Project: "ICU-Knowledge Triangle, Innovation: Reinforcing of Education- Research E-Health & Medical Links."

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A DRAFT

Public Deliverable 1- Report on E-Health readiness and needs in Lebanon and Egypt

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"This project has been funded with support from the European Commission **via the grant holder Linnaeus University-Sweden represented by Professor Mosad Zineldin** This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein"

Preface

This report documents the work carried out on the first work package of the project, named Preparation**: University-Enterprise (UE) Centers of E-Health Innovations (CeHI)**

The leading institution responsible for the first work package is Beirut Arab University

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BAU team would like to thank Dr Bassem Kaissi from MUBS partner for his support.

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EXECUTIVE SUMMARY

This report concerns the preparation stage about the needs assessment within the ICU- KTERE Erasmus+ project reference number - 609506-EPP-1-2019-1-SE-EPPKA2-CBHE-JP, entitled: "**ICU-Knowledge Triangle, Innovation: Reinforcing of Education- Research E-Health & Medical Links.**"

The mission of the ICU- RERE project is to enforce A Knowledge Triangle (AKT) Approach to integrate Education, Research and Community (ERC) to provide timely eHealth system. This system focuses on the advances in technology that offer patients, practitioners, medical centers, and hospitals new and innovative options for high quality and cost effective e-medical and healthcare services.

The objective of this study is to assess the e-health readiness, identify the needed gaps and consequently design suitable action plan to create or improve e-health innovation centers within education institutions.
The report includes many sections:

A general introduction including:

- An overview of the project with general aims and specific objectives
- The consortium which consists of 6 European partners, 5 Lebanese partners and 8 Egyptian partners
- A brief description of each work package (University-Enterprise (UE) Centers of E-Health Innovations (CeHI), University-Enterprise (UE) Web Platform based on Knowledge Triangle, Innovation (Education, Research- E-Health Business/sector) KTERE, Academic Course Modules and Professional Diploma, University-Enterprise (UE) In service training, Capacity Building, Dissemination, Sustainability, Quality Control and Management)
- An overview of work package 1 including a general description, different tasks, action plan and an introduction to the report

The work Methodology which describes the different steps in conducting this study from questionnaires design, revision, distribution on participants among faculty/staff, students and stakeholders, data collection, analysis and interpretation, SWOT analysis and recommendations.

The Data analysis, which include an introduction about the questionnaires for faculty/staff, students and stakeholders, the results including general information analysis, analysis and interpretation for: institutional eHealth presence, existing situation of relevant E-Health activities, E-Health readiness and interpretation of open questions addressed to stakeholders.

A SWOT analysis identifying the strengths, weaknesses, opportunities, threats as well as recommendations

Conclusions and recommendations to address the existing gaps in addition to the cross findings between Lebanon & Egypt, especially the necessity of creation and/or enhancement of eHealth centers to foster the health system adopted in both Lebanon and Egypt

INTRODUCTION

Overview of the project:

The project proposal mainly addresses the priorities defined at both national and regional levels in Lebanon and Egypt under category D "developing the higher education sector within society at large- Knowledge triangle, innovation (Reinforcing links between education-research and business) as well as University-Enterprise cooperation based on the following elements as expected outcome of this project:

a- University-Enterprise joint training centres
b- Support for students replacement
c- Increase the employability opportunities.

The project will also develop curricula for some new training courses, which will be part of the regular education at the partner university, which address part of curricula development in Health at LEG partners as well as introduce new technologies in higher education that is a national priority in Egypt.

The aim and Wider objectives of this project are:

a- To Promote University -enterprise cooperation by creating a comprehensive vertically integrated system of innovative development of knowledge triangle (study – research – e-health business utilization) while achieving synergetic effect by using the knowledge and experience of the EU partner universities and institutions as well as LEG partners.
b- To develop effective e-service for interactive collaboration between university-hospitals and healthcare and medical sittings in development and commercialization of e-health-innovative study and professional lifelong learning training programs.
c- To produce a new generation of healthcare institutions (enterprises), university, IT, engineering and research staff capable of performing constructive development in e-health and satisfy patient needs and safety in LEG.

The Specific objectives are:

1) To establish the international Industrial Cooperation with University (ICU) Centers of e-health Innovations in EG and LB (LEG) for administrative and technical supporting of e-health research/ consulting / training activities.
2) To develop the Knowledge Triangle, innovation: Education-Research- e-health business web platform KTERE for collaboration in development and commercialization of e-Health innovative technologies and tools.
3) To develop a new integrated professional short term (6 months) and long term (one year) diploma program in Medical informatics and e-Health (6 basic modules) for partner universities in LEG.
4) To develop in-service lifelong learning training (LLT) program (4 modules) in the area of e-health innovative Medical/health/IT/engineering.
5) To develop on site and distance in-service training program (4 modules) in the area of innovative E-health for the further utilization of OER (open educational resources) and rich open learning environments.

Consortium:

The consortium consists of experienced partners, which have different levels of knowledge and skills in the fields of e-Health and Medical Informatics. The consortium includes 6 European partners, 5 Lebanese partners and 8 Egyptian partners.

Partner nb	Partner name	Country
P1	Linnaeus University **LNU**	Sweden
P2	University Of Genoa **UNIG**	Italy
P3	European Centre Of Studies And Initiatives **CESIE**	Italy
P4	Institute For The Danube Region And Central Europe **IDM**	Austria
P5	Tallinn University Of Technology **TUT**	Estonia
P6	Notre Dame University **NDU**	Lebanon
P7	Universite Libanaise **LU**	Lebanon
P8	Beirut Arab University **BAU**	Lebanon
P9	Modern University For Business And Sciences **MUBS**	Lebanon
P10	Alexandria University **AU**	Egypt
P11	The British University Of Egypt **BUE**	Egypt
P12	October 6 University **O6U**	Egypt
P13	Al-Azhar University **AZHU**	Egypt
P14	Sinai University **SU**	Egypt
P15	Assiut University **ASU**	Egypt
P16	International For Applied Science And Technology **IAST**	Egypt
P17	Lead Healthcare Consultan **LEAD**	Lebanon

The partnership has the necessary capacity to implement the project and achieve the expected outcomes. It will have an important impact on students, on the higher education institutions involved & on society such as increasing the number of MOU signed with health enterprises & increase the number of placements and job opportunities.

Work packages:

The project has participants from different Middle Eastern and European countries with different Working Packages (WP) assigned thoroughly in order to divide the working load.

WP1: Preparation: University-Enterprise (UE) Centers of E-Health Innovations (CeHI)

The objective of the WP1 of this RERE project is to establish the international network Centers of EHealth Innovation system (CeHI) in Lebanon (3) and Egypt (4). The functions of each center include administrative, technical and consultation supporting to promote and develop different E-Health-innovative projects, e-promotion, education, research and training activities for wide target groups (research, education, IT, even production of E-Health tools and devices, medical engineering , manufacturer).

WP2: Preparation: University-Enterprise (UE) Web Platform based on Knowledge Triangle, Innovation (Education, Research- E-Health Business/sector) KTERE

The objective of the WP2 is to develop the international web platform (Knowledge Triangle" Educating, Research, E-health" activities)" KTERE for collaboration between universities, health sectors and IT, Engineering companies in development and commercialization of programs in E-Health and medical informatics innovation. Integration of this platform with the existing networks at partner universities and other institutions in the field of E-health technologies and innovation support in order to achieve synergetic effect on the development of a comprehensive system of inter-regional development of sustainable E-Health system.

WP3: Development: Academic Course Modules and Professional Diploma

The objective of the WP3 is to develop the 6 basic modules and professional diploma (BM1-BM6) in E-Health and Medical Informatics. Each target module consists of 3-4 parts, their content will reflect the modern methods, techniques and tools used in the different aspects of E-Health, engineering, technology and IT. Each module will have an equal structure developed in line with practice at EU partner universities and industry (lectures, practical studies, simulations, tasks for presentations and projects, test questionnaires etc.).

WP4: Development: University-Enterprise (UE) In service training

The objective of the WP4 is to implement the joint UE effective training service in the area of innovative E-Health and medical informatics. The center will be developed and run with close consultation and supervision of experts form different enterprises in health, engineering and IT sectors.

WP5: Development: Capacity Building

The first objective of the WP5 is to initiate the comprehensive system of continuous capacity building measures for the academic/research staff involved at the design and the study curricula and delivering of lectures for students of the E-Health course modules as well as professional training of the coachers engaged at functioning of the CeHI centers in Lebanon and Egypt.

WP6: Dissemination

The objective of the WP 6 is to implement the effective scheme for comprehensive sustainable dissemination of the project achievements at the institutional, regional, national and international levels.

WP7: Exploitation: **Sustainability**

The objective of the WP7 is to ensure both institutional and financial sustainability of key projects developments.

WP8: Quality Plan: Quality Control

The objective of the WP8 is to provide the systematic mechanisms for internal and external Quality Control procedures for the project activities and outcomes.

WP9: Management

The objective of the WP9 is to arrange the timely administrative coordination and financial management of the project. The actual day-to-day management of the project is the responsibility of the Project Manager (PM), which is nominated and provided by the Coordinator.

Overview of the work package 1

With reference to original project application submitted by the grant holder University, LNU, the main focus of WP1 is the preparation and recommendation for the establishment of the University-Enterprise (UE) Centers of E-Health Innovations (CeHI).

Based on the submitted application, the objective the WP1 of this RERE project is to establish the international network Centers of EHealth Innovation system (CeHI) in Lebanon (3) and Egypt (4). The functions of each center include administrative, technical and consultation supporting to promote and develop different E-Health-innovative projects, e-promotion, education, research and training activities for wide target groups (research, education, IT, even production of E-Health tools and devices, medical engineering , manufacturer).

WP1 provides establishment of CeHI developers' teams on the 1-st stage for the activities in tuning the objectives and definition of the requirements for the CEHI network and analysis of accessible e-materials for analogous units of EU partners, studying experience of EU partners, specifying the regulations, staff structure, software and hardware resources. It provides pilot establishment of the centers in 7 partner universities and equipping with the specified set and special equipment.

The WP1 plan includes revision and verification (Internal verification and preparing the regulations for approval by responsible WP Partner University and administration of the partner universities. It allows starting consulting, research and training activities for the healthcare sittings (hospitals, centers and clinics as well as other users):

a) Evaluation of the healthcare market potential;
b) Exploring the potential contracts, etc.;
c) Providing technical support of for different segments;
d) Providing the e-promotion service for E-Health;
e) Supporting the universities training courses update;
f) Providing the research and training system in the area of E-Health and medical informatics in cooperation between university staff, medical engineering, IT staff and healthcare professionals.

Integration of the CeHI centers with the Centers already exist in EU and partner countries in the field of E-Health and medical informatics based on knowledge triangle

approach (Education, Research and Business) and lifelong learning allows to achieve synergetic effect on the establishing of a comprehensive system for inter-regional E-Health system.

WP1 includes different tasks:

- Establishment of CeHI developers' teams
- Tuning the objectives and definition of the requirements for the CeHI network
- Analysis of accessible e-materials for analogous units of EU partners,
- Studying experience of EU partners,
- Specifying the regulations, staff structure, and software and hardware resources.
- Pilot run of the centers in 7 partner universities and equipping with the specified set and special equipment.
- Revision and internal verification of the guidelines, instructions and regulations for approval by the leaders and administrations of the partner universities.
- Start consulting, research and training activities

The corresponding action plan includes the following different steps

1. Starting by surveying (with focus groups, potential academic and non-academic trainers, trainees, students and other stockholders form healthcare sittings and ministry of health), the activities of the existing centres at partner universities and enterprises to identify their capacities, capabilities, challenges and opportunities
2. Analysing data and identifying gaps & needs
3. Summarizing results & preparing a report.
4. Reports will be presented and discussed during open seminars with stakeholders from health sector & all partners in Egypt and Lebanon. Bit due to COVID19 pandemic **this will be conducted Online December- January 20 via ZOOM.**
5. The outcomes will be presented and discussed by with EU partners at CESIE **(according to updates related to COVID19 restrictions).**
6. Based on this report, an updated list of requirements of for CeHI is created **(February 2021).**
7. The CeHI developer team will be in place to finalize the requirement and tuning the objectives. **(March 2021).**
8. Business plan and Roadmap of the centres are developed including activities, strategies, responsibilities and purchasing of the equipment **(April 2021)**
9. Pilot run of the canter activities. Different filed visits, workshops and seminars will be conducted. **(May 2021)**
10. The university-enterprise centres established in Lebanon and in Egypt, the centres are verified, approved and accredited by the relevant university council and project international board and committees. The centres are operating during the life of the project with continues improvement and updating.

All partners will work together on the definition of centres' policy, strategy, regulations & plans (**as stated on point number 8 above).**

This report addresses the first three steps of the action plan to assess the e-health readiness, identify the needed gaps and consequently design suitable action plan to create or improve e-health innovation centers within education institutions. **Steps 4 to 10 were rescheduled due to the COVID-19 and related issues.**

METHODOLOGY

In order to fulfill requirements of WP1, Leaders and Co-Leaders of the group in coordination with the grant holder, LNU, performed many actions in order to fulfill WP1 requirements:

- Participation in the Kickoff meeting that was held in Cairo in February 2020. In this meeting, all work packages were assigned to project participants and presentations were shared regarding the Project and objectives.
- BAU was assigned leader of WP1 and co-leaders were assigned.
- The main aim of the work was to conduct a study analysis to identify gaps and needs regarding E-Health and telemedicine.
- BAU in collaboration with different co-leaders, mainly MUBS, did prepare three surveys to be addressed to University faculty and staff, students, and stakeholders [Appendix A, B, and C].
    - Student's survey: included questions about readiness and attitudes towards eHealth and Telemedicine.
    - Faculty/staff survey: included questions about readiness and attitudes towards eHealth and Telemedicine in addition to questions regarding the status of eHealth and Telemedicine in their institutions.
    - Stakeholder's survey: included questions about readiness and attitudes in addition to open questions to get more accurate response.
- Many Zoom meetings were done (between BAU team and Grant coordinator in addition to email communications in order to facilitate communications between different project members.
- Surveys were shared with all co-leaders and approved prior dissemination.
- BAU disseminated the surveys to universities and stakeholders in Lebanon and Egypt starting 8th of September 2020.
- The primary report was sent to the grant holder for his comments on 10 November, 2020 and feedback from the grant holder was received the 17th November, 2020.
- A revised report was finalized 17th November to be discussed on 18th November, 2020 on zoom during the management meeting.
- The final report identifies the strengths, weaknesses, opportunities, threats as well as recommendations.

DATA ANALYSIS:

Questionnaires:

The questionnaire was shared with three-focus populations including University faculty/staff, university students, and stakeholders. The concerned faculty/staff and students are from Medical schools, which include Pharmacy, medicine, dentistry, health sciences. The External stakeholders include relevant national authorities (ministry of public health, ministry of social Affairs, ……), health care centers, medical clinics, hospitals and E-health industry institutions

The faculty and staff survey: It includes three main sections:

1- **General Information** regarding gender, institution, position, age and specialized field.
2- **Existing situation of relevant E-Health Activities** regarding availability of a center of E-health innovation and its activities, interactional platforms through the website, ehealth services, awareness of, and knowledge about e-health,
3- **E-Health Readiness** regarding: eHealth and internet services about specific diseases, symptoms and therapeutic options, vaccinations, reliability of Health information, use of portable sensors and smart phones applications, data security and privacy, telemedicine and relevant applications and services, especially in covid-19 period.

The student survey: It includes two mail sections:

1- **General Information** regarding gender, institution, academic level, age and specialized field.
2- **E-Health Readiness** regarding: eHealth and internet services, reliability of Health information, use of portable sensors and smart phones applications, data security and privacy, telemedicine and relevant applications and services, especially in covid-19 period.

The External stakeholders' survey: This survey was designed first to be in the form of an interview, but due to the covid-19 pandemic and to increase the number of responders, it was converted to be online. It includes two main sections:

1- **General Information** regarding gender, institution, working place (Hospital, Health center, NGO, Ministry or Other), position and age.

2- **Open-ended questions covering** E-health readiness at both institutional and national levels; main trends in E-health on institutional, national and international levels; main challenges associated with E-health implementation; vision of E-health implementation; current institution involvement in any E-health project(s)/ initiative (s); scope of collaboration with academic institutions; recommendations for the improvements of E-health

The links for these surveys were:

- **Faculty/Staff** Questionnaire: https://bau.bluera.com/bau/a.aspx?l=140_1_AAAAAAAABJc

- **Student** Questionnaire: https://bau.bluera.com/bau/a.aspx?l=141_1_AAAAAAAABJ8
- **Stakeholders** Questionnaire: https://bau.bluera.com/bau/a.aspx?l=142_1_AAAAAAAABKc

Results

General information analysis

Below are the results of the responses and interpretations. The various counts between Lebanon and Egypt are illustrated. It is seen here that student responders were 259 and 25 in Lebanon and Egypt respectively. In contrast, faculty/staff responders were 48 and 98 respectively. Stakeholder's responders were 15 and 35 respectively. The variance in responders might be due to either the interest in focus groups about the subject of the survey or the strategy adopted to push them to fill the survey. In addition, the small number of students may be due to the lock down regarding covid-19 pandemic.

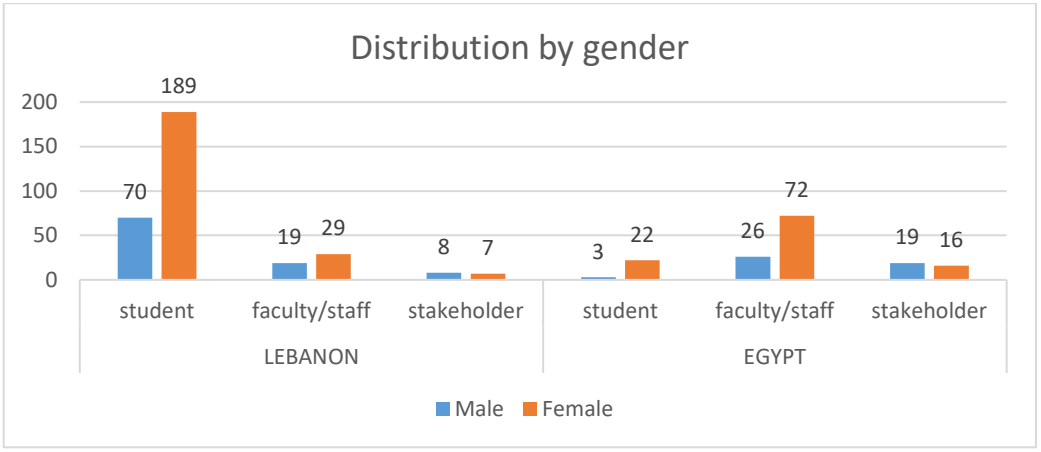

Figure 1. Gender distribution between students, faculty/staff, and stakeholders in both Lebanon and Egypt

From this survey, we had discrepancy in number of **student** responders between Lebanon and Egypt possibly due to vacation period and COVID19 related restrictions. However, the total number of responders can be considered as acceptable to draw from it some conclusions. Between the three focus populations, it is obvious the higher response from the student group compared with faculty/staff and stakeholders. Another observation was the higher response from females compared to males (Figure 1). This might be due to either higher number of females working in the health sector or that the interest in answering a survey related to health was more answered by females.

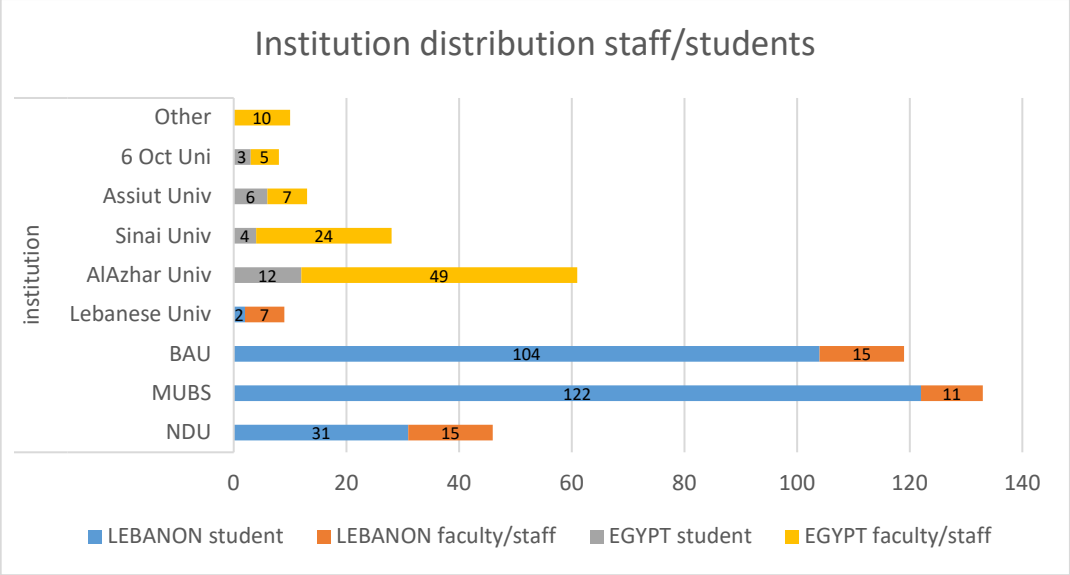

Figure 2. Distribution of faculty/staff and students by institution in both Lebanon and Egypt

Figure (2) represents the number of responders from different universities in the groups of faculty/staff and students. Unfortunately, some universities showed very low response rate but which was balanced by the high response from other partners. The figure contrasts the numbers were the highest at MUBS (133) and BAU (119).

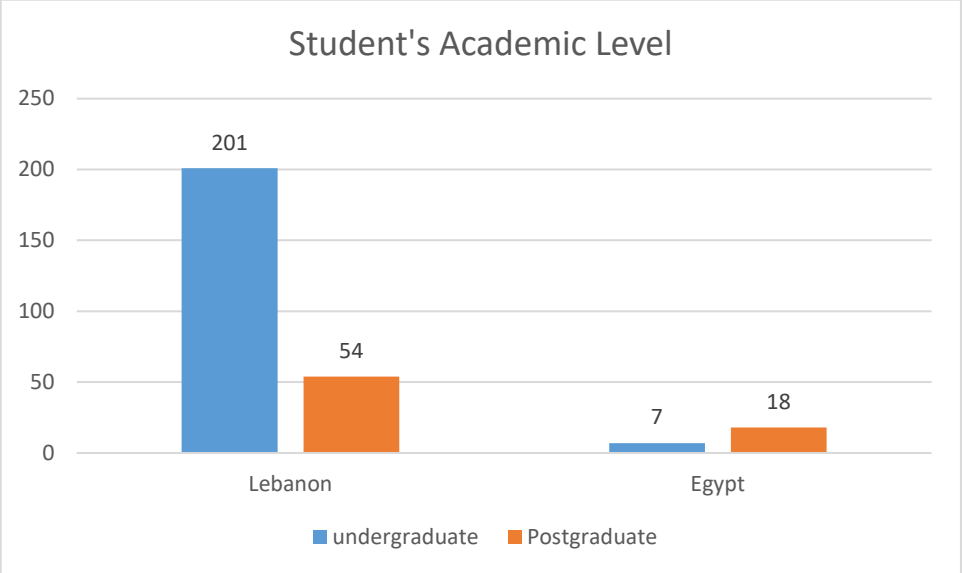

Figure 3. Distribution of students according to their academic level

Figure (3) highlights the distribution of student's level showing clearly that undergraduate student's response was higher (255) than postgraduate ones (25). We consider this observation compatible with the higher number of students at the undergraduate level.

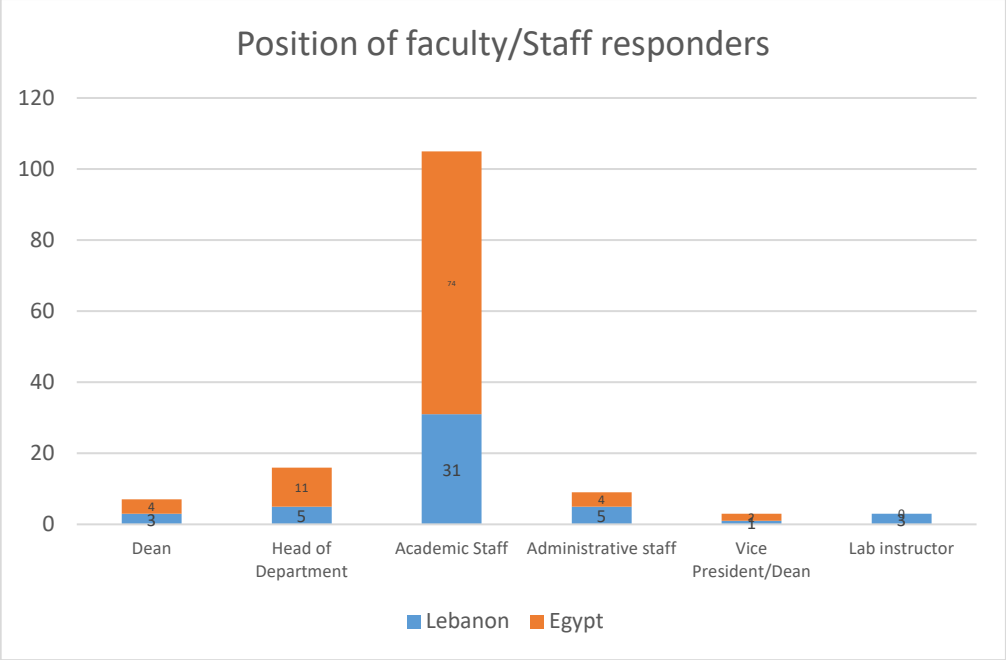

Figure 4. Position of faculty/ responders in both Lebanon and Egypt

Figure (4) illustrates the position of responders in the faculty/staff group with evident high response from academic staff (105) compared to other subgroups. Such observation seems logical due to the usual difference in numbers between interviewed groups and gives a clear view about the interest of academic staff in issues related to eHealth and telemedicine.

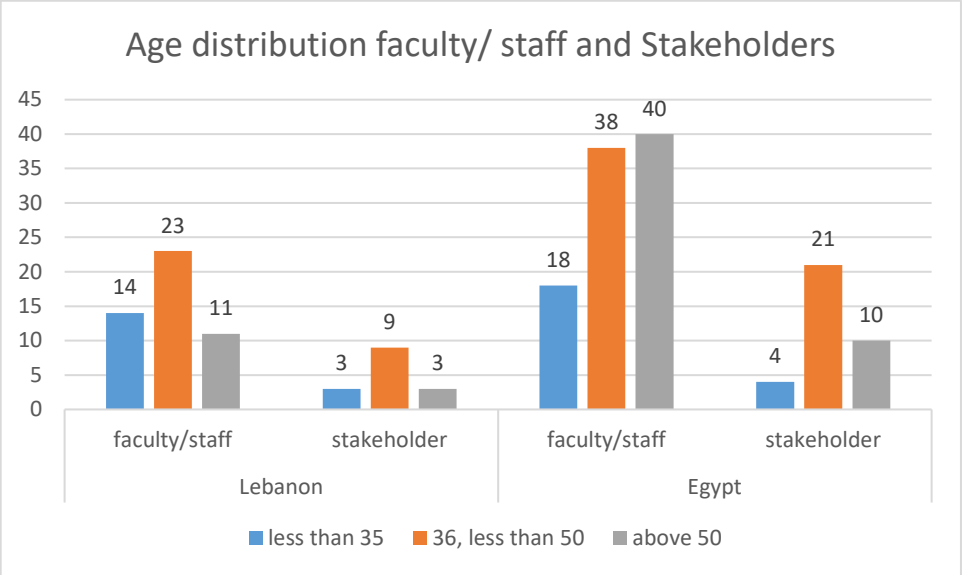

Figure 5. Age distribution of faculty/staff in Lebanon and Egypt

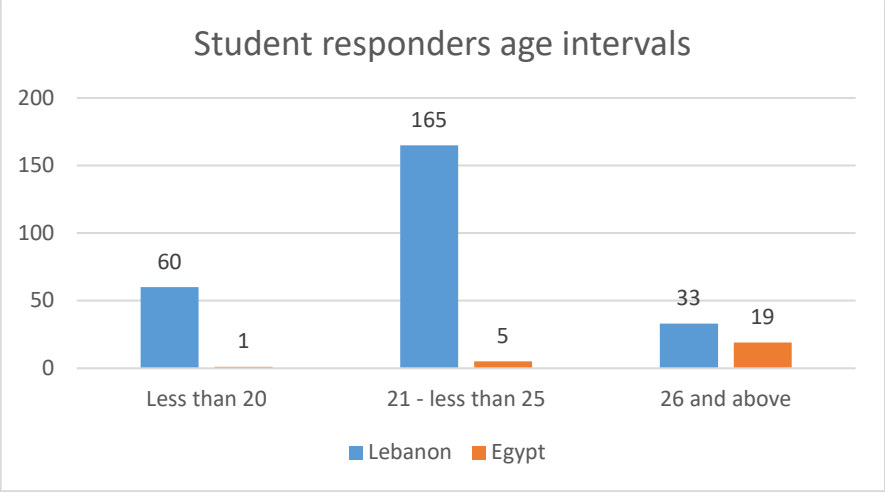

Figure 6. Age distribution of students in Lebanon and Egypt

Figures (5) and (6) clarify the age intervals for faculty/staff and stakeholders, and students respectively. It is seen that the majority of student responders were aged between 21 and 25 years old. In contrast it can be seen the discrepancy between Lebanese and Egyptian responders. Regarding the faculty/staff age group, the majority is between 36 and 50.

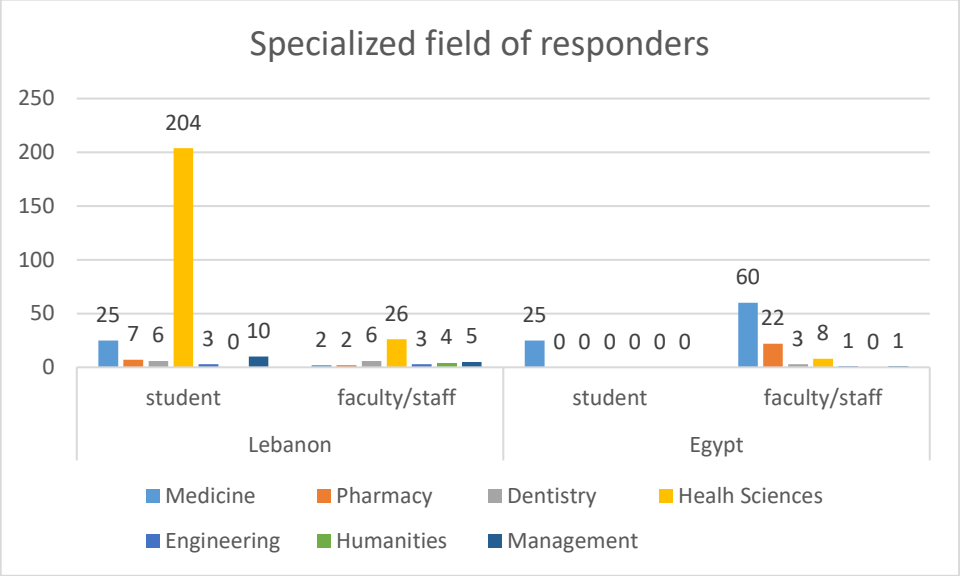

Figure 7. Distribution of responders according to their specialized fields

Figure (7) clearly shows the high response rate from health sciences students (>200) and possibly translating the interest of such health specialties in the implementation of eHealth in the contemporary health system. This may be due to the availability of the faculty of health sciences in most responding partner institutions. **More effort can be exerted to collect more data from other Faculties including Pharmacy and Dentistry.**

Institutional eHealth presence

The questions to faculty and staff can be divided into three subsections. Questions regarding institutional health, questions related to the use of internet to have

information about health, and questions regarding readiness to eHealth in both Egypt and Lebanon. The responses to these three subsections are illustrated and highlighted in Tables 1, 2, and 3.

Table 1. Faculty and staff responses regarding institutional eHealth

	Lebanon	Egypt
1- Your institution invested in the field of Information health technology.	71.2	**63.8***
2- Your institution has online communication with patients or remote consultation procedures	**64.2***	**55.2***
3- Your institution stores patient records electronically.	70.4	**56.2***
4- Your institution has a planning for e-health projects.	73	**66***
5- Your institution has interactional platforms through its website for responding the viewers' queries	**63***	**60.4***
6- In your institution, there is a sufficient level of awareness of, and knowledge about e-health in your institution?	**68***	**60.2***

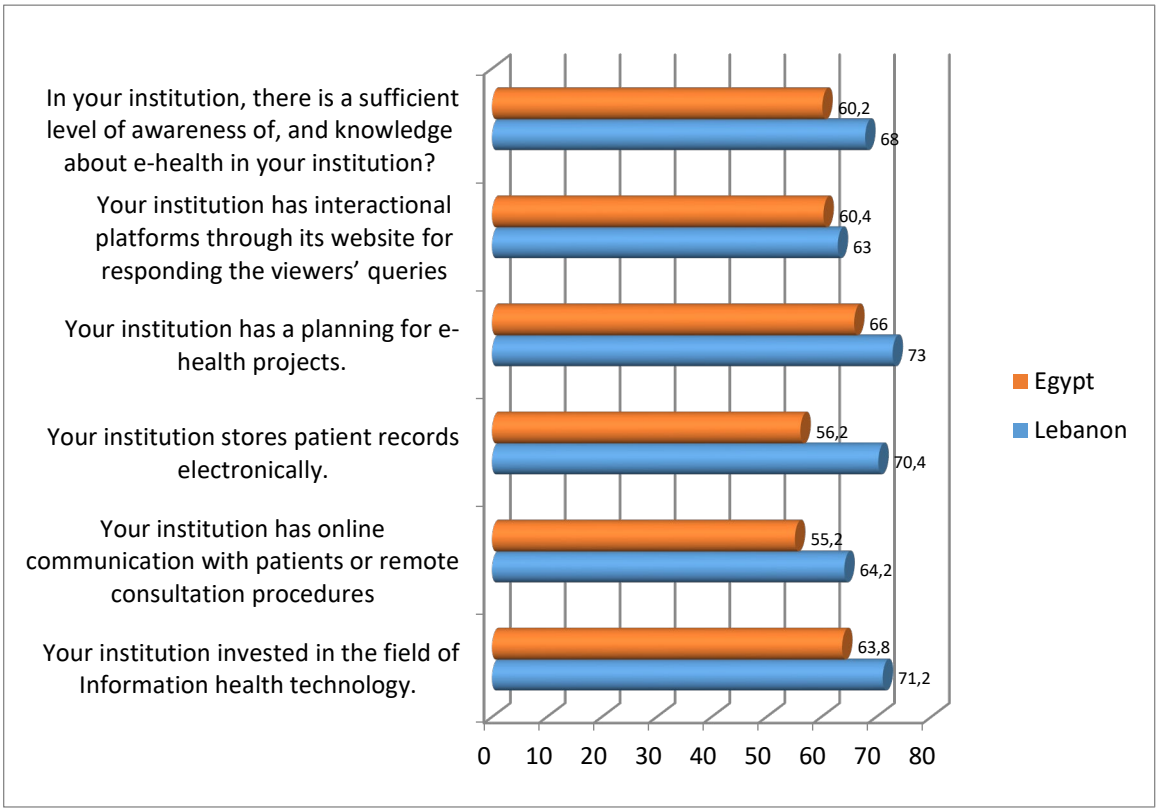

Figure 8. Faculty and staff responses regarding institutional eHealth

Table 1 and Figure 8 clearly show that most of the responses scored <70%. However these questions were mainly investigating the truth about institutional fact related to the presence of basics of eHealth infrastructure. On the other hand, a slight better score can be seen when questioning about future perspective related to eHealth strategies and infrastructure. It can be deduced here that there is a lack and need of preparing and implementing eHealth at the institutional levels especially that responders to this questions group were faculty and staff in universities probably the first line in implementing and serving community through eHealth. **From this data it is highly recommended to have interactional online platform through websites to respond to viewer queries.**

Searching the internet for different health concerns

In this second part, and according to the results addressed in Table 2 and Figure 9. The shadowed cells reflect that the concerned question was not within the questionnaire to this group of responders. For Figure 9, the mean of responses of questions regarding the search on the internet of health related information's was used to give clear idea about attitude of responders towards this issue.

Table 2. Responses of responders to questions related to the use of internet to have information about health

	LEBANON			EGYPT		
	Student	Faculty/staff	Stakeholders	Student	Faculty/staff	Stakeholders
1- Searching the internet is useful to find, compare, and assess a healthcare service.	81.8			75.2		
2- Making a doctor's appointment through the internet is adequate	77			**67.2***		
3- The internet is suitable to identify the meaning of a specific medical term	84.2	78.8		81.6	74.6	
4- Searching the internet is useful to know about specific diseases, symptoms, therapeutic options	83.8	76.2		81.6	80.4	
5- Searching the internet can help in smoking cessation, nicotine replacement therapy	72	71.2		72	**67***	
6- Searching the internet can help having information's regarding calorie intake, nutrition diary	82.4	79.2		79.2	78.6	
7- Searching the internet can give information's about vaccinations, screening programs	80	76.6		80.8	77.8	
8- Searching the internet can give relevant information's regarding side effect of prescription or non-prescription medicines	80.6	75.4		72.8	75.4	
9- The internet can be a good source of information's regarding fitness instructions	82.4	77.8		73.6	72.6	
10- Information's about eHealth and telemedicine are clear	75.8	**68.6***		**64***	**61.4***	
11- Health information from the Internet is reliable	72	**66.4***	**66.2***	**63.2***	**65***	**68.6***

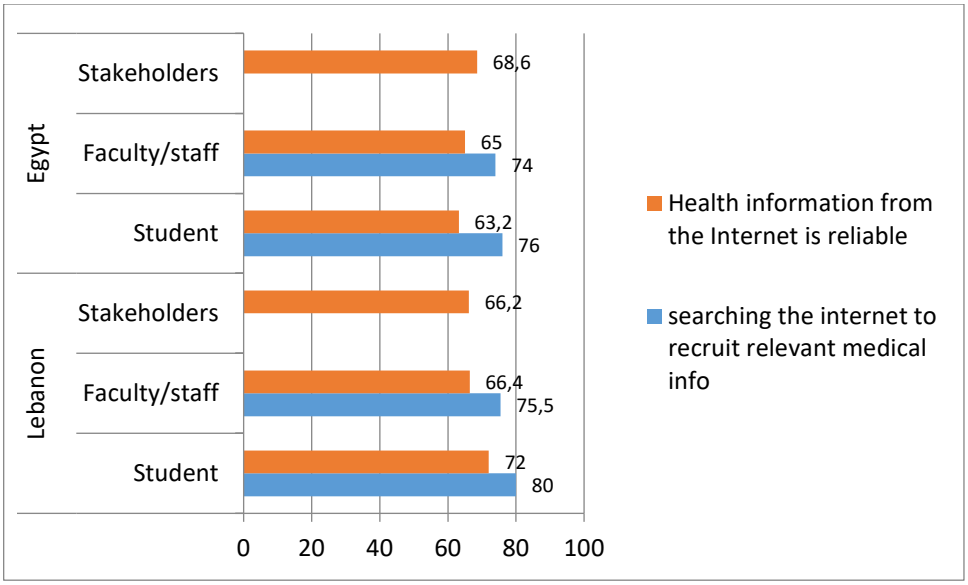

Figure 9. Responses of responders to questions related to the use of internet to have information about health (mean of similar questions was calculated and compared)

It is clear that almost all responders did consider that internet based information are important and relevant in many interviewed aspects including: finding health services [Question 1], taking appointment [Question 2], searching for medical information's (smoking cessation, dieting, exercise, vaccination, medication effect and side effects,….) [Questions 3-9]. On the contrary, scores showed non satisfactory results when the questions turned into the reliability and the clearness about eHealth and telemedicine [Question 11]. From these observations we can deduce the need to correctly implement Tele health and eHealth and clarify their procedures in order to have better outcomes. Possible ways to do this might be the implementation of trainings to faculty and staff to monitor and assure correct implementation any eHealth initiative. However, special considerations must be taken into account regarding the transparency and guarantee of high level of security concerning shared information.

Readiness to eHealth in both Egypt and Lebanon

Table 3. Answers of responders regarding readiness to eHealth in both Egypt and Lebanon

	LEBANON			EGYPT		
	Student	Faculty/staff	Stakeholders	Student	Faculty/staff	Stakeholders
1- Electronic health information exchange between healthcare professionals and patients is reasonable	77.6	72.8		70.8	**63.6***	
2- Collection of health data or health behavior through portable sensors and smartphone apps to monitor a chronic illness or disability is useful	78.6	74.4	**69.2***	**65.6***	**69.8***	74.2

3- Collection of health data through portable sensors and recommendations for a healthy lifestyle derived from them is useful	81	76		**68***	73	
4- Data security and privacy are guaranteed for electronically collected health data.	75.4	**69.8***	**58.4***	**66.4***	**65.2***	**65.8***
5- Collecting health data via telemonitoring improves the holistic view of the patients.	78	76.6	**67.6***	**67.2***	70.6	75.4
6- Online health information improves patient knowledge.	82.8	78.6		78.4	74	
7- Telemedicine improves interaction between physicians and patients.	76.4	75.8	72.4	**65.6***	73.2	**64***
8- Telemedicine reduces healthcare costs.	81.4	76.6	73.8	74.4	74.6	73.2
9- Telemedicine reduces healthcare administration.	79.6	73		**66.4***	**68.6***	
10- Telemedicine enhances quality of healthcare	76.4	71.6	**67.6***	**64***	71.6	**64.8***
11- Telemedicine enhances doctor-patient relationship.	74.8	**68***	**63***	**65.6***	71.2	**65.8***
12- Telemedicine supports communities during crises (for example: COVID-19)	86.4	87.6	75.4	84.8	82.6	85.2

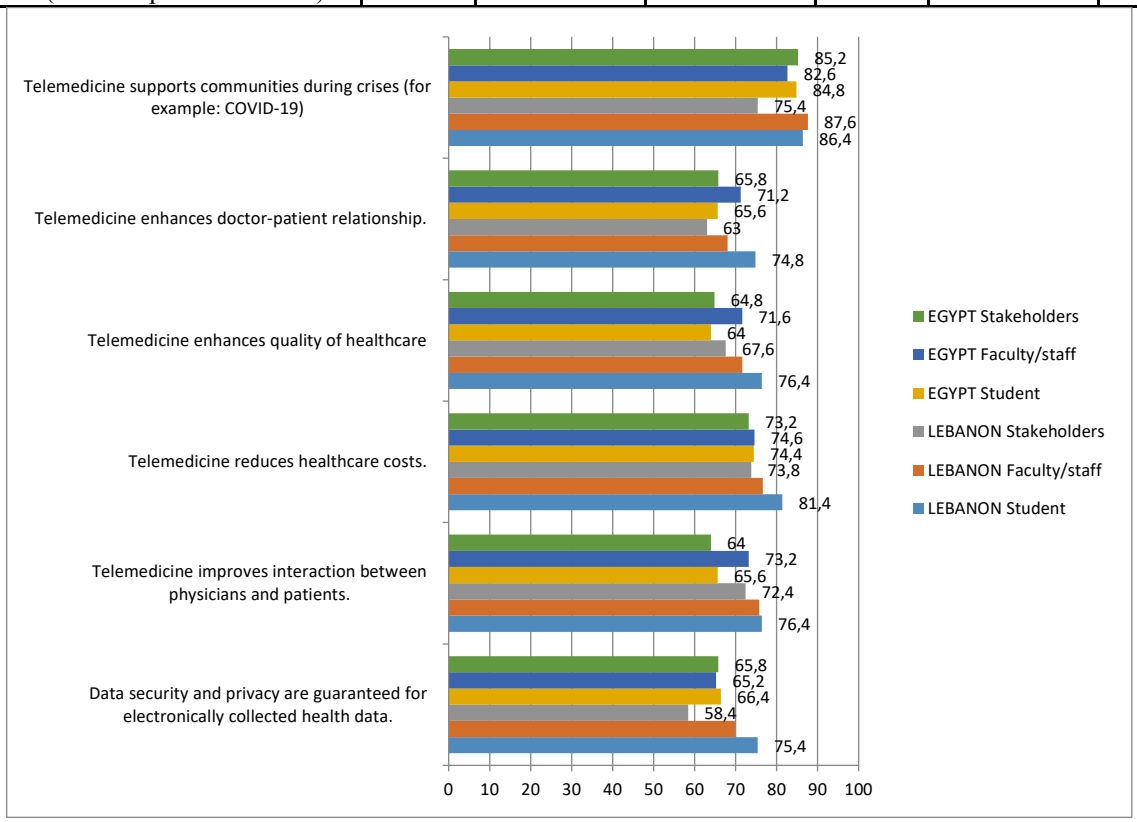

Figure 10. Answers of responders regarding readiness to eHealth in both Egypt and Lebanon (selected questions are included in this figure).

The readiness of responders to eHealth can be viewed in Table (3) and figure (10). The shadowed cells reflect that the concerned question was not within the questionnaire to this group of responders.

For question 1 [Electronic health information exchange between healthcare professionals and patients is reasonable], it can be deduced that there was a discrepancy between Lebanon and Egypt, however this difference was not very wide leading to a potential conclusion that responders do consider the need for such information exchange.

Questions 2 and 3 [Collection of health data or health behavior through portable sensors and smartphone apps to monitor a chronic illness or disability is useful; Collection of health data through portable sensors and recommendations for a healthy lifestyle derived from them is useful] clearly show that the use of sensors or applications is considered acceptable in health promotion issues rather than in cases of illness. However, difference in reporting between Lebanon and Egypt might be due to the reduced number of responders from Egypt.

Question 4 [Data security and privacy are guaranteed for electronically collected health data] results raised the concern of all responders regarding the privacy and security of exchanged information through eHealth. Such reporting might urge the need to guarantee in a transparent way for all elements of eHealth and Telemedicine regarding the high level of security and privacy of all exchanged information.

Questions 5 -7 [Collecting health data via telemonitoring improves the holistic view of the patients; Online health information improves patient knowledge; Telemedicine improves interaction between physicians and patients] results revealed that responders considered that online information improved patient knowledge, but the contradiction in results with question 11 asking about patient-health care provider relationship can be possibly be explained by the fact that the responders considered the difference between knowledge acquired through online means and the humanitarian relationship that might be lost in such mean.

Question 8-11 [Telemedicine reduces healthcare costs; Telemedicine reduces healthcare administration; Telemedicine enhances quality of healthcare; and Telemedicine enhances doctor-patient relationship] interrogated the responder's perception regarding the aspects of online information and eHealth in terms of quality, administration, and cost. All responders viewed eHealth to reduce cost of health service. However, there was a discrepancy in terms of quality and administration, which surely raises the concern of training in cases where eHealth is to be implemented. The agreement of all responders on the effectiveness and need of eHealth implementation is clear in response to question 12 [Telemedicine supports communities during crises (for example: COVID-19), can assure the need of such health approach in the medical world, especially if emerging health needs arise and needs management.

<u>Interpretation of open questions addressed to stakeholders</u>

1- **Please describe the E-health readiness at both institutional and national levels**
   The response on this question from stakeholders tackled many important points that can be summarized as follows

- Most responses considered that the national and international readiness was not that high due to many causes including lack of suitable knowledge and skills from both health care professionals and patients.
- In Lebanon particularly, most of responders pointed on the problems related to the infrastructure i.e. electricity cut-off, and internet services.
- Responders from both Lebanon and Egypt also addressed the cost of eHealth for both institutions and patients.
- Responders also addressed the difference between major cities and rural area in such readiness.

2- In your opinion, what are the main trends in E-health on institutional, national and international levels?

Most responses considered the trends in eHealth to be related to the use of mobile health application, interactive websites, in addition to the electronic health record. All these cited trends were claimed by many responders to ease patient/health care professional communication and promote better health outcomes.

3- What are the main challenges associated with E-health implementation in your country?

Many challenges were addressed in this question including: Electricity cut down (Lebanon), cost of expensive technologies, internet infrastructure, level of knowledge and skills at both health care personnel and patients, legislative issues related to privacy of information concerns, cultural differences between urban and rural areas.

4- What is your vision of E-health implementation in your country?

In this section, we had contradictory responses, while few responders considered eHealth implementation not feasible and difficult to be implemented, however, most others presented optimistic point of view in which they considered it an excellent and promising solution and worth to be invested in. They went beyond and consider that correct implementation will increase health in rural areas or in non-ambulant patients. In addition, they considered that eHealth helps in creating national database for patients with chronic disease thus facilitating the performance of relevant research and managing resources. The answer to such reply might be fostering of the relationship and collaboration with concerned Ministries i.e. Ministries of Health, social affairs, ….

5- Is your institution currently involved in any E-health project(s)/ initiative (s). If yes, please briefly describe these initiatives (project, national programme, public-private partnership, etc.) and the main objectives.

In this section, we had contradictory answers. Most answered that their institutions do not have any source of eHealth service, little of responders had no idea, while the remaining claimed that the eHealth service in their institution's was limited to online training, limited telemedicine, or are part from national programs using eHealth.

6- **Does your institution have any collaboration with academic institutions? If yes, please briefly describe the scope of this collaboration**

Most of responders replied as having no collaboration with academic institutions regarding eHealth. However, some of them did state that they have limited collaboration with some academic institutions but needs to be deepened.

7- **What recommendations do you have for the improvements of E-health in your own country**

Recommendation from responders did show variance in the points of view. These can be summarized as follows:

Legislative approach: responders considered important opinion regarding laws and legislations related to eHealth, including inclusion of Orders, syndicates, private sector in addition to funding issues. Furthermore, ensuring transparency and confidentiality as well as the guarantying paid service and specific procedures related to the service.

Awareness approaches: including training and awareness campaigns to highlight importance of eHealth, benefit, in addition to providing suitable training and capacity building.

Multidisciplinary approach: the inclusion of engineers and other relevant specialties in order to offer high level of service. Responders suggested collaboration with experienced experts from abroad if applicable.

SWOT ANALYSIS

The SWOT analysis was done to determine applicability and potential creation or development of existing eHealth and telemedicine centers in Universities in Egypt and Lebanon.

The following SWOT figure was considered drawn from data analysis.

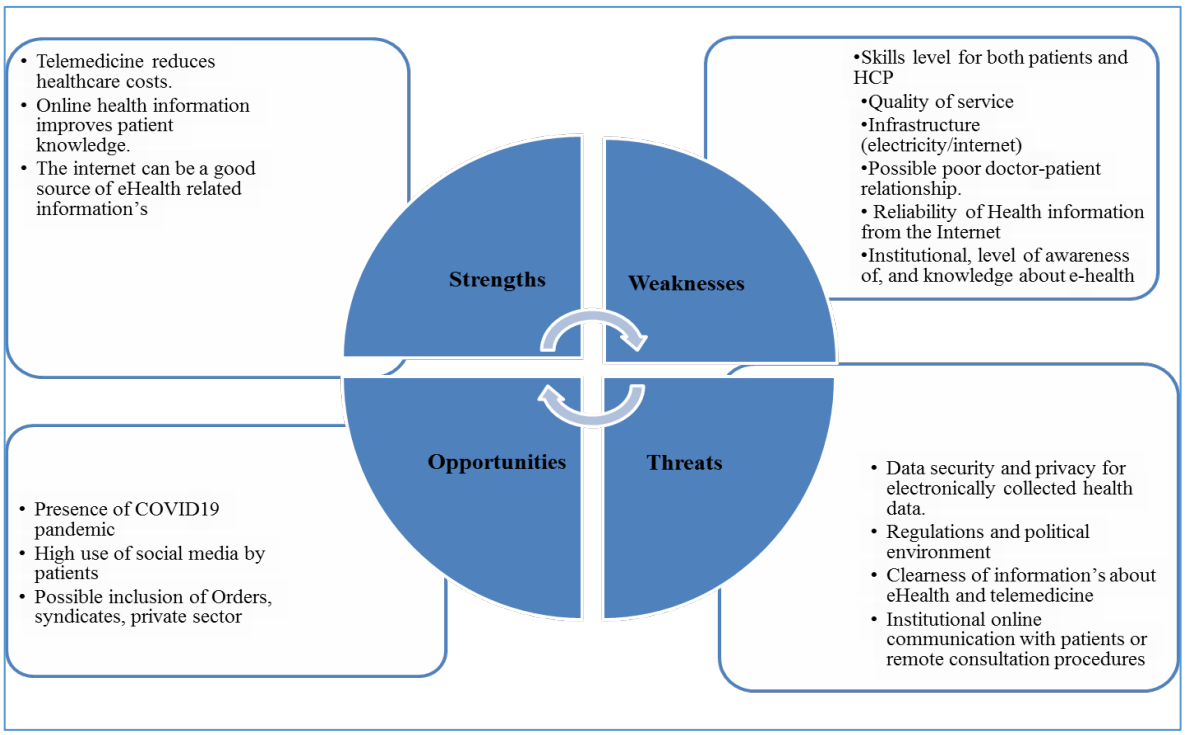

Figure 11. SWOT Analysis

CONCLUSIONS AND RECOMMENDATIONS

As conclusions and recommendations from the surveys implemented, it can be deduced that the creation and/or enhancement of eHealth centers in universities is a necessity to foster the health system adopted in both Lebanon and Egypt. This might include:

- Preparing required infrastructure for eHealth centers.
- The need to consider the difference between urban and rural areas in terms of cultural differences,
- To consider infrastructure issues related to telemedicine and eHealth especially in Lebanon, as such problem was highly cited by responders due to the status of electricity and internet in Lebanon.
- Improve communication and collaboration with national ministries, syndicates, Orders, and organization as suggested by stakeholders.
- Improve communication and collaboration with academic institutions in order to foster research, community service, and education.
- Capacity building directed towards eHealth requirements. This might include training of personnel involved in eHealth regarding all elements of eHealth.
- Involve other relevant specialties like biomedical and IT engineers for better outcome.
- Providing technological support like mobile, application and devices.

APPENDICES

Appendix A: Questionnaire for students (English)

I- GENERAL INFORMATION	
1. Please indicate your gender:	Male Female
2. Institution	
3. Academic level	Undergraduate Postgraduate
4. Age	Less than 20 21 – less than 25 26 and above
5. Specialized field	Medicine Dentistry Pharmacy Health Sciences Others: Specify
II- E-HEALTH READINESS	
6. Searching the internet is useful to find, compare, and assess a healthcare service.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
7. Making a doctor's appointment through the internet is adequate	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
8. The internet is suitable to identify the meaning of a specific medical term	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
9. Searching the internet is useful to know about specific diseases, symptoms, therapeutic options	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
10. Searching the internet can help in smoking cessation, nicotine replacement therapy	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
11. Searching the internet can help having information's regarding calorie intake, nutrition diary	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
12. Searching the internet can give information's about vaccinations, screening programs	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
13. Searching the internet can give relevant information's regarding side effect of prescription or non-prescription medicines	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
14. The internet can be a good source of information's regarding fitness instructions	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
15. Information's about eHealth and telemedicine are clear	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
16. Health information from the Internet is reliable	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
17. Electronic health information exchange between healthcare professionals and patients is reasonable	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
18. Collection of health data or health behavior through portable sensors and smartphone apps to monitor a chronic illness or disability is useful	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
19. Collection of health data through portable sensors and recommendations for a healthy lifestyle derived from them is useful	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
20. Data security and privacy are guaranteed for electronically collected health data.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
21. Collecting health data via telemonitoring improves the holistic view of the patients.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
22. Online health information improves patient knowledge.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
23. Telemedicine improves interaction between physicians and patients.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree

24. Telemedicine reduces healthcare costs.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
25. Telemedicine reduces healthcare administration.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
26. Telemedicine enhances quality of healthcare	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
27. Telemedicine enhances doctor-patient relationship.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
28. Telemedicine supports communities during crises (for example: COVID-19)	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree

Appendix B: Questionnaire for Academic/ administrative staff

III- GENERAL INFORMATION	
1. Please indicate your gender:	Male Female
2. Institution	
3. Position	Dean Head of Department Academic staff Administrative staff Other, please specify
4. Age	Less than 35 36 – less than 50 51 and above
5. Specialized field	Medicine Dentistry Pharmacy Health Sciences Others: Specify
IV- Existing situation of relevant E-Health Activities	
1. Does your institution have a center of E-health innovation (or equivalent)	Yes No
6. If Yes, please list its main activities - - -	
7. Your institution invested in the field of Information health technology.	1=Strongly agree to 5= Strongly disagree
8. Your institution has online communication with patients or remote consultation procedures.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
9. Your institution stores patient records electronically.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
10. Your institution has a planning for e-health projects.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
11. Your institution has interactional platforms through its website for responding the viewers' queries	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
12. In your institution, there is a sufficient level of awareness of, and knowledge about e-health in your institution?	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree

V- E-HEALTH READINESS	
13. The internet is suitable to identify the meaning of a specific medical term	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
14. Searching the internet is useful to know about specific diseases, symptoms, therapeutic options	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
15. Searching the internet can help in smoking cessation, nicotine replacement therapy	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
16. Searching the internet can help having information's regarding calorie intake, nutrition diary	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
17. Searching the internet can give information's about vaccinations, screening programs	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
18. Searching the internet can give relevant information's regarding side effect of prescription or non-prescription medicines	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
19. The internet can be a good source of information's regarding fitness instructions	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
20. Information's about eHealth and telemedicine are clear	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
21. Health information from the Internet is reliable	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
22. Electronic health information exchange between healthcare professionals and patients is reasonable	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
23. Collection of health data or health behavior through portable sensors and smartphone apps to monitor a chronic illness or disability is useful	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
24. Collection of health data through portable sensors and recommendations for a healthy lifestyle derived from them is useful	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
25. Data security and privacy are guaranteed for electronically collected health data.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
26. Collecting health data via telemonitoring improves the holistic view of the patients.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
27. Online health information improves patient knowledge.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
28. Telemedicine improves interaction between physicians and patients.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
29. Telemedicine reduces healthcare costs.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
30. Telemedicine reduces healthcare administration.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
31. Telemedicine enhances quality of healthcare	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
32. Telemedicine enhances doctor-patient relationship.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
33. Telemedicine supports communities during crises (for example: COVID-19)	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
34. What is the percentage of the employees who have access to the PCs in your institution?	Approximately 0–25 % 26–50% 51–75% 76–100% I don't know?
35. What is the percentage of the employees who have access to the personal e-mail in your institution?	Approximately 0–25 % 26–50% 51–75% 76–100% I don't know?

Appendix C: Questionnaire and open ended questions for stakeholders

GENERAL INFORMATION	
1. Please indicate your gender:	Male Female
2. Your Institution	
3. You work in	Hospital Health center NGO Ministry Other: specify ……
4. Position	Health worker Administration Other: specify
5. Age	Less than 35 35 – less than 50 50 and above

E-HEALTH READINESS	
6. Health information from the Internet is reliable	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
7. Collection of health data or health behavior through portable sensors and smartphone apps to monitor a chronic illness or disability is useful	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
8. Data security and privacy are guaranteed for electronically collected health data.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
9. Collecting health data via telemonitoring improves the holistic view of the patients.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
10. Telemedicine improves interaction between physicians and patients.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
11. Telemedicine reduces healthcare costs.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
12. Telemedicine enhances quality of healthcare	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
13. Telemedicine enhances doctor-patient relationship.	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree
14. Telemedicine supports communities during crisis (for example: COVID-19)	1: Strongly agree – 2: Agree – 3: Neutral – 4: Agree – 5: Strongly Agree

Open Questions:

1- Please describe the E-health readiness at both institutional and national levels
2- In your opinion, what are the main trends in E-health on institutional, national and international levels?
3- What are the main challenges associated with E-health implementation in your country?
4- What is your vision of E-health implementation in your country?
5- Is your institution currently involved in any E-health project(s)/ initiative (s). If yes, please briefly describe these initiatives (project, national programme, public-private partnership, etc.) and the main objectives.