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**H. M. Younis**

Belarusian State Technological University

**MODERNIZING THE HEALTHCARE MODEL IN LEBANON:  
PROMISING INNOVATIONS AND THEIR IMPACT  
ON HUMAN DEVELOPMENT**

This paper presents a study about the influence of creation and implementation of an innovative healthcare model that uses information and communication technologies on human development in Lebanon. The expected model will allow patients and healthcare personnel to use the modern technology to access healthcare information, in a way that increases the speed to reach the correct information, and decreases the distances between the patient, doctor, healthcare center, guarantor and the supervisor of the whole sector – the ministry of public health. By interconnecting the health care institutes with the patient, this will allow him to search, access and benefit from the healthcare services available. The ease and efficiency of use will have its direct impact on better quality of life, and on the long run will affect indirectly the indicators of life length, education especially related to computer literacy. The author will explain the patient's position in this model and the tools that he can use to make effective integration into the system in an easy manner that is compatible with all ages, literacy levels and regions. A qualitative and quantitative approach allowed gathering information from the stakeholders, to prove the necessity of a new innovative healthcare model and its influence on human development.

**Keywords:** healthcare, innovative model, information and communication technologies (ICT), digital services, human development.

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**Х. М. Юнис**

Белорусский государственный технологический университет

**МОДЕРНИЗАЦИЯ МОДЕЛИ ЗДРАВООХРАНЕНИЯ В ЛИВАНЕ:  
ПЕРСПЕКТИВНЫЕ ИННОВАЦИИ И ИХ ВЛИЯНИЕ  
НА ЧЕЛОВЕЧЕСКОЕ РАЗВИТИЕ**

В данной статье представлено исследование влияния создания и внедрения инновационной модели здравоохранения, использующей информационные и коммуникационные технологии, на развитие человеческого потенциала в Ливане. Ожидаемая модель позволит пациентам и медицинскому персоналу применять современные технологии с тем, чтобы увеличить скорость получения достоверной информации и уменьшить расстояние между пациентом, врачом, медицинским центром, поручителем и супервайзером. Она охватывает весь сектор – министерство здравоохранения. Связь учреждения здравоохранения с пациентом позволит ему осуществлять поиск, получать доступ и пользоваться доступными медицинскими услугами. Простота и эффективность использования напрямую повлияют на улучшение качества жизни, а в долгосрочной перспективе опосредованно окажут воздействие на показатели продолжительности жизни, образование, особенно связанное с компьютерной грамотностью. Раскрыта позиция пациента в этой модели и инструменты, которые он может использовать для эффективной интеграции в систему простым способом, совместимым со всеми возрастами, уровнями грамотности и регионами. Благодаря применению качественного и количественного подходов автору удалось собрать информацию от заинтересованных сторон, доказать необходимость новой инновационной модели здравоохранения и ее влияние на развитие человека.

**Ключевые слова:** здравоохранение, инновационная модель, информационные и коммуникационные технологии (ИКТ), цифровые услуги, человеческое развитие.

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**Introduction.** Human development has been a continuous concern for governments and international organizations. Initiative for standardizing this matter have started back at the nineties of the 20<sup>th</sup> century by issuing a yearly report from the United Nations Development Programme (UNDP) that addressed general issues and country-specific issues. Lebanon, as one of the countries rated among the high developed countries according to Human development index (HDI) is suffering a great economic crisis placing more than half of the population living in poverty [1], which is affecting its living standards and development indexes. Any initiative that could improve the quality of life, and at the same time decrease efforts and costs, will definitely have direct positive impact. An innovative healthcare model that automates the processes related to healthcare institutions, and facilitates the citizens' interaction with the healthcare system as a whole, is suggested as an important tool for human development taking the current socio-economic situation into account.

**The socio-economic situation in Lebanon and its influence on the health sector.** According to UNDP, Lebanon's HDI score was 0.73 in 2018, putting it among countries of high human development category, positioning at rank 93 among 189 countries and territories surveyed [2], and ranked slightly better in the next year scoring 0.744 HDI and positioning in the 92<sup>nd</sup> place among the 189 countries [3]. Life expectancy at birth scored 78.9 in both years 2018 and 2019 [2, 3] which indicates the high level of healthcare sector. The consecutive events that hit Lebanon since the end of 2019 starting with the revolution then financial and economic crises, the Covid-19 epidemic accompanied by lockdowns, the Beirut Harbor Blast, and the dollar madness, affected all sectors of the Lebanese economy, especially the healthcare sector. The health sector has been negatively affected by a) the greater number of critical cases caused by Covid-19 and the harbor blast; b) the fewer intensive care beds due to shortage of fuel, medicine, tools and oxygen; c) the immigration of professionals (doctors, nurses, and experts) into more financially-stable countries [4, p. 3–4]; d) the gap between the payment covered by guarantors of the public sector and the amount paid by healthcare facilities in fresh dollars, and still priced in Lebanese pounds on old exchange rates, and many related issues. Being one of the economic sectors directly affected by the new situation, the healthcare sector is affected on the short term regarding the increase of the prices of medical services or the decrease of quality of these services. On the long term, this poses risks on indexes related to quality of life, length of life, life expectancy, neonatal deaths and many more, as many mortalities and

morbidity were reported due to shortage of human, financial or material resources linked directly to the crisis. There has to be many initiatives and solutions that take the new conditions into account, to facilitate the access into medical services in a faster, cheaper and more effective manner. ICT has been introduced into many sectors, including the health sector. The benefit is achieved after automating processes and allowing access through computers, networks, and the internet. In Lebanon, many healthcare facilities are trying to make their own solutions, implementing an information system only for their data, but this isn't enough. Such situation necessitates a national solution that combines all health data in order to collaborate all efforts into one network that is accessible to all stakeholders according to suitable privileges and authorities.

**Promising innovations in the health sector.**

To modernize the Lebanese health sector, an innovative model is suggested taking into account the peculiarities of the Lebanese situations, and integrates all the health services together to improve the access to services regarding treatments, finance, audit, quality, documentation and others. This model depends on the implementation of ICT to integrate healthcare data. This model was proposed in the study named "An innovation model for the development of the Lebanese health sector: a roadmap for the creation and implementation" [5], in which it integrates the healthcare institutes and processes into an national information system that allows the patient access into the processes of the healthcare system from his computer or smart device, in order to search for medical services and make inquiries about financial and procedural status and provide the suitable feedback. This system will integrate all health facilities under one application with different interfaces, all connected to a main server at the Lebanese ministry of public health (MoPH). This system will not replace the current situation totally, as it will connect the current systems in all facilities taking the compatibility issues into account, and install new interfaces into each facility, added to this a user interface (app) will be accessible with different privileges and access authorities (citizens, patients, guarantors, doctors, nurses, technicians, official authorities and others).

The model idea is the development of one integrated database for management of the health sector in Lebanon in a holistic and centralized approach. This database will hold all the health data of the Lebanese citizens and those who get hospitalized in Lebanese healthcare institutes, in both the private and public sectors. This will include the citizens' and patients' experiences with the supporting and diagnostic services available (clinics, laboratories,

radiology, pharmacies and others). This health information will be saved in the form of electronic health records (EHRs) in the dedicated data center at the ministry of public health. These records will have a unique citizen/patient identifier so that each one will have one and only one health file that contains his history. In addition to EHRs, the database will hold all relevant statistical data and indicators that will be submitted by health institutes, for use in planning, resource allocation, campaigns, and benchmarking among peers and other services. The database will also allow determine the eligibility of citizens to receive the hospitalization services requested, and the approval decision electronically. Also information about vacancies, services, doctors, quotas, budgets, expenses and revenues will be stored in this database, in addition to monitoring and control functions that will allow MoPH and health institute owners' better management and supervision.

In order to provide the centralized control, monitoring and access, there will be one database, and it will be accessed through internet using dedicated portals and proper authorization for each type of stakeholder.

Programming the database using one of the available and efficient database management systems available can be done using three approaches. The first approach assumes using MySQL or PostgreSQL for low cost, and solution-based functions and security, and self-dependent add-ons. The second approach goes for bigger and more equipped database engine that contains more functionalities and security measures, the Microsoft® SQL server provides a good platform for such solution. The licensing is per core that is not very precious for a national solution, and it could allow the sector to activate its ICT with proper licensing which will allow more professional work, maintenance, and support. The third approach is to use cloud storage provided by Oracle® with its large capabilities for storage, backup, support, analytics, security and others. This will provide more professional transactions, but larger cost on MoPH and especially on the stakeholders.

This solution will provide integrating health data into electronic health records (EHRs) which is the largest step into creating the necessary background for better management of the sector. It will also contain the statistical data submitted by health institutes for national health indicators. Another benefit is by providing the electronic fillable forms used for reporting from the health institutes and professionals to MoPH. Lists of doctors, clinics, bed vacancies, services, and health centers will be available with real time data regarding availability, in addition to expected costs.

So this database will have dedicated sections for citizens/patients identified by the national identification serial number depending on the ministry of interior's

data (and if this was not available, MoPH could create its own health identifier). Related to the unique identifier, each citizen's EHR will contain the following sections.

Demographics: Full Name, Mother's name, Date of birth, Place of birth, blood group, and all other information existent on national ID card.

Contact information: phone numbers, address, e-mail (when applicable).

Health history: previous history of patient including hospitalization, prescribed treatments, doctor and clinic prescriptions, immunization, tests, images, medications, allergies and others.

Electronic medical records: of previous hospitalization experiences especially the admission and discharge reports, doctors and nursing progress notes, test results, nutrition diets, treatments, surgeries and medications.

Guarantor information: defining the party that supports the hospitalization of the patient, in which percentage, and what type of coverage, with continuous update and validation of such status.

To store these data of citizens, and other reported material, the database needs to be accessed by each stakeholder, each according to his privileges and authorization. This access needs to be secure, available, easy to use, and interoperable. The best technology is using web pages that are secured using the HTTPS (Hypertext transfer protocol secure) which will provide the necessary protection, end-to-end encryption for private health data.

All these data contained will allow different querying from different types of participants, starting from normal citizen with no access credentials, reaching the top management of health in Lebanon, passing through patients, hospitals, health-related institutes, and guarantors.

**Surveying the influence of a modernized health sector on human development.** In line with the expected benefits that will develop the life of citizens, and the encouraging results of previous studies that proved the influence of modern ICT technologies on human development, it became important to survey the Lebanese stakeholders and the possibilities of human development that this solution could provide and which processes it can affect. M. AlSulami et al. in their study named "Examining the relationship between the internet and life expectancy" proved the hypothesis right [6], and that there is also an influence in the relationship between the two variables when a country's economic standing is taken into consideration. While L. Cheng-Wen and K. Min-Sun studied the effects of the internet environment, and its variables related to ICT, on life expectancy in Asia [7]. Studying the influence on life expectancy is the closest to the health sector, but this does not deny the effect of a modernized health sector on other human

development factors mainly the education and quality of life. The Covid-19 pandemic is the newest proof regarding the need to have a modernized digital health system. People were obliged to use the digital platforms while in quarantine, added to having the proper literacy to handle such issues. Not only that, ICT saved the education systems at the times of quarantine by using online learning. This has preserved and improved the quality of life of citizens. Such relation between ICT and human development to face Covid-19 and similar upcoming events were studied in the report of the Economic and Social Council in the United Nations, as it also included a paragraph for each side of the world, indicating that in the West Asian area “despite the persistent digital divide, Covid-19 had pushed more government activities online” [8, p. 4].

Stakeholders’ opinions by interviews made by the researcher with professionals in the health sector, especially hospital, pharmacy, laboratories, imaging, clinics managers gave the feedback on how they could benefit from such solution, which will eventually reflect

positively on their work flow, and the citizens. This is shown in table 1 below. Another quantitative study was made among the professionals who are directly working on field with patients and health processes. The study gathered their feedback and awareness of the impact of a modernized healthcare model on human development, and this is shown in table 2 below.

**The impact of innovation on human development.** The impact of using ICT on human development has the topic of study for many researchers these days. Human development is approached using three factors or variables: “Standard of Living, Knowledge Acquisition, and Health” [9], or as they are commonly known as quality of life, education, and life expectancy at birth respectively. The effects of using ICT on human development can be deduced from the study of Bladimir de la Hoz-Rosales et al. in 2019 [10]. The modernization of the healthcare sector can have an impact on improving the quality of life of citizens and accelerating human development in the country.

Table 1

**Stakeholders’ opinion: Influence of modernized healthcare model on human development**

Stakeholder	Qualitative feedback
Hospitals and other long stay institutes	The whole file is sent to MoPH at discharge time of the patient, or at the end of each day (if there were no direct connection between MoPH database and the institute’s database), after files are completed in the medical records department of each hospital, they are sent daily to MoPH database
Doctors	The doctor will enter the prescription for tests, imaging, medications, or treatments directly using a dedicated portal into the MoPH database. This prescription will be saved with a serial unique prescription number that is held by the patient and handled to the next destination (health institute or center). Then the doctor can use the number to access the prescription’s results after it is executed by the destination services
Assisting medical services	Primary health care, Clinics, pharmacies, laboratories, radiology centers’ data is entered directly using the portal assigned by MoPH solution. They will use the prescription number held by the patient or the doctor to access, execute and validate the prescription
Guarantors	Continuous update about their subscribers into the MoPH database, including their status, health records, and coverage
Ambulatory services	Full and instant update on vacant beds and available services in healthcare institutes, in addition to locating patients (GPS) in need of their help
Citizens	Inquire about services, direct communication (suggestion, complaint), search for vacancies and services, online applications, contact details (doctors and services)
Patients	Access current diagnosis and care plan, direct communication with doctor, history, billing and cost information, discharge plan, and appointments

*Source.* Table prepared by researchers based on interviews conducted on healthcare professionals 2022.

Table 2

**Human awareness of ICT influence on human development**

Question	Doctor	Nurse	Technician	Non-medical employee	Patient	Relative
Sample size	50	100	50	50	100	50
Do you believe automating healthcare processes will influence the wellbeing and longer life expectancy?	50%	90%	80%	80%	75%	95%
Do you believe that automating healthcare processes will improve the quality of life?	70%	90%	90%	84%	91%	76%
Do you aware that such solution can contribute to human development?	50%	66%	70%	70%	54%	60%

*Source.* Table prepared by researcher based on his national survey of year 2021.

Encouraged by a study that is made in the Gulf Cooperation Council area (GCC) that proved that there is a significant impact of ICT on the human development index in that area [11]. Although Lebanon lies 91<sup>st</sup> in the out of 130 included in the network readiness index (NRI 2021) [12], and despite all economic problems, the highest majority of Lebanese are still online. Using ICT in the health sector, and saving patients' data into one data center, and under the direction of one party (the ministry of public health), and the possibility of disseminating these information into authorized parties, will create better access to patient's history anywhere, the patient will be more secure knowing that he'll get the same treatment regardless of time, place, and different expertise. The patient is also more stable and secure money-wise, he won't have to pay more or less, receive unjustified bills, pay for unnecessary medications and treatments. The financial issues of patients will be supervised by the ministry or delegated auditing authorities. Added to that is that the use of internet to communicate with relatives, friends and social media platforms has proven to improve the mental health and relieve depression. This was studied by Wang [13, p. 101–104] in his Comprehensive Social Survey in 2013 that proved a significant relation between the use of internet and the physical and mental health of the elderly, and those two variables increase by 31.9 and 18.8% respectively in the same study.

Various studies also confirm that hospitals have shown positive results with the enhancement of technology and the various tools that are facilitated by the Internet [14]. One Lebanese study in north Lebanon also gave some attempt to modernize the health sector in north Lebanon by implementing electronic health records [15], which is a starting point, but the solution need to be national not for a specific region. In more detail, the impact of healthcare modernization can be considered in the following aspects:

*Patient length of life.* ICT provides quick and accurate access to relevant health data, avoiding any complications that could be caused by slow access or false information, consequently saving more lives. It also provides the capabilities of measuring, monitoring and alerting variations of vital signs if needed, in addition to providing information about illnesses, diets, medications, and exercises. Follow-up online is available between the patient and the doctor. Also information about medical centers available for special treatments, addresses, access possibilities, appointments. This will lead the patient directly into the source of best treatment, and receive it in timely manner, with highest expertise in place. Worries about medical malpractice are lower, and the possibility of a longer and healthier life is very promising.

*Quality of service.* Armed with information technology, management of medical sectors, starting from the ministry to the hospitals reaching the patients, can offer services with higher quality.

Speed of access to health information is vital, where a patient can be saved or lost within a second now or lost. Accurate data retrieved in a timely manner improves the service quality, and gives a correct view of any status to be solved or analyzed. Financial services are much better and easier with ICT. Calculations, validations, audit, reports generated have higher quality, and are more reliable than paper financial documents. Management can offer their services to patients, ministry, and supplier better using ICT. Examples are numerous that prefer services of managements using ICT over managements using paper information systems.

*Cost of treatment.* Using ICT, a lot of unnecessary steps and procedures are omitted, a lot of processes can be done online without cost, better access to correct treatments and medications minimizes procurement costs, electronic study of alternatives regarding treatments, procurements, hospitals, doctors and specialists, suppliers, offers the stakeholder the best choice to spend his money. Also operational costs using paper systems, manual delivery and transportation of documents, unnecessary storage spaces rented or bought to hold paper archives, also their paper cost. The use of filmless/paperless methodologies (for example Beirut governmental university hospital) minimizes the cost, and replaces films and paper by information technology. But to succeed it needs to be met by involved parties (the ministry, the suppliers, the guarantors, the patients). The cost of medical imaging, and lab tests is drastically minimized as the scanning, and testing is done electronically, and then validated and delivered electronically. The cost of treatment using them is minimized as well. All costs paid by organizations are reflected eventually on the patient and increase his hospitalization bill. ICT offers better processes that will help the patient economically.

*Change in the quality and type of jobs.* A highly important socio-economic factor that is not handled seriously so far is the inevitable change in job types, and its influence on citizens, especially those dealing with the health sector. Jobs like accountants, auditors, middle-managers, medical committees, supervisors, monitors, drivers, correspondences, and many others will gradually disappear with the governance of ICT in the everyday life. Even the size of work needed for each job will be minimized, eventually decreasing the number of workers for each job in each organization. This will open the path for other types of jobs, more effective and productive and the computer literacy will be a must.

*Less patient effort.* With all applications and approvals done online, a patient won't have to travel to the capital, or to the guarantors' offices, or the ministries representatives to get the approval and signature for hospitalization. He doesn't need to pay for these approvals, especially regarding transportation, also time lost trying to get these approvals and effort of transferring from one office to

another. This agony can be all removed with ICT integration into the application and approvals process. Also, he is aided to find hospitals, doctors, specialists, quicker and simpler. Added to all is the new concept of “on demand healthcare” where healthcare professionals and equipment will find and reach the patient and offer the medical treatment and services, all thanks to productive use of ICT in the health sector.

**Conclusion.** The proposed modernization initiative by implementing an innovative healthcare model that integrates the healthcare system using ICT will have its great social and economic outcomes, which will improve the human development. As the human development index relies on three factors, the quality of

life, the life expectancy and the literacy level. The qualitative and quantitative findings of this study approached those three factors. By facilitating the digital access into medical services, the citizen needs to be more educated especially regarding the use of ICT, at the same time, this access could save lives and make people more secure due to speed and connectivity thus allowing better life expectancy, and of course a better quality of life is achieved by making services easier, cheaper, less forged and more professional. The patient is the core of this system, which makes such healthcare model addressed to all, not to a specific group, and by improving this sector of the economy, it will have its direct effect on the human development as whole.

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### Information about the author

**Younis Hassan Mohammad** – external doctorate student, the Department of Enterprise Economy and Management. Belarusian State Technological University (13a, Sverdlova str., 220006, Minsk, Republic of Belarus). E-mail: [hssnyougmg@gmail.com](mailto:hssnyougmg@gmail.com)

### Информация об авторе

**Юнис Хассан Мохаммед** – соискатель кафедры экономики и управления на предприятиях. Белорусский государственный технологический университет (220006, г. Минск, ул. Свердлова, 13а, Республика Беларусь). E-mail: [hssnyougmg@gmail.com](mailto:hssnyougmg@gmail.com)

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