

# e-Health Implementation in Lebanese Teaching Hospitals: What Can We Learn from Their Successes and Imminent Challenges

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Abstract: We set on an exploration to learn from two major implementations of eHealth in teaching hospitals in Lebanon. After an explorative qualitative empirical work; we summarize learnings from these successes and present them as a backdrop for future studies. The main value of this study is in the discovery of the importance of technical and process readiness with an emphasis on dedicated stakeholder engagement to guarantee the successful outcome. The focus on the patient journey and the wellbeing of the practitioner in the new digital ecosystem are as important as financial preparation and infrastructure readiness. Researchers are still pondering the unintended consequences of EMR implementations and the effect of such implementations on the stakeholders of the healthcare ecosystem. In this paper, we argue that the road to success in the implementation of eHealth must be through stakeholder engagement as a means to increase the satisfaction of practitioners with the new work environment.

## 1 INTRODUCTION

*“e-Health is the cost-effective and secure use of information and communication technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research”* (WHA 58.28<sup>4</sup> & 66.24<sup>5</sup> Resolutions). Since more than two decades, e-health has taken center stage in the healthcare technology discourse (Eysenbach, 2001 and Healy, J., 2008). In 2015, the concept of, “eHealth for all”, was launched by the WHO in 2015 with a backdrop to support the sustainable development goal of “Good health and wellbeing for all” – SDG3.

eHealth, is a vast medium of software, hardware, and network facilities, focused on managing medical related data, audio or videos collection, storage and transmission amid all healthcare collaborators, turning the healthcare ecosystem into a boundless engine for diagnosis, treatment and prevention, fuelled by artificial intelligence relying on data

(Police et al, 2010). Technologies such as “telemedicine, m-health (mobile health), electronic medical/health records, etc.” make up this rich field of practice (Ahern et al, 2006).

At the point of care, eHealth is a platform for practitioners to enhance the quality of care via advanced systems to manage health records, make informed decision techniques using informatics applied to healthcare data from a patient or population. As a facilitator of equitable access to primary healthcare (Saleh, et al, 2018), eHealth has been touted for enhancing advanced research, achieving educational goals, formulating preventive approaches to disease and informing legislation (Minichiello et al, 2013).

### 1.1 The Context of Lebanon

For this paper, we choose the context of Lebanon. A small country in the eastern Mediterranean, with a population estimated around 4.8 Million and

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<sup>4</sup> <https://www.who.int/healthacademy/media/WHA58-28-en.pdf>

<sup>5</sup> [https://www.who.int/ehealth/events/wha66\\_r24-en.pdf?ua=1](https://www.who.int/ehealth/events/wha66_r24-en.pdf?ua=1)

healthcare expenditure around 6% GDP<sup>6</sup>. Growing to meet increasing demand on healthcare services, the Lebanese are in the process of adding more than 1,000 beds, as well as many operating rooms and intensive care units, to their hospitals. Established hospitals have allocated at least \$700 million to expand their premises, and improve the quality of their services (Business News, 2019). The American University of Beirut Medical Center has plans to add 135 hospital beds, and Hôtel-Dieu de France 115 beds, representing 20-30% additional capacity.

According to the Lebanese Ministry of Public Health (MoPH) in 2013, the national e-health program initiator, has set a primary objective to encourage and enable sharing of Health Information (MOPH, 2014). Local resources public and private have dedicated significant resources to improving the state of eHealth services. The American University of Beirut has collaborated with the MoPH to develop the country's digital health records (moph.gov.lb). The "Health Card" project was followed by point of use mobile APPs, developed by the WHO to locate available hospitalization resources with the use of Geographic Information System (GIS).

In Lebanon, a developing country, the majority of the primary care providers are ready to implement eHealth services (Saleh et al, 2016). However, the usage of the Information and Communication Technologies in primary health centres is still residual and reserved to highly financed institutions. Attempts have been made to improve the situation and obstacles are still extant to date, primarily due to lack of serving infrastructure such as internet and telecom services (Telecom Review, 2018), especially in underserved rural areas. Consequently, the Ministry of Public Health (MOPH) has announced the introduction of the first mass deployment of remote health in primary healthcare centres in the region. Using a technology designed to be deployed at home to remotely connect patients and physicians this solution offers the capability of running 16 different tests including ACG and sugar levels, for diabetic patients, etc. (Telecom Review, 2018) The deployment of tools and technologies continues to proliferate; hospital eHealth implementations are no exception.

## 1.2 Motivation

Shifting from traditional healthcare to e-health can be challenging, especially if the country's health sector has not quite evolved lately and rural areas still lack access to primary healthcare services. To date, the absence of e-health policy and standards, influenced by many other factors in the country, such as political instability, privatization control, and political power, have aggravated the impact of the high cost of technology, already hindered by the lack of funding resources in addition to budgetary constraints. The reluctance to change from the traditional health practice to e-health practice was also a significant factor.

Still, major hospitals have managed to successfully deploy health information systems such as the American University of Beirut (AUB) and Hotel-Dieu de France (HDF), focusing on the efficiency and speed of services in the hospitals' departments, optimizing and enhancing the practice, tracing, monitoring and evaluating in a transparent manner. Both hospitals are recognized today as the leading digital hospitals in the country.

As our brief literature review will show, the lack of fiscal expenditure and funding, non-conformity to standard and standardization can slow the rate of technology adoption in hospitals. The extant gaps related to technical requirements, staff's preparedness, motivation and computer's knowledge can hinder the implementation of innovation in a hospital setting – Especially in the case of teaching hospitals where a variety of distraction can add to the complexity of adoption.

Our aim is to learn about the factors and practices that led to such successful implementations and explore the adoption roadmap of these two pioneer teaching Hospitals in Lebanon. We set out on this project to answer the question of *"What were the facilitators of e-health implementation in Lebanese Hospitals?"*

Such learnings have the premise to establish a precedence and serve as an example for other health institutions in Lebanon, attempting to integrate eHealth into their practices. Our paper summarizes the empirical research launched to collect the evidence from these two institutions and draws some interesting conclusions.

<sup>6</sup>[https://www.who.int/ageing/projects/intra/phase\\_one/alc\\_intra1\\_cp\\_lebanon.pdf](https://www.who.int/ageing/projects/intra/phase_one/alc_intra1_cp_lebanon.pdf)

## 2 BACKGROUND

In preparation for the empirical research, we carried out an investigation of the existing research and found a scarcity of academic work published on facilitators of e-health development, implementation, maintenance and solutions in Lebanon. Expanding the scope of our review to include similar developing country settings, we identified three main themes related to financial factors, technical and process readiness and related sociodemographic factors of the healthcare delivery team.

### 2.1 Financial Factors

The lack of fiscal expenditure and funding is a barrier to e-health implementation in hospitals (King et al, 2012). Jha et al (2009) and Stroetmann et al (2011) agree that financial support, motivators and repayments are a positive contributor in the implementation process. Financial support from several funders such as pioneer banks and innovative technologies companies, who belong to the private sector, is a crucial enabler for the implementation process. Ajami & Bagheri-Tadi (2013) and Ross et al (2015) explain that the expenditure element may also become an obstacle, especially when selecting the funders, specifying the cost of the accessibility, networking process, obtaining the appropriate tools, continuous upgrading, evaluation and auditing, thus limiting the available funding sources. Ross et al, (2015) also highlight on the significance of having a clear contract between the vendor-installer, and the hospital-end user, where an unclear agreement between these stakeholders can lead to a hurdle in the implementation process.

### 2.2 Technical and Process Readiness

Standard and standardization are primordial in automating processes and paving the way for a successful implementation of a hospital system. Beyond the somewhat classical funding issue in such large scale and involved implementations, the lack of unified criteria and standards, anonymous knowledge of the expenditure (payers, cost), present remarkable and ad hoc changes in clinical workflow, eroding the trust and security in the radical shift from paper to electronic work (Collins et al, 2014). The early and comprehensive assessment of the infrastructure, identifying the gaps related to requirements, and the diligent preparation of the infrastructure are crucial prerequisites for a solid start of the implementation project (Hamadeh, 2019). The lack of hardware

portability, or slack of software and hardware upgrades are as damaging as the inadequate electrical, cooling, connectivity and space needs for the new system implementation.

### 2.3 Managerial Support

Unplanned managerial and administrative conflicts may slow down the implementation process, already burdened by ethical and privacy concerns concerning patient data, privacy, accountability, safety and confidentiality (Stroetmann et al, 2011). Zayyad & Toyacan (2018) and Woodward et al, (2014) tackled the enablers of a successful e-health implementation from healthcare practitioners' view. Their findings agree that staff's preparedness, motivation and computer's knowledge were likely to increase the chance of the software's adoption. In the absence of managerial and leadership sponsorship, lack of motivation, poor infrastructure readiness, etc., human resource obstacles related to resistance, reluctance to learn, poor computer skills and literacy are significant barriers of e-health implementation in the hospitals (King et al, 2012). Prescriptive guidance was presented in the literature encouraging department level engagement and the encouragement of group work, in the aim to emphasize adoption (Palabindala et al., 2016). Moreover, managing the interaction between practitioners, managers and vendors, was as important in ensuring successful adoption (Hamadeh, 2017).

### 2.4 Human Resources and Sociodemographic Factors

Palabindala et al (2016) and Cashen et al (2004) cited that healthcare practitioners' resistance to change, can slow down the implementation process.

Resistance to change can be rooted in practitioners' poor computer skills, unprepared and unwell trained employees, educational linguistic background, limited knowledge and literacy, low socio-economic level for enhancing their education, age and gender. For example, Shiferaw & Mehari (2019) found that internet and e-health knowledge and education among healthcare providers in Ethiopia, varied by age, gender education level and role within the ecosystem of health services. Practitioners 21 - 29 years of age have scored a high level of e-health knowledge, females than males, with physicians and nurses more knowledgeable than pharmacists and other healthcare practitioners. Likewise, in Lebanon, Saleh et al (2016) have linked readiness levels to e-health implementation to

practitioners' sociodemographic, computer proficiency and expertise, managerial backing, changes' effectiveness, and personal benefits. Authors considered that practitioners' preparedness is a crucial component for a successful implementation. Findings indicate that the perceived usefulness of the system was different among the care team as physicians expected a higher benefit from the implementation more than nurses did.

### 3 METHODS

We conducted the semi-structured interviews in two Lebanese hospitals located in Beirut. Both have successfully implemented e-health. Open ended inquiries, included focusing questions (Appendix) to enrich the data collection. The field activity included 8 participants as a whole, based on the participants' availability and willingness, distributed between 2 IT managers, IT employee, 1 archiving employee, 1 nurse and 3 physicians (Radiologist, Gastroenterologist and Anaesthesiologist). We conducted the interviews during the month of January 2020, lasting around 30-40 minutes with each informant. The latter, purposefully chosen healthcare practitioners have worked in the organization before and after the implementation so they will be able to offer a deeper knowledge on the subject. We then perform key point coding to isolate and group the findings into themes of financial, Human and technical. In section 4 to follow, we present the findings followed by a discussion on the success factors for the implementations and we close with a summarized list of these findings. We introduce the learnings from this study in Section 5. Then, in section 6, we conclude with contribution statement of this paper that is essentially part of a larger project.

#### 3.1 Site Selection

For our study, we have chosen two of the leading hospitals in Lebanon where successful implementation of eHealth services were concluded. Both are teaching hospitals located in the Lebanese capital.

##### 3.1.1 Hospital A: HDF

The Hôtel-Dieu de France is one of the three leading Lebanese medical centres, located in the capital Beirut. Established in 1883, HDF transformed into a

teaching hospital in 1984. Today, HDF is a non-profit hospital, affiliated with Saint Joseph University with the capacity of 430 beds, 43 beds for the Intensive Care; 125 Doctors ; 90 Surgeons ; 450 Nurses; 1000 deliveries/year; 11.300 surgeries/year, 29.000 admissions/year and 30.000 emergencies/year<sup>7</sup>. As part of the eHealth initiative at HDF, the implementation of the Hospital Information System started late 2015 (ITG Holding, 2015) and took more than two years to complete placing HDF at the leading edge of the eHealth services.

##### 3.1.2 Hospital B: AUBMC

Affiliated with the American University of Beirut, the AUB medical centre (AUBMC) operates 376 beds, serving more than 40,000 inpatients annually (AUBMC.org). On November 3 2018, AUBMC launched AUBHealth to replace its existing homegrown electronic health record and provide a platform for integrated care, ensuring patients have convenient digital access to their health information (AUBMC.org). "Within AUBHealth, physicians have access to real-time patient data and information, which saves time, avoids duplicate diagnostic tests, and could reduce clinical costs. AUBHealth empowers patients and their designated caregivers with easy access to health records. Using a patient portal, MyChart, patients can connect with their healthcare providers, schedule appointments, and access test results easily. The paperless system provides a secure and seamless patient experience". Quoting the Hospital's chief Medical Information Officer. The project was executed over 3 years of planning, preparation, and training. AUBHealth, is designed to integrate clinical documentation with ancillary systems such as radiology, pharmacy, laboratory, ambulatory, perioperative, patient transport, blood bank, and billing.

## 4 FINDINGS AND DISCUSSION

In this section, we select a few notions from the interviews in order to frame the empirical discoveries shaping the successful endeavours at each hospital.

From healthcare practitioners' point of view, the main technical obstacles of the implementation were on the technical and infrastructure factors, pointing at equipment, electrical needs, hardware and software upgrades. After a careful evaluation, the infrastructure preparation started and included the

<sup>7</sup> <https://hdf.usj.edu.lb/indexen.php>



implantation of tools to monitor proper performance. The data centre was designed with high availability in mind. The selection process started with a careful review of the requirements and a purchasing process that narrowed down the potential vendors. Both Hospitals reported similar issues with infrastructure readiness having to plan for physical expansion of their premises and the rehabilitation of 100+ year old components of the structures.

The IT director of HDF, tenured of 26 years at the hospital, stated that the most crucial step in success was to draft the patient's journey through the hospital services. *"The project was not a technical project, it was a project of rebuilding processes"*, the IT Director (HDF) explicated. The hospital assigned a special and dedicated team for the implementation. To reinforce adoption, the project manager at AUBMC in coordination with the IT department, assigned a Champion from every department in the project implementation activities designated as "super users". *"We have picked about 120 people from departments, each geographical location at least had 1 or 2 super users, by roles"*; the Project Manager, who has witnessed the entire implementation process, explained. The objectives for the implementation aimed at better patient outcome, a more efficient hospital operation, enhanced interaction among the care team and a more effective data driven decision-making. They then evaluated a few software products, to settle on a French based firm because of its modularity and its best fit to the processes at the hospital, mainly the admission, discharge and transfer (ADT) including the billing standards. Participants to this study shared some insight into financials and grants, underscoring the burden of high cost of compliant hardware and software. Even after implementation, HDF has designated a centre of excellence to continuously monitor, detect opportunities for improvements and apply the changes necessary. The system that was implemented was designed as a patient centric ecosystem which includes outpatient services, pharmacy and other services.

Similarly, the implementation team at AUBMC managed the implementation project as a clinical transformation project with "Standardized Care" as the central notion. It was also a people and process transformation project rather than a technical challenge. The project stakeholders at the hospital identified nurses as the primary users and assigned a focal point in the implementation of the process and workflow through the system. The implementers integrated opportunities for improvement directly into the system design. Here too, a project team of all

practitioners was assigned to direct the project at the direction of the Chief Medical Information Officer.

Though the system was American built and standardized, it was customisable to meet the local processes, workflows and currencies. Hundreds of sessions with stakeholders were necessary to normalize the processes and integrate them through the system. The project management team included steering committees, advisory councils (by practice), readiness groups of champions and early adopters, super users who test the systems and provide early insight.

A cost-effective budget plan was well prepared, in addition to compensatory approaches demonstrated by the employees, as participants mentioned, where they had to deduct some expenses from certain factors and compensate in others to maintain a balanced expenditure, in addition to eased budgeting loan obtained from the central bank. The informants emphasized the advantage of early adoption incentives (in some cases monetary or career path).

Additionally, frequent trainings of highly qualified employees, focused on role-playing was a major plus. These trained members later dispatched all over the hospital as problems fixers. Innovative techniques performed by the employees facilitated the integration of the system in the work stream of each practice. A radiologist, with 4 years of service, who was appointed as trainer on the use of the integrated PACs interface reported that practitioners had the flexibility to adjust the software's settings in a suitable manner for their workflows; consequently, some participants mentioned that only some additive software and hardware were required as they tuned their tasks.

Whereas elements that enabled the implementation were many, teamwork and departments, community and stakeholders' engagement lead to a successful implementation.

To improve the adoption of the Electronic Health Records (EHR) at AUB, the implementers set their sight on meeting the Electronic Medical Records' (EMR) criteria. They exploited international standards provided by the Healthcare Information and Management Systems Society (HIMSS). A pilot implementation phase made tuning and adjustments possible, easing the way for a full implementation that is more swift and resilient. Users in each department evaluated the new system before implementation and were trained before use. They were able to provide valuable input on process and user interface parameters for more successful wider adoption. Testers role-played to test the patient navigation

through the system and provided the necessary adjustments before launch.

## 5 WHAT WE LEARNED

Learning from this research emphasize the need for technical and process readiness, consideration of important resources to mobilize for stakeholder engagement in addition to the obvious financial consideration. We can therefore, line up the guidance of this work with a fundamental requirement for an EMR implementation to align with the Quadruple Aim of quality care through an improved patient journey, improved overall health, through a measured cost model, ensuring practitioner's satisfaction (Sikka et al, 2015). This is especially important in the context of teaching hospitals where the workload of the medical body is compounded by the extended collaborative nature of medical work and reduce the burden on the practitioners who are pulled (Park et al, 2012).

### 5.1 Focus on the Patient Journey

The main theme echoed by both case studies was the resolve to focus on the patient journey. Processes and workflows were carefully modelled to ensure that the ecosystem is covered with a standardized care model and safeguard that the system is implemented as a patient centric ecosystem, which includes outpatient services, pharmacy and other services. This implies the emphasis on defining the implementation objective in terms of better patient outcome, a more efficient hospital operation, enhanced interaction among the care team and a more effective data driven decision-making.

### 5.2 Selecting the Best Fit Scenario

Both studies indicated the need to respect a measured cost model with a solution sized for the contextual setting. This means choosing a product / software that best fits the objective – Evidenced by the choice of two different systems based on their support and alignment with the existing workflow and culture of the hospital.

### 5.3 Technical and Process Readiness

Technical and process readiness are of great importance in the implementation of an eHealth system at a hospital. The technology ecosystem and process transformation must align for successful

outcome. This reinforces the importance to prepare the infrastructure technical and infrastructure components, pointing at equipment, electrical needs, hardware and software upgrades as transcribed by one of the participant.

### 5.4 Ensure Practitioner's Satisfaction

Both teaching hospitals have gone to great length and measures to maintain stakeholder engagement at all levels of the organization and communicate clear assignments and process changes widely - incentives for early adopters recommended.

We can henceforth summarize four main lessons in stakeholder engagement that can provide for a sustainable practitioner satisfaction:

First, involving users in the evaluation and deployment encourages open innovation by all members of the eHealth ecosystem and provides means for the stakeholders to improve on the overall experience in their process of care.

Second, the emphasis on training for rapid adoption and long-term success is a precursor to success. Frequent trainings of highly qualified employees and role-playing are key success factors – sustained by proper and timely logistics.

The third lesson here relates to the methodology of deployment that proves more effective in introducing incremental change in the environment, empowering the practitioners to tune the system to their workflow. The advice here is to deploy in pilots while improving the process and handling the incremental adjustments and nominate champions from every department.

Lastly, maintaining traction on improvements post implementation can result in a lasting value realization of the system deployment – preferably through the designation of a centre of excellence to continuously monitor, detect opportunities for improvements and apply the changes necessary.

## 6 CONCLUSION

In addition to the usual suspects of financial constraints in implementation of this scale, the study has identified key enablers for engagement between all involved stakeholders. Vendors, suppliers, implementers, hospital staff, management and practitioners are all stakeholders in the process. A process that requires a level of technical and process readiness to succeed. Interaction between stakeholders, the universal commitment of all levels

of the health care delivery is key to successful implementation of eHealth services in Hospitals.

The informants to this study noted the logistics around training as barriers of the implementation, such as time-consuming commitments, delays, attendance, low training frequencies, incomplete training, varying training time and location. In some cases, as the project implementation got at scale, the implementers observed some resistance, occasional lack of personal efforts and cooperation, potential due to unclear job assignments and changes in processes, managerial support was fundamental to improve adoption.

In conclusion, this research provides a descriptive approach on addressing several factors that enable e-health implementation process in hospitals of developing countries. The context of Lebanon could also be extended to similar models across developing nations and will prove valuable to inform current and future adopters of eHealth in Hospitals.

## 6.1 Contribution

Though our paper did not significantly change or add to what is already known as best practices in EMR implementation (Keshavjee et al, 2006), nevertheless, it does focus on teaching hospitals, where the collaborative work is intense, rendering greater value to the objective of maintaining practitioner satisfaction. Consequently, the paper serves to underscore the focus on patient journey, process and workflow, user engagement, managerial support and a solid implementation plan that includes a phased approach to a measured success.

Furthermore, our work ties the success factors of an EMR implementation to the Quadruple Aim of quality care through an enhanced patient journey, improved overall health through technology innovation, implemented based on a measured cost model sized for the contextual setting, while ensuring a sustainable practitioner's satisfaction.

Researchers are still pondering the unintended consequences of EMR implementations and the effect of such implementations on the stakeholders of the healthcare ecosystem (Alami, 2020). In this paper, we argue that the road to succeed in the implementation of eHealth must be through stakeholder engagement as a means to increase the satisfaction of the practitioners with the new work environment.

## REFERENCES

- Ahern, D. K., Kreslake, J. M., & Phalen, J. M. 2006. What is eHealth (6): Perspectives on the Evolution of eHealth Research. *Journal of Medical Internet Research*, 8(1). <https://doi.org/10.2196/jmir.8.1.e4>
- Ajami, S., & Bagheri-Tadi, T. 2013. Barriers for Adopting Electronic Health Records (EHRs) by Physicians. NCBI. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3766548/>
- Alami, H., Lehoux, P., Gagnon, MP. et al. Rethinking the electronic health record through the quadruple aim: time to align its value with the health system. *BMC Med Inform Decis Mak* 20, 32 (2020). <https://doi.org/10.1186/s12911-020-1048-9>
- Business News, 2019. "\$800 Million Invested in Hospital Expansions." [BusinessNews.com.lb, 11 Oct. 2019, www.businessnews.com.lb/cms/Story/StoryDetails/7316/\\$800-million-invested-in-hospital-expansions.](https://www.businessnews.com.lb/BusinessNews.com.lb,11Oct2019,16/$800-million-invested-in-hospital-expansions)
- Cashen, M. S., Dykes, P., & Gerber, B. 2004. eHealth Technology and Internet Resources: Barriers for Vulnerable Populations. *Journal of Cardiovascular Nursing*, 19(3), 209. [https://journals.lww.com/jcnjournal/Fulltext/2004/0500/eHealth\\_Technology\\_and\\_Internet\\_Resources\\_.10.aspx](https://journals.lww.com/jcnjournal/Fulltext/2004/0500/eHealth_Technology_and_Internet_Resources_.10.aspx)
- Collins, S. A., Gazarian, P., Stade, D., McNally, K., Morrison, C., Ohashi, K., Lehmann, L., Dalal, A., Bates, D. W., & Dykes, P. C. (2014). Clinical Workflow Observations to Identify Opportunities for Nurse, Physicians and Patients to Share a Patient-centered Plan of Care. *AMIA ... Annual Symposium proceedings. AMIA Symposium*, 2014, 414–423.
- Eysenbach, G. 2001. What is e-health? *Journal of Medical Internet Research*, 3(2). <https://doi.org/10.2196/jmir.3.2.e20>
- Hamadeh, G. 2017. E-Health Roadmap for Lebanon. 13. <https://www.aub.edu.lb/fm/CME/Documents/EHR-Readiness/eHealthRoadmapforLebanon-GHamadeh.pdf>
- Healy, Jean-Claude. 2008. Implementing e-Health in Developing Countries Guidance and Principles. ICT Applications and Cybersecurity Division Policies and Strategies Department ITU Telecommunication Development Sector. [https://www.itu.int/ITU-D/cyb/app/docs/e-Health\\_prefinal\\_15092008.PDF](https://www.itu.int/ITU-D/cyb/app/docs/e-Health_prefinal_15092008.PDF)
- ITG Holding. "MDSL Signs with Hôtel-Dieu De France to Implement a Full-Fledged Hospital Information System - Media Center - ITG: Information Technology Group." ITG Holding, [www.itgholding.com/news/277/mdsl-signs-with-hotel-dieu-de-france-to-implement-a-full-fledged-hospital-information-system/](http://www.itgholding.com/news/277/mdsl-signs-with-hotel-dieu-de-france-to-implement-a-full-fledged-hospital-information-system/).
- Jha, A. K., DesRoches, C. M., Campbell, E. G., Donelan, K., Rao, S. R., Ferris, T. G., Shields, A., Rosenbaum, S., & Blumenthal, D. 2009, December 10. *Use of Electronic Health Records in U.S. Hospitals* <https://doi.org/10.1056/NEJMsa0900592>

- Keshavjee, K., Bosomworth, J., Copen, J., Lai, J., Küçükyazici, B., Lilani, R., & Holbrook, A. M. (2006, January). *Best practices in EMR implementation: a systematic review*. In AMIA.
- King, G., O'Donnell, C., Boddy, D., Smith, F., Heaney, D., & Mair, F. S. 2012. Boundaries and e-health implementation in health and social care. *BMC Medical Informatics and Decision Making*, 12, 100. <https://doi.org/10.1186/1472-6947-12-100>
- Minichiello, V., Rahman, S., Dune, T., Scott, J., & Dowsett, G. 2013. E-health: Potential benefits and challenges in providing and accessing sexual health services. *BMC Public Health*, 13, 790. <https://doi.org/10.1186/1471-2458-13-790>
- MOPH, 2014 Home Page, [www.moph.gov.lb/](http://www.moph.gov.lb/). <https://www.moph.gov.lb/userfiles/files/Programs%26Projects/NationalE-healthProgram/E-Health%20Solutions-2014.pdf>
- Palabindala, V., Pamarthy, A., & Jonnalagadda, N. R. 2016. Adoption of electronic health records and barriers. *Journal of Community Hospital Internal Medicine Perspectives*, 6(5), 32643. <https://doi.org/10.3402/jchimp.v6.32643>
- Park, S. Y., Lee, S. Y., & Chen, Y. (2012). The effects of EMR deployment on doctors' work practices: A qualitative study in the emergency department of a teaching hospital. *Int. J. Med. Inform.*, 81(3), 204-217.
- Police, R., Foster, T., & Wong, K. 2010. Adoption and use of health information technology in physician practice organisations: Systematic review. *Journal of Innovation in Health Informatics*, 18(4), 245-258. <https://doi.org/10.14236/jhi.v18i4.780>
- Ross, J., Stevenson, F., Lau, R., & Murray, E. 2015. Exploring the challenges of implementing e-health: A protocol for an update of a systematic review of reviews. *BMJ Open*, 5(4), e006773. <https://doi.org/10.1136/bmjopen-2014-006773>
- Ross, J., Stevenson, F., Lau, R., & Murray, E. 2016. Factors that influence the implementation of e-health: A systematic review of systematic reviews (an update). *Implementation Science*, 11(1), 146. <https://doi.org/10.1186/s13012-016-0510-7>
- Saleh, S., Alameddine, M., Farah, A., El Arnaout, N., Dimassi, H., Muntaner, C., & El Morr, C. 2018. eHealth as a facilitator of equitable access to primary healthcare: the case of caring for non-communicable diseases in rural and refugee settings in Lebanon. *Int. J. Public Health*, 63(5), 577-588.
- Saleh, S., Khodor, R., Alameddine, M., & Baroud, M. 2016. Readiness of healthcare providers for eHealth: The case from primary healthcare centers in Lebanon. *BMC Health Services Research*, 16(1), 644. <https://doi.org/10.1186/s12913-016-1896-2>
- Shiferaw, K. B., & Mehari, E. A. 2019. Internet use and eHealth literacy among health-care professionals in a resource limited setting: A cross-sectional survey. *Advances in Medical Education and Practice*, 10, 563-570. <https://doi.org/10.2147/AMEP.S205414>
- Sikka, R., Morath, J. M., & Leape, L. (2015). The quadruple aim: care, health, cost and meaning in work.
- Stroetmann, K. A., Artmann, J., & Stroetmann, V. 2011. Developing national eHealth infrastructures – results and lessons from Europe. *AMIA Annual Symposium Proceedings*, 2011, 1347-1354. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3243126/>
- Telecom Review, 2018 “New Milestone towards e-Health in Lebanon.” Telecom Review, 19 Apr. 2018, [www.telecomreview.com/index.php/articles/exclusive-interviews/2229-new-milestone-towards-e-health-in-lebanon](http://www.telecomreview.com/index.php/articles/exclusive-interviews/2229-new-milestone-towards-e-health-in-lebanon).
- Woodward, A., Fyfe, M., Handuleh, J., Patel, P., Godman, B., Leather, A., & Finlayson, A. 2014. Diffusion of e-health innovations in ‘post-conflict’ settings: A qualitative study on the personal experiences of health workers. *Human Resources for Health*, 12(1), 22. <https://doi.org/10.1186/1478-4491-12-22>
- Zayyad, M. A., & Toyman, M. 2018. Factors affecting sustainable adoption of e-health technology in developing countries: An exploratory survey of Nigerian hospitals from the perspective of healthcare professionals. *PeerJ*, 6, e4436. <https://doi.org/10.7717/peerj.4436>

## APPENDIX

### Questionnaire

#### Socio-demographic information:

- Can you please introduce yourself?
- For how long have you been at hospital?
- What is your profession?

#### Knowledge of the concept:

- Did you work in this hospital before the implementation occurred?
- Have you ever worked on such technology in any healthcare field?

#### Implementation process:

- How do you describe working in the hospital prior and after the implementation?
- Do you find it user-friendly and easy to use?
- How long did it take you, so you practiced it efficiently?

#### Outcome:

- Have you noticed any changes in healthcare delivery?
- Can you summarize your professional experience concerning e-health implementation as a comparison form between the old informatics system and the new one?
- Would you suggest any further modifications to the process of implementation?