment.

Scenario planning: A foresight method used to explore plausible future states by considering megatrends, critical uncertainties, and strategic implications.

Social determinants of health: Economic and social conditions that influence individual and group differences in health status.

Stakeholder engagement: Involvement of individuals affected by or influencing the decisions made within a project.

Strategic foresight: Methodologies of systematically exploring future trends, uncertainties, and potential scenarios to inform decision-making, anticipate challenges, and seize opportunities.

Telehealth (Telemedicine): Healthcare services offered remotely using information and communication technologies.

Terminology Service: A software application designed to manage, interpret, and facilitate the use of standardized vocabularies and code systems within various domains, particularly in healthcare. It provides a set of functions that enable client applications to interact seamlessly with complex terminologies, ensuring consistent and accurate data representation across systems.

Universal health coverage (UHC): A healthcare system where all individuals have access to essential health services without facing financial barriers.

Value-based care (VBC): A healthcare delivery model that focuses on providing high-quality care while improving patient outcomes, with healthcare providers being reimbursed based on the value they deliver rather than the volume of services provided.

Voice-enabled assistants: Software applications that use speech recognition and natural language processing (NLP) to understand and respond to voice commands.

Wearable health technologies: Devices that can be worn on the body to monitor and track health-related data, such as heart rate and activity levels, providing real-time health insights.

Wind tunnelling: Method used to test strategies over the long term under various future scenarios.

Workforce development: Training and education strategies aimed at enhancing the skills and capabilities of healthcare workers.

Zero-trust architecture: A cybersecurity model based on the principle that no user or system is inherently trusted; continuous verification and strict identity management are utilised to protect resources.

Abbreviations

Abbreviation	Definition
2FA	Two-Factor Authentication
AI	Artificial Intelligence
AR	Augmented Reality
ATC	Anatomical Therapeutic Chemical Classification
AUB	American University of Beirut
CDA	Clinical Document Architecture
CDHO	Chief Digital Health Officer
CDR	Clinical Data Repository
CDSS	Clinical Decision Support Systems
CDW	Clinical Data Warehouse
CIO	Chief Information Officer
CMIO	Chief Medical Information Officer
CPD	Continuous Professional Development

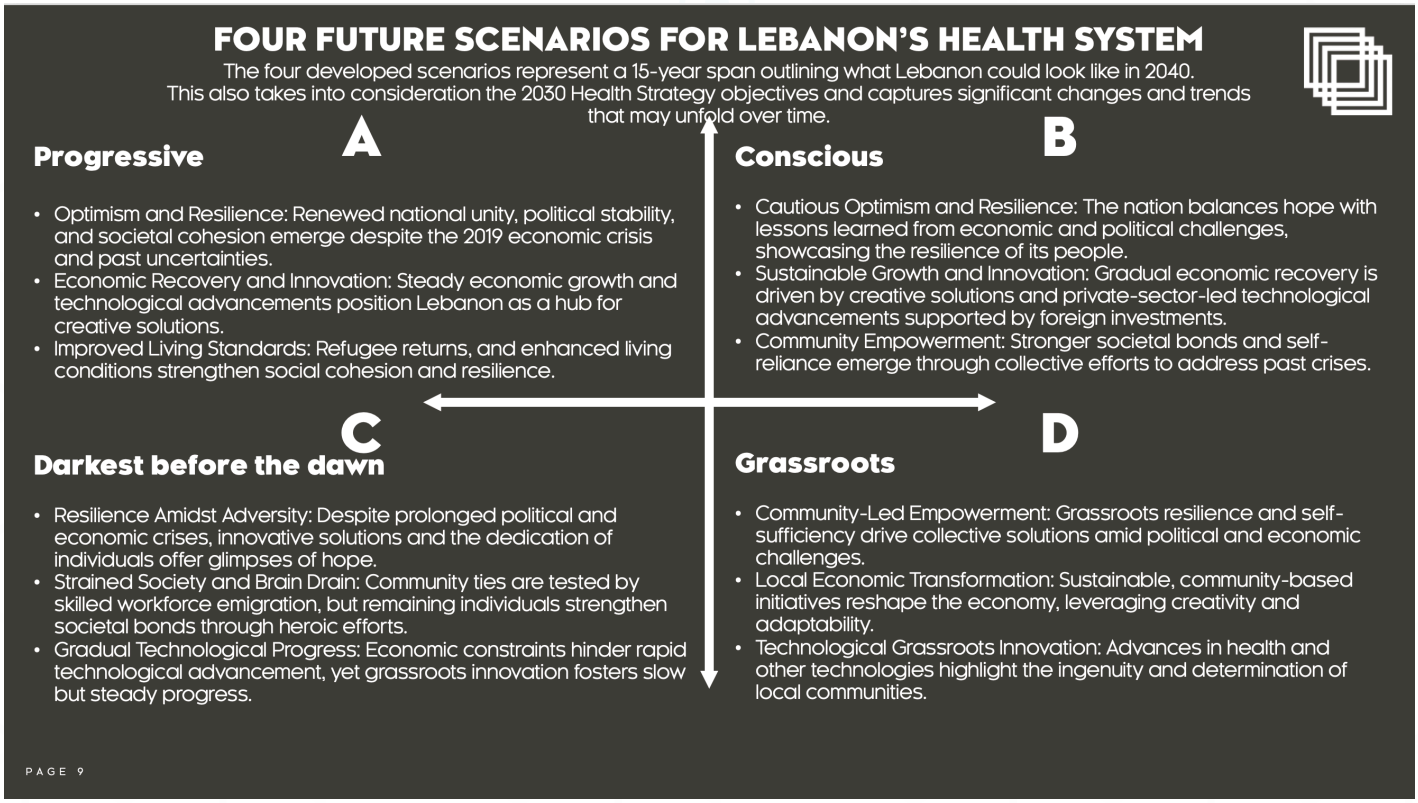
CPT	Current Procedural Terminology
CSR	Corporate Social Responsibility
DHHE	Digital Health & Health Education
DHIS2	District Health Information Software 2
DICOM	Digital Imaging and Communications in Medicine
DTU	Digital Transformation Unit (related to OMSAR)
EHR	Electronic Health Records
EMD	European Medical Device Directive
EPP	Electronic Patient Portal
EU	European Union
FDA	Food and Drug Administration
FHIR	Fast Healthcare Interoperability Resources
GDPR	General Data Protection Regulation
GIS	Geographic Information System
HIE	Health Information Exchange
HIS	Health Information Systems
HL7	Health Level Seven International
HTA	Health Technology Assessment
ICD	International Classification of Diseases
ICT	Information and Communication Technologies
IoMT	Internet of Medical Things
IT	Information Technology
ICT	Information and Communication Technologies
KPI	Key Performance Indicator
KPIs	Key Performance Indicators
LGIF	Lebanese Government Interoperability Framework
LIS	Laboratory Information System
LMS	Learning Management System / Logistics Management System
LOINC	Logical Observation Identifiers Names and Codes
M&E	Monitoring and Evaluation
MERA	Mobile Epi Registry Application
mHealth	Mobile Health
MITC	Ministry Committee of Information and Communication Technology
MoPH	Ministry of Public Health
NCDs	Non-Communicable Diseases
NGOs	Non-Governmental Organizations

NHS	National Health Strategy
NHIS	National Health Information System
NLP	Natural Language Processing
NMHP	National Mental Health Programme
NSSF	National Social Security Fund
NTU	Nanyang Technological University
OAuth	Open Authorization
OECD	Organization for Economic Co-operation and Development
OMSAR	Office of the Minister of State for Administrative Reform
PCM	Presidency of the Council of Ministers
PHC	Primary Healthcare Centre
PHENICS	Primary Healthcare Network Information and Communication System
PHEOC	Public Health Emergency Operations Centre
PHR	Personal Health Records
PII	Personal Identifiable Information
PPP	Public-Private Partnership
PREMs	Patient-Reported Experience Measures
PROMs	Patient-Reported Outcome Measures
PSO	Policy Support Observatory
QA	Quality Assessment
RACI	Responsible, Accountable, Consulted, Informed
RBAC	Role-Based Access Control
REST	Representational State Transfer
RFI	Request for Information
RFP	Request for Proposal
RMT	Remote Monitoring Technology
RPA	Robotic Process Automation
RPM	Remote Patient Monitoring
SDGs	Sustainable Development Goals
SMART	Specific, Measurable, Achievable, Relevant, Time-bound
SNOMED CT	Systematized Nomenclature of Medicine -- Clinical Terms
SOAP	Simple Object Access Protocol
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TG	Transformation Goal
TI	Transforming Initiative
TLS	Transport Layer Security

TPAs	Third-Party Administrators
TWFS	Transactions and Workflow System
UHC	Universal Health Coverage
UHID	Unique Health ID
UX	User Experience
VBC	Value-Based Care
VNA	Vendor Neutral Archive
VR	Virtual Reality
WHO	World Health Organization

10.2. Scenarios

Scenarios are narrative descriptions of possible futures. They are not meant to predict what will happen, but rather to help participants imagine different possibilities. By exploring these scenarios, individuals can better understand the range of potential challenges and opportunities the future might hold. The goal isn't accuracy, but to create a shared vision that guides today's strategic decisions. This way, organizations can act now to shape a more desirable future. The below scenarios represent what the Lebanon and the health system looks like in 2040.



Scenario Comparison Table

The below table compares the scenarios against perspectives shared and discussed with stakeholders during the workshops.

Perspective	Scenario A Progressive	Scenario B Conscious	Scenario C Darkest Before Dawn	Scenario D Grassroots
Optimism	HIGH	MED-HIGH	MED	MED
Economic Recovery	HIGH	MED-HIGH	LOW-MED	LOW
Living Standards	HIGH	MED	LOW-MED	MED
Healthcare Coverage	HIGH	MED	LOW	MED
Community Empowerment	HIGH	HIGH-MED	MED	HIGH
Sustainable Growth	HIGH	MED	MED	LOW
Resilience to Adversity	HIGH	HIGH	HIGH	HIGH
Brain Drain	LOW	LOW-MED	HIGH	HIGH
Technological Progress	HIGH	HIGH	MED	MED-LOW

Best Alignment with Strategy Goals

While Scenario A represents an ideal outcome, it may be overly optimistic given Lebanon's current challenges. Scenario B provides a more realistic pathway that still achieves the strategy's core objectives through a phased approach, strong governance and stakeholder engagement. It represents a balance between the human-centred needs and technological advancement that could feasibly be implemented if resources are made available.

Balanced Realism and Ambition

We need to acknowledge Lebanon's significant challenges while maintaining optimism about transformation. Scenario B's "cautious optimism" mirrors this approach, recognizing both constraints and opportunities.

Multi-Stakeholder Collaboration

There is a need for extensive stakeholder engagement and public-private partnerships. Scenario B highlights the crucial roles of private actors, partners, civil society, and the "optimists vs realists" dynamic, reflecting the collaborative governance model proposed.

Trust and Transparency Focus

Scenario B emphasize rebuilding and maintaining public trust through transparency and accountability. Transparent e-health governance is core for successful digital health transformation. This also aligns with the strategy's human-centred care priority and data governance principles.

Sustainable Innovation

The scenario's focus on gradual, sustainable growth through innovation matches the strategy's approach of building an e-Health Innovation Ecosystem that balances immediate needs with long-term transformation.

Technology Integration with Human Elements

Scenario B outlines a plausible future where AI solutions augment capabilities while maintaining the human engagement that reflect the culture and hence the strategy's emphasis on workforce development and human-centred digital solutions.

Scenario A: Progressive

LEBANON GENERAL

In the wake of the severe economic crisis and political uncertainties of 2019, Lebanon has experienced a profound transformation, driven by a combination of visionary leadership and significant structural reforms. Amidst a renewed sense of optimism and unity, the nation is characterized by a forward-looking perspective, with citizens actively engaged in shaping their future. This resurgence of hope has been fuelled by a new generation of leaders committed to transparency, accountability, and efficiency, fostering a climate of political stability through comprehensive reforms. These changes include innovative recruitment strategies and fiscal measures such as sin taxes, alongside a strategic emphasis on decentralization in the beginning to ensure a smooth transition to a central leadership that earned the population's trust.

Economically, Lebanon is witnessing a steady recovery, with robust growth in sectors like health tourism, technology manufacturing, agriculture, and banking. This economic revival is underpinned by sound fiscal policies and a boost in foreign investments, further supported by reforms aimed at rebuilding public trust and fostering local industries. The return of approximately 80-90% of refugees has alleviated significant pressures on Lebanon's healthcare systems and economy, contributing to societal stability.

Cultural shifts are also evident across the country, from advancements in waste management and universal health coverage to the introduction of free education. The stability and burgeoning growth potential of Lebanon have attracted a substantial return of the Lebanese diaspora and foreign talent, enriching the nation's cultural and intellectual fabric. Additionally, progressive laws enabling civil marriage and the acquisition of nationality through maternal lineage have made it easier for people to settle and build lives in Lebanon.

Technologically, Lebanon has positioned itself as a hub for innovation, with significant investments in digital infrastructure, healthcare technology, and renewable energy sources. The introduction of unique IDs, widespread adoption of telemedicine, robust internet connectivity, a reliable electrical grid, and comprehensive e-government services are seen as pivotal in supporting other sectors and ensuring sustainable progress. This holistic approach has not only restored public faith in governance but has also set Lebanon on a path of promising and inclusive growth, where technological advancements play a crucial role in the nation's overall advancement.

LEBANON HEALTH SYSTEM

The health system of Lebanon is inextricably linked to the overall status of the country and is therefore characterised by reliability, accessibility and comprehensiveness. In this model, out-of-pocket expenditures have been eliminated, introducing instead non-monetary transactions such as deductions from monthly salaries for expensive medical procedures. This model alleviates immediate financial burdens for a large part of the population and ensures that financial constraints do not hinder access to care. Moreover, the integration of advanced technologies such as unique

IDs, telemedicine, enhanced internet connectivity enabled a revolution in the landscape of medical devices for non-invasive monitoring. Examples include smart patches that enable continuous health monitoring without invasive procedures aligning the national push towards a more robust digital infrastructure. Key private hospitals have expanded their use of telemedicine and electronic health records (EHRs), while rural areas have gained better, though still limited, access to digital health services through targeted government initiatives and NGO support.

The Ministry of Public Health is addressing the balance between public and private sectors by streamlining healthcare delivery. Primary and secondary care remains in the public sector and there are clear referral pathways for tertiary care in the private sector. In addition to make interaction with the healthcare system easier for Lebanese citizens, this strategy is a part of a broader initiative to ensure preparedness for emergencies such as natural disasters of pandemics. Public hospitals have received incremental but impactful upgrades, reducing the quality gap with private facilities. Public health initiatives are now more consistent and better funded, leading to successful vaccination drives and enhanced chronic disease management programs.

Academic institutions are dynamically adapting to these changes by tailoring educational programs to produce a workforce that meets the specific health needs of the population. The implementation of a comprehensive healthcare workforce retention policy is crucial for retaining skilled professionals within Lebanon, thereby strengthening the overall quality of healthcare services. The brain drain issue has been partially mitigated by policies encouraging the return of Lebanese healthcare professionals from the diaspora.

Amidst these positive developments, concerns about health data confidentiality, particularly in the context of genetic information, remain a significant issue. Questions about data ownership and privacy reflect growing concerns about the potential misuse of personal health information by insurance companies to adjust premiums. Ensuring that genetic data remains confidential and is not exploited for profit-driven adjustments in insurance rates is essential to maintaining trust in the healthcare system.

Scenario B: Conscious Scenario

LEBANON GENERAL

A cautious optimism prevails, tempered by the lessons of the severe economic crisis and political uncertainties, and strengthened by the resilience of the people. A spirit of pragmatism and innovation defines this era, with private actors and the diaspora playing key roles in driving development and offering solutions where the public sector falls short. Trust in the nation has been restored, and the community is committed to maintain trust to avoid repeating past cycles of corruption. The diaspora plays a key role in building this trust and in driving development especially in areas where the public sector falls short.

The political landscape shows signs of direction and purpose, largely due to the commitment of civil servants and the public's push for transparency and stability. Due to the political instability of the past, there are members of the community that believe change will only happen when they see it who call themselves the realists. However, there is a strong vocal group of people who call themselves the optimists that believe in renewed trust and are actively pushing for transparency in politics which leads to the decline of the influence of earlier politicians and the emergence of new political faces at the helm of this movement. Slowly, the optimists are convincing the realists and bringing more and more people over to their side. One of the core elements both groups agree on is implementation of an electronic voting system which is still in progress and has been tested for the election of the currently sitting President in 2040.

Economic development is characterized by gradual, sustainable growth, leveraging the innovative and creative solutions that emerged during times of crisis. Startups and hybrid businesses were already finding opportunities amidst the crises reflecting the community's resilience. By 2040, growth is expected in productive industries and Lebanon has a massive potential in capitalising in its fuel resources to bolster the economy. The economy benefits from a diversification push led by the private sector focusing on using the newfound fuel resources to develop innovative renewable energy solutions to make sure the country remains sustainable.

Society has become more self-reliant, with individuals and communities often stepping in to provide services and support in the absence of robust government action. This has fostered a strong sense of community and solidarity especially among the optimists. The realists are still sceptical because some decisions need to be made on the political level, and they are very resistant to change. Due to more regional stability, many refugees can return to their homelands and the rights and benefits for Lebanese citizens are gradually restored and strengthened. While international organizations continue to provide critical support, government policies have only partially addressed the needs of refugee populations.

The private sector, fuelled by foreign investments and the capitalisation of fuel resources, partner with academia and the public sector leadership to collaborate on technological advancements. Most notable implementations include e-government, adjustments of the curriculums at higher education facilities, and integration of AI in some areas. Certain jobs are replaced by AI while it also creates new opportunities, benefiting Lebanon as they were at the forefront of implementing AI in the

curriculums. While Lebanon is catching up in some respects, there are many foreign internationals coming to Lebanon for the great educational opportunities.

LEBANON HEALTH SYSTEM

Residents in Lebanon, empowered by the progressive healthcare reforms, have complete control over their health records by 2040. This paradigm shift enables individuals to grant or restrict access to their records as necessary, thereby enhancing data protection and increasing public trust in the healthcare system. This model of healthcare not only empowers patients but also ensures greater confidentiality and accessibility to healthcare services. Such advancements reflect a societal shift towards greater autonomy and trust, aligning with the broader theme of transparency and efficiency that has rejuvenated the national spirit.

Digital health experts are capitalizing on this momentum to propose the creation of a common, interoperable data hub. This initiative would standardize data systems across all ministries, improving health monitoring, analysis for future studies, and prevention strategies. The integration of cutting-edge technologies, such as smartwatches that store individual health records and augmented reality applications in medical treatment, is set to further enhance healthcare delivery. These innovations are part of a broader push towards a more technologically integrated Lebanon that was earlier described as becoming a hub for innovation.

From the Ministry of Public Health's (MoPH) perspective, the use of such data hubs is pivotal for efficiently monitoring and containing disease outbreaks. The MoPH also supports the tailored application of artificial intelligence (AI) in healthcare. By personalizing AI scripts, Lebanon aims to enhance healthcare delivery while maintaining human employment within the sector, thus building trust in new technologies and sustaining economic stability.

Academics contribute to this evolving scenario by focusing on the application of AI in healthcare, underscoring the need for a healthcare workforce trained to customize AI tools to meet specific needs. Moreover, the academic community is keen on enhancing digital health literacy. Leveraging popular social media platforms like TikTok and Instagram, they propose engaging the public through educational content that reflects contemporary trends, as seen during the COVID-19 pandemic with viral health challenges. This approach not only educates but also embeds a culture of health awareness among the population, particularly the youth.

Scenario C: Darkest Before the Dawn Scenario

LEBANON GENERAL

Amid years of economic and political difficulties, Lebanon is now witnessing a mood of resilience and growing hope, especially as signs of stability start to show around 2035. This spirit of perseverance is deeply rooted in the enduring efforts of visionary locals and dedicated public servants. Together, they are forging a path to a brighter future, inspiring the nation to rebuild and recover from its past challenges.

In the political realm, Lebanon has endured a long road of ongoing crises until a significant turnaround between 2035 and 2040. This change, spurred by improved regional stability and fresh attempts at political and economic reform, has started to alleviate long-standing issues, setting Lebanon on a hopeful course for recovery. These changes have not come easy, with plenty of hurdles still to overcome in reforming government operations and renewing public trust.

The economic landscape has also been marred by prolonged instability, compounded by the decreasing support from international aid organizations, who are experiencing donor fatigue. Yet, as 2040 approaches, there's a renewed sense of hope. The country is increasingly relying on its local industries like agriculture, healthcare, and technology, and starting to utilize its fuel resources more effectively with help from abroad. This shift is aimed at making Lebanon economically self-reliant and sustainable, reducing dependency on external aid.

On the societal front, Lebanon continues to grapple with challenges posed by both incoming refugees and the loss of skilled workers. Despite these pressures, international organizations like UNICEF and WHO have been critical in providing necessary support. At the same time, local educators are striving to revitalize Lebanon's educational system, working hard to return to the days when the country was known for its well-educated populace. Amid these challenges, the community's spirit of unity and solidarity has grown stronger, helping to hold the society together and fostering a sense of belonging and resilience among its members.

Technologically, Lebanon's progress has been slow due to financial constraints, with much of the innovation driven by private companies rather than the government. As stability starts to return, there has been a concerted effort to better integrate and improve essential technologies like telemedicine and electronic health records. Despite early challenges with these systems, efforts are underway to ensure they are streamlined and connected to serve the country better, enhancing healthcare accessibility and efficiency.

This scenario depicts a nation slowly finding its footing, navigating through its tumultuous past toward a more hopeful and stable future. The community's resilience and innovation are proving crucial in overcoming obstacles, illustrating a collective journey towards recovery and renewal.

LEBANON HEALTH SYSTEM

As Lebanon continues its transformative journey, the healthcare sector has emerged as a pivotal area of progress. Residents now experience improved healthcare services at their local Primary Healthcare Centres (PHC) or with General Practitioners (GP), where both preventative and curative services have reached high standards, facilitated by an efficient gateway referral system. This arrangement has simplified how residents access healthcare, ensuring timely and appropriate care.

Public perception of the healthcare system has undergone a significant shift, marked by an increase in trust and awareness of the services provided by PHCs. People now have a better understanding of the Universal Health Coverage (UHC) system and how to navigate it effectively, empowering them to engage more actively with their health management.

Digital health experts have played a crucial role in this transformation by implementing several innovative solutions. Every individual is assigned a unique ID to ensure interoperability across different healthcare platforms, enhancing the continuity and quality of care. Health Technology Assessment (HTA) has been pivotal in analysing the effectiveness, cost, and safety of medications and clinical methods, fully integrating these insights into a national data warehouse. Additionally, AI chatbots now serve as healthcare assistants, providing digital support to help patients navigate the system and utilize services effectively.

From the Ministry of Public Health's (MoPH) perspective, the collaboration with the private sector has been essential. This partnership has focused on utilizing digital tools and advanced navigation systems to enhance healthcare delivery and retain skilled healthcare professionals. The MoPH has also strengthened its governance and regulatory roles, including the operation of a fully functional quality control laboratory. However, challenges such as brain drain and the sustainability of resources were significant hurdles that have been addressed to ensure the long-term effectiveness of these reforms.

The academic sector in Lebanon has aligned with these developments. Academic institutions have introduced new majors specifically designed to equip students with the skills needed for the digital transformation of the healthcare sector. An emphasis on inter-ministerial collaboration ensures that educational programs are closely integrated with market needs and healthcare facilities. The activation of a national research unit has motivated students to pursue research degrees and engage actively in studies that could shape the future of healthcare in Lebanon.

These comprehensive efforts in healthcare reform—from enhancing service delivery at the local level to integrating advanced digital tools and fostering academic growth—reflect the broader narrative of a nation that is not only recovering but thriving. Lebanon's journey towards a technologically advanced, well-educated, and health-empowered society is a testament to its resilience and innovative spirit, driving it toward a future where healthcare is accessible, effective, and trusted by all its residents.

Scenario D: Grassroots Scenario

LEBANON GENERAL

In Lebanon, a prevailing mood of community empowerment and self-sufficiency has taken root, driven by collective resilience and creative solutions emerging at the grassroots level. This culture of innovation and self-reliance flourishes, fuelled by local initiatives and a strong sense of national identity. However, as some grassroots initiatives evolved into private companies, concerns arose about them straying from their original community-centric goals, particularly as they began recognizing opportunities for profit.

Politically, grassroots movements have grown into a powerful force for change, reflecting the commitment and dedication of the Lebanese people amid ongoing uncertainties. These movements gained momentum due to the slow political process, eventually compelling the government to recognize the need for reform. Decentralized decision-making has become more prevalent, with communities actively participating in governance and shaping policies that directly impact their lives.

Economically, the country has witnessed a shift towards sustainable, locally driven initiatives that capitalize on the creativity and resilience honed during previous economic crises. The private sector, now a significant growth driver, heavily relies on Lebanese production. This has led to debates about fairness and equity, with some voices raising concerns over the private sector potentially reaping excessive profits. Particularly notable are some companies in the energy sector that started as grassroots initiatives but have grown into major organizations, prompting discussions about their commitment to societal responsibilities.

In society, volunteerism and community service are widespread, contributing to strong social cohesion and a united force for change. Although refugees remain in the country, their integration has been challenging due to the private-sector-led model. Nevertheless, they participate in grassroots initiatives, supported by international organizations such as UNICEF and the UNHCR, to help ensure they receive fair treatment. Many Lebanese people continue to volunteer at local organizations that prioritise community service over profit-making.

Technological innovation at the grassroots level, particularly in renewable energy and sustainability, reflects the creativity and determination of the Lebanese despite economic constraints. This also aligns with the country's shift towards self-sufficiency. Technology use has significantly increased across society, although the rollout has been somewhat uncoordinated. Individual initiatives have managed to expand to cover larger cities, but rural areas often remain underserved. Additionally, the lack of centralised coordination sometimes leads to conflicts, especially when residents need to access services outside their local jurisdiction.

LEBANON HEALTH SYSTEM

In Lebanon, the evolving healthcare landscape is marked by a complex interplay of trust, innovation, and private sector dominance, reflecting broader societal trends and concerns. Residents, while benefitting from the high accessibility of health services, express mistrust towards the private sector due to perceived high costs, inequities, and questions about the quality and availability of treatment. Despite these concerns, the health service system is noted for being well-organized and familiar to those it serves, offering a fragmented yet accessible care structure.

There is a substantial profit potential within the digital health sector which is beneficial when used to support awareness campaigns and health initiatives. This potential for profit, however, raises concerns about the possibility of mismanagement. Innovations in remote health surveillance and community involvement in prevention initiatives are expected to advance, yet there are apprehensions about the adequacy of public infrastructure to support these advancements effectively due to lack of coordinated efforts from the government.

For the Ministry of Public Health (MoPH), there is a critical opportunity to unify data for various surveillance purposes, which enhanced digital literacy and provide the necessary resources to keep pace with digital health trends globally. However, the dominance of the private sector, particularly centred around non-governmental organizations (NGOs), presents challenges, including infrastructure inadequacies, human resource limitations, and concerns about logistic capacities such as the availability of hospital beds and medical trolleys. Funding limitations and questions about the sustainability of health initiatives further complicate the landscape.

Academic institutions stand to benefit from these shifts, with enhanced research platforms and improved data analysis capabilities that maximize research outcomes. There is a growing emphasis on training and educating healthcare workers and interested citizens in health information, data analysis, and communication. Furthermore, awareness campaigns deployed in schools, colleges, and cities aim to educate the public about new health trends. These campaigns emphasize the importance of volunteering and teamwork, crucial components for fostering a collaborative and informed community.

10.3. e-Health governance & Health Leadership Roles and Responsibilities

Entity	Stakeholders	Roles & Responsibilities	Interactions
e-Health Governance Council	– Ministry of Public Health (MoPH) Leadership – High-level delegates from other Ministries (ICT, Finance, etc.) – Civil society & patient representatives – Private healthcare sector leaders– Donor & NGO observers	– Set strategic directions for national e-health initiatives – Approve and prioritize e-health projects & funding – Enforce legislation & standards across the healthcare system – Ensure alignment with the National Health Strategy & broader digital transformation agenda – Fosters collaborative input. Major financial or policy decisions rely on a majority or weighted vote approach. – Build trust through transparency, publish monthly or quarterly updates on ongoing projects and spending, facilitating trust among citizens, donors, and the private sector. – Evaluate proposals based on feasibility, alignment with strategic priorities, return on investment, and alignment with established HTA, legal and technical standards. – Monitor implementation with real-time analytics tracking each initiative's progress. Senior stakeholders convene for periodic performance reviews and strategic adjustments.	– Convenes with non-MoPH stakeholders (e-Gov (OMSAR), and other Ministries) on cross-sectoral projects and laws – Collaborates with donors & NGOs for funding & capacity building – Coordinates with private sector health organizations to align priorities & facilitate policy compliance – Proposes policy shift to adapt laws to strengthen health services with digital solutions

Entity	Stakeholders	Roles & Responsibilities	Interactions
Workgroups (Doctors, Nurses, Pharmacy Services, Laboratory Services, Medical Imaging Services, Patient Portal, Supply Chain, eHealth Policies, Standards & Coding, Data Governance, Health Technology Assessment, Ambulatory Services, Others)	– Clinical professionals (physicians, nurses, pharmacists, lab technicians, imaging specialists, others) – Patient advocates & administrative staff – Regulatory/legal advisors (for policy sub-groups)– Informatics & standards experts	– Provide subject-matter expertise for specialized domains (e.g., pharmacy, lab, imaging, others) – Identify clinical requirements and validate workflows for digital health systems – Develop or refine policies, standards, and guidelines in respective focus areas	– Collaborates with external professional associations for licensure & best practices – Maintains relationships with software developers & device suppliers to ensure domain-specific compliance – Engages with donor/NGO technical experts for specialized training or resource mobilization in targeted sub-sectors

Entity	Stakeholders	Roles & Responsibilities	Interactions
Health informatics Leadership and Team	– MoPH Healthcare CIO or Chief Digital Health Officer (CDHO) – Senior IT managers within MoPH – Technical infrastructure experts – Health informatics analysts responsible for solutions (admin, clinical, financial) – Integrations experts – Database experts – Data analytics experts – Trainers – Service desk team – others	– Oversee technical roadmap & system architecture – Oversee definition of functional requirements in coordination with Stakeholder-led groups. - Responsible for digital health projects implementation and management. – Responsible for building open interoperability platform based on standards (HL7, FHIR, OpenEHR, etc.) – Manage cybersecurity, infrastructure. – Manage procurement in coordination with HTA team. – Responsible for data intelligence/analytics, – Provide guidance to sub-project IT teams – Offering in-depth training programs for existing staff, while also forging partnerships with universities and professional orders. – Standardize data collection, define medical terminology sets, and clarify privacy protocols. – Reengineer health administrative processes, like licensing, claims, or health record-keeping. – Ensures that technology and regulation reinforce each other, building a more consistent end-to-end patient experience. – push the entire ecosystem to modernize, incorporating AI-driven solutions for diagnostics, optimize care pathways or resource allocation, clinical decision support and workflow automation – others	– Coordinates with external technology vendors for solution development & deployment – Engages with telecom operators for connectivity enhancements – Partners with academic/research institutes for specialized IT training & pilot testing – Represent MoPH in e-heath innovation hub. - Interacts with private health sector technology teams to implement national standards others

10.4. Summary of SWOT

People & Capacity Building	
Challenges and Limitations	**Opportunities**
• Staff shortages and overburdened workforce, high risk • Skill gaps and limited exposure to emerging technologies • Resistance, low readiness to digital transformation • Healthcare workforce migration and imbalances • Low public engagement and digital literacy	• Strengthen and reorganize workforce and expand capacity • Enhance training and innovation exposure and create retention plan • Foster a culture of innovation, partnerships, and sustainability • Integrate digital health into national education and professional development • Empower communities with digital literacy and access
Policy & Governance	
Challenges and Limitations	**Opportunities**
• Fragmented and outdated digital health policies • Weak governance and oversight • Insufficient legal protections • Limited interoperability and data sharing • Lack of legal protections and standards • Weak national e-government services	• Clearly define what e-government support services and infrastructure • Strengthen national digital health governance • Enhance data governance adherence and protection • Strengthen policies to support standardized terminology and interoperability • Implement monitoring and evaluation frameworks
Digital Health Solutions	
Challenges & Limitations	**Opportunities**
• Fragmented digital health ecosystem • Outdated infrastructure • Overlap in functions • Gaps in solutions leading to reliance on manual and semi-digital systems • Low data quality and trust • Disparities between public and private facilities	• Review detailed gaps in solutions linked to admin and health services • Streamline and consolidate digital solutions • Standardize digital health systems & practices • Enhance digital health solutions in public health facilities, implement new solutions as needed • Reduce public-private sector disparities, promote PPP • Implement standards and interoperability framework for Lebanon • Build-up data governance and analytics

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