What Changes Need to be Made within the LNHS for Ehealth Systems to be Successfully Implemented?

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Abstract: This piece of work provides an assessment of the readiness levels within both urban and rural hospitals and clinics in Libya for the implementation of Ehealth systems. This then enabled the construction of a framework for Ehealth implementation in the Libyan National Health Service (LNHS). The study assessed how medications were prescribed, patients were referred, information communication technology (ICT) was utilised in recording patient records, how healthcare staff were trained to use ICT and the ways in which consultations were carried out by healthcare staff. The research was done in five rural healthcare institutions and five urban healthcare institutions and focused on the readiness levels of the technology, social attitudes, engagement levels and any other needs that were apparent (Jennett et al., 2010; Hasanain et al., 2014). Collection of the data was carried out using a mixed method approach with qualitative interviews and quantitative questionnaires (Molina et al., 2010; Creswell and Plano, 2010; Mason, 2006; Cathain, 2009; Cathain et al. 2008). The study indicated that any IT equipment present was not being utilised for clinical purposes and there was no evidence of any Ehealth technologies being employed. This implies that the maturity level of the healthcare institutions studied was zero.

1 INTRODUCTION

When Ehealth systems are incorporated in healthcare systems they can support them in addressing the healthcare problems that are now facing most countries within the developing world (Kwankam, 2004; Ludwick and Doucette, 2009; Lau et al., 2011). However, in order to introduce Ehealth systems in developing countries there needs to be an overhaul of the ICT systems being used there at present and these calls for examinations of the infrastructure, organisation and political situations in these countries (Hossein, 2012). The research carried out on transforming the LNHS has indicated that a majority of Libyans do not have enough access to the basics required for healthcare and most people receive medical attention purely from the LNHS. The LNHS has invested large amounts of money in both urban and rural healthcare institutions and services, along with ICT, in order that the provision of healthcare services are improved by healthcare staff having more efficient work processes (Hamroush, 2014). However, although there had been a large financial has been invested,

many healthcare staff have not benefitted from improved ICT. This study looks at how Ehealth systems can lead to healthcare professionals carrying out their jobs more effectively and efficiently in the LNHS. For achieving this, the researcher conducted a study of urban and rural healthcare institutions in order to assess their Ehealth readiness and to be able to create an Ehealth framework for improving the job processes of healthcare staff. The study looked at ways in which Ehealth systems could be utilised for improving the keeping of patient healthcare records, making consultations, carrying out training, making referrals and prescribing medication (Bilbey and Lalani, 2013; Yellowlees, 2005; Broens et al., 2007; Khoja et al., 2007). This study has lead to the compilation of an Ehealth framework formulated from the research data and it has formulated a list of recommendations that can be utilised for the transition from the present ICT levels in the LNHS to a more complex and developed one where Ehealth solutions can be integrated.

2 THE THEORY OF Ehealth READINESS ASSESSMENTS

The theory of Ehealth Readiness Assessments was carried out to define Ehealth systems, how they might benefit a populace in a developing country and how the readiness of that country might be evaluated. There are many factors determining the readiness of a country for the implementation of Ehealth systems (Khoja et al., 2007; Jennett et al., 2004), so it was a rewarding task to investigate the findings of previous research. Using the Brighton University data base, Science Direct, Google Scholar, various Libyan data bases and existing reports from hospitals in Libya, searches were made for relevant articles about the implementation of Ehealth systems in developing countries. Though there were already assessments made of several countries, none had yet been carried out in Libya. This literature review will give some examples of relevant research discovered during this search and then expand on how these frameworks will be utilised in this assessment on the readiness of Libya for the implementation of Ehealth systems. There was though a limited amount of formal articles on this subject pertaining to developing countries, so a search was made on many databases to find any recent research carried out on assessing the readiness of developing countries for Ehealth implementation.

Blaya et al, 2010 made a review of Ehealth system that had been implemented in developing nations. They found that if a system improved communications between the healthcare institutions, assisted in the management and ordering of medications and helped in monitoring patients that might abandon their care plan, then it could be considered as 'promising'. They found the systems were effective at evaluating personal electronic assistants and mobile apparatus as they improved the collection of data in regards to quality and time taken.

A majority of studies carried out to evaluate Ehealth systems are made once the system has been implemented, as seen in the example of Ammenwerth et al. 2001. Alexander, 2007 points out the importance of such studies for evaluating the success of an Ehealth system, though Brender, 2006 points out the need for evaluations to take place before the implementation of an Ehealth system in, order to allow decisions to have a better sense of direction. It is the advice of Brender, 2006 that the researcher has heeded in the formulation of the research question, tending toward the theory that a readiness evaluation framework is needed before

implementing Ehealth systems (Yellowlees, 2005; Broens et al., 2007; Khoja et al., 2007).

Li et al, 2010 cite four main areas to evaluate in a study to assess readiness for implementing an Ehealth system. Those areas are: if it is feasible; does the organisation possess the necessary resources, the risks involved; an assessment needs to be made of what external factors might threaten the project's success, areas where problems may arise; to identify weaknesses in the solution where risks may occur and an assessment of how complete and consistent the solution is.

3 METHODS

A mixed method approach was employed for carrying out this research on healthcare institutions, in both rural and urban areas of Libya (Figure 1) (Molina et al., 2010; Creswell and Plano, 2010; Mason, 2006; Cathain, 2009; Cathain et al. 2008), employing both questionnaires and group interviews. The data from the multi-case study was analysed using the Cresswell framework (2007) (Lynna et al., 2009). The formulation of the interview questions and questionnaires was carried out to make sure there was not anything missing by seeing what was needed from the literature review and the Chan framework (2010). The selection of the healthcare institutions was done so that all the major population centres of Libya were covered in five primary areas.

3.1 Research Methods and Sample Size

For the purposes of this study the participants were found in hospitals and clinics within the professions of nursing, hospital administration, ward attendants and doctors. The sample size (see Figure 1) of this study was 165, with 138 of these returning a questionnaire; as a percentage that worked out at 83.6%. Because 58 of the questionnaires were excluded from the final total because they were filled out incorrectly or superfluous, the final number for analysis was 80 (N=80).

The questionnaire was divided into two sections, with one set of questions aimed at general medical staff, the other aimed at administration staff. The questions for the medical staff were designed in order to better understand of the work processes involved in recording the healthcare data of patients, carrying out referrals, consultations and prescriptions. The questions for the administrative staff were formulated in order to better understand
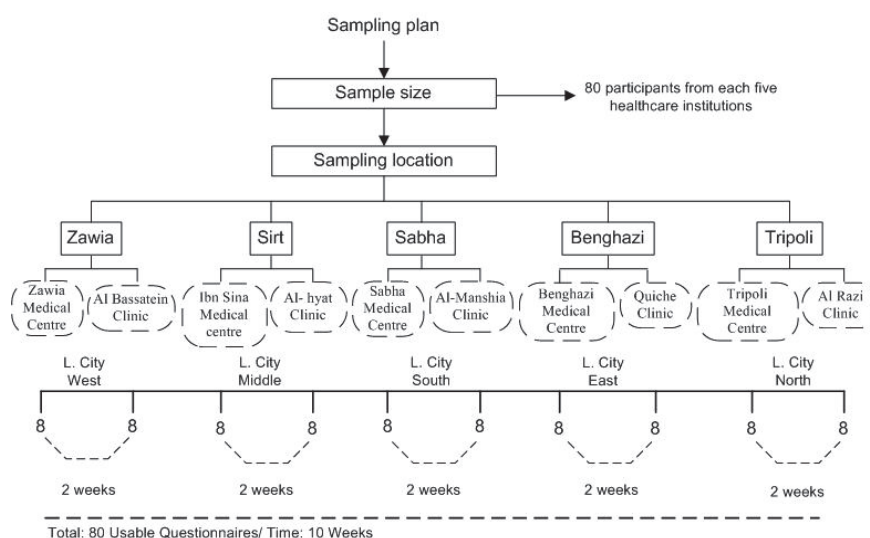
Figure 1: Sample size.

Table 1: Semi-structured interviews.

categories of participants	Healthcare institution										
	Tripoli Medical Centre	Al Razi Clinic	Benghazi Medical Centre	Quiche Clinic	Sabha Medical Centre	Al-Manshia Clinic	Ibn Sina Medical centre	Al- hyat Clinic	Zawia Medical Centre	Al Bassatein Clinic	
Administrators	1	1	1	1	1	1	1	1	1	1	10
Doctors	1	1	1	1	1	1	1	1	1	1	10
Nurses	1	1	1	1	1	1	1	1	1	1	10
Ward assistants	1	1	1	1	1	1	1	1	1	1	10
Total of participants											40

of the present ICT infrastructure in the healthcare institutions, the background history of the healthcare institutions and the settings of the healthcare institutions. The formulation of each question was done using the Li et al, 2010 framework for assessing Ehealth readiness.

Semi-structured interviews: A total of 40 individual actors (doctors, ward assistants, administrators and nurses) were interviewed in Arabic using semi-structured interview techniques (Table 1). The durations of the interviews varied between 20 and 40 minutes and averaged out at 30 minutes for each interview. The total time taken for all the interviews was about 20 hours and the details of these interviews are shown below in Table 1.

The reason for interviewing the staff at the healthcare institutions was to find out what their perceptions of Ehealth technologies were and how useful and beneficial they would be if implemented in the healthcare institutions where they worked.

4 RESULTS

The results of the data were separated into separate sections based upon the Cresswell framework (2007).

4.1 Results of the Questionnaire

4.1.1 Healthcare Staff Availability within Urban and Rural Healthcare Institutions

The results of the research showed that there was a lack of doctors available to work in rural healthcare institutions. The results indicated that the lack of doctors in rural healthcare institutions meant that doctors have much less time to spend treating patients and often patients had more severe symptoms as they had further to travel to receive treatment and had consequently waited until their condition worsened, whereas patients in urban areas would seek treatment earlier as they lived closer to healthcare institutions and had better transport options available.

4.1.2 ICT Access in Urban and Rural Healthcare Institutions

The study indicated that urban healthcare institutions had more ICT equipment and more reliable internet connections than those in rural areas. The rural healthcare institutions had their internet connections affected by bad phone lines and electrical power supplies that were unreliable. Though the urban healthcare institutions had more computers per doctor than their rural counterparts, this was academic as there were no computers present in the rooms utilised by doctors for their consultations in both rural and urban healthcare institutions, indicating that doctors were not employing computers to carry out consultations. Rather than being used for medical purposes, it was ascertained in the study that the computers in the healthcare institutions were being utilised for administration purposes. Though the study indicated that rural medical staff were using computers more often than in urban areas, this was only for personal use and was not being carried out during their work time at the healthcare institutions where they worked.

4.2 Results of the Group Interviews

Results of the group interviews were conducted by using qualitative data analysis program called NVIVO (Bazeley, 2007; Hamed and Alabri, 2013; Ishak and Abu Bakar, 2012).

4.2.1 Access to Ehealth Solutions in Urban and Rural Healthcare Institutions

The results of comparing access to Ehealth solutions, in both rural and urban healthcare institutions, indicated that there were not any Ehealth solutions in any of the healthcare institutions used in the case studies. The participants returned positive feedback regarding the possible future implementation of Ehealth solutions in the healthcare institutions where they worked. It was felt that the implementation of Ehealth technology would improve the recording of patient healthcare records, the treating of patients and the diagnosis of patient's ailments. The results indicated that the participants thought that the use of electronic patient healthcare record systems would greatly improve the service offered to patients and make the job easier for staff and it would stop patients that attended multiple healthcare institutions in order to get repeat prescriptions of medication, therefore stopping fraud occurring and saving the LNHS valuable resources. Presently patient referrals are carried out by giving a patient a handwritten referral on paper to take with them to the healthcare institution to which they have been referred. This meant referral letters were getting lost or patients did not attend. Respondents felt that this task being carried out electronically would eliminate many of these problems.

5 DISCUSSION

5.1 Availability of Medical Staff in Urban and Rural Healthcare Institutions

The issue of physician shortages is far more pressing in rural healthcare institutions than in urban hospitals, though urban clinics do also experience shortages.

The World Bank (2008), Jennett et al. (2005), Campbell et al. (2001) , Blaya and Fraser (2010) indicate that there are many challenges to providing healthcare services in rural areas because of the distances between populations that are dispersed and isolated. Because of these challenges, in rural areas there have often been problems in the recruitment of staff and of them leaving to urban healthcare institutions. In the LNHS, most of the skilled healthcare staff choose to work in urban areas (8280), whereas in rural areas staff are more reluctant to relocate for work (3043) (Hamroush, 2014). A lot of rural areas do not have any healthcare staff to provide healthcare to those that require it, so the inhabitants have to travel long distances to seek medical attention, particularly as Libya is so big, yet so sparsely populated.

The lack of healthcare staff in rural healthcare institutions has to be the driving force for attracting more money being invested in Ehealth solutions to help healthcare staff to provide improved healthcare using localised Ehealth frameworks that are appropriate like the framework offered in this research study. Hamroush (2014) compares the availability of physicians in urban and rural healthcare institutions in Libya.

Tables in Hamroush (2014) summarise the average number of physicians that worked in the rural healthcare institutions that were surveyed. The Tables show that on average, there are approximately 73% of physicians in Libya working in urban healthcare institutions, compared to 26 % physicians working in rural hospitals. Those percentages indicate there are 20 physicians for every ten thousand local inhabitants in Libya. The following section will focus on how available and accessible ICT technology is within the healthcare institutions chosen for this study.

5.2 The Availability of ICT in Urban and Rural Healthcare Institutions

The study outcomes showed that the availability of ICT and internet connections in both rural and urban healthcare institutions was insufficient for the implementation of Ehealth solutions. In order to function efficiently the ICT systems at each healthcare institution need to be expanded and integrated with other healthcare institutions.
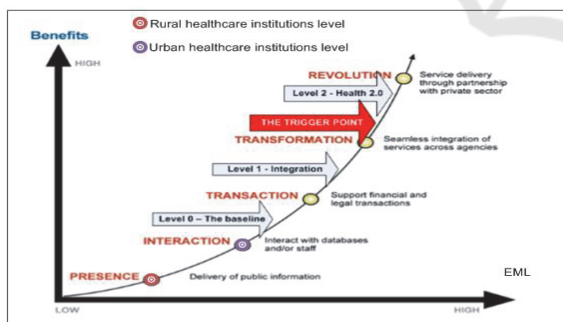

Figure 2: Phases of Ehealth Maturity Curve.

6 EHEALTH MATURITY DIAGRAM (EMD)

The study outcomes showed that when placed on an Ehealth Maturity Curve (Van de Wetering and Batenburg, 2009) the healthcare institutions in both rural and urban areas were at level 0, as can be seen below in Figure 2.

Figure 2 above shows that the urban and rural healthcare institutions Ehealth solution levels are at level 0. The healthcare institutions are able to send emails to a central data storage facility for the purpose of administration, but do not appear to use this facility for medical purposes. Despite the existence of some ICT in the healthcare institutions, these systems are not used for contacting other healthcare institutions. This is because of a lack of equipment sometimes or bad internet connections and electrical supplies, but is primarily due to the technophobic attitudes of staff who feel unwilling to embrace new forms of technology (Bain, and Rice, 2006-2007). Therefore, it is essential if these healthcare institutions are to rise above level 0, a Provincial Ehealth framework be formulated using these findings to facilitate a plan for the future in order for the healthcare institutions to move to level 2 on the Ehealth maturity curve. Because of this the Provincial Ehealth framework was formulated, as can be seen below in Figure 3.

The Provincial Ehealth framework architecture highlights the need for the services offered in the healthcare institutions to be integrated online by using an Ehealth service hub that supports the whole of the LNHS and for data to be stored electronically rather than by using paper records as at present.

7 STRATEGY FOR EHEALTH IN THE LNHS

In order for the LNHS to raise its maturity levels for the implementation of Ehealth technology, it needs to persuade LNHS staff and patients to adopt Ehealth technologies. This can be carried out at a local level throughout the LNHS, though this will need to be orchestrated at a national level through training, education and programmes to encourage compliance and providing incentives.

The drive to raise the maturity levels for the implementation of Ehealth technology throughout the LNHS needs to focus in several areas. This is a non exhaustive list of some of those:

1. LNHS users need to be made aware of what is available to them through use of Ehealth in the LNHS through media and other sources and be shown the advantages of accessing their individual healthcare records. Public support for Ehealth developments will encourage politicians to invest in developing ICT
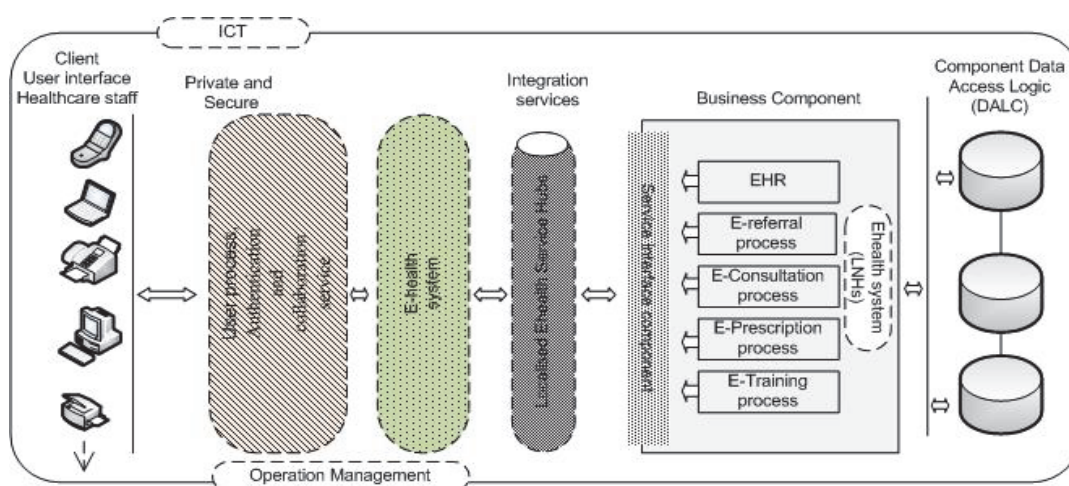
Figure 3: Provincial Ehealth framework.

infrastructures and to ensure that broadband speeds are sufficient and telephone connections are reliable.

2. Healthcare institutions need to be given financial aid with implementing Ehealth systems to encourage their widespread usage. There needs to be a direct link between usage of Ehealth technology and funding.

3. It is of great importance for a healthcare system utilising Ehealth technologies to ensure that sufficient numbers of healthcare staff have been trained to high enough standards to operate the technology effectively. Staff also need to be convinced of the need for Ehealth technologies and be enthusiastic about the prospect of being able to utilise it in order to offer improved healthcare services

4. Researches carried out in other countries have shown the Ehealth solutions that need to be prioritised: sources of healthcare data, tools for the delivery of services and the sharing of electronic information.

5. The establishment of the foundation required for exchanging data electronically throughout the LNHS. This development is essential because if it is not possible to exchange healthcare data in a secure manner within the LNHS there will be no Ehealth capabilities in the LNHS.

6. Making sure that the LNHS Ehealth adoption program is effectively coordinated, lead and overseen. This will help establish the necessary structures and mechanisms for governing Ehealth solutions in the LNHS.

7. There needs to be a lot of money spent on updating the IT infrastructure throughout the LNHS as lack investment, coupled with widespread civil war and looting, has left the LNHS in short supply of basic computer equipment.

8. Ehealth information stored by the LNHS needs to be standardised throughout the LNHS in order that information can be exchanged effectively. This can be carried out through central planning establishing implementation procedures along with Ehealth implementation.

9. It is essential that the LNHS protects sensitive healthcare data so that it remains private. In order for this to succeed there needs to be a robust and secure security system implemented throughout the LNHS.

10. Healthcare information requires a regime for identifying and authenticating information as quickly as the LNHS can manage so that it can be accessed and shared securely.

11. Facilitating healthcare institutions in the establishment of ICT that are appropriate for their individual needs.

12. Coordinating healthcare institutions to create ICT infrastructures that are sustainable.

13. Supporting healthcare institutions to connect to a nationwide fibre optic network for sharing data and connecting to other healthcare institutions.

14. Implementing policies for the exchange of information between healthcare institutions that do not contravene any privacy laws.

15. Implementing E-learning for improving education levels.

16. The construction of the Ehealth capabilities of the LNHS incrementally and pragmatically, while initially investing in Ehealth technologies that will afford the most benefits to users of the LNHS.

17. Provide help to those areas of the LNHS that require it, but not at the expensive of those that would like to develop at a faster pace.

18. Creating processes for EHRs, E-consultations, E-prescriptions, E-referrals and E-training systems;

8 THE STUDY'S LIMITATIONS

The largest challenge in carrying out this case study for the researcher was not just the large distances between healthcare institutions that were travelled, in order to create as balanced a reflection as possible of opinions in the LNHS, but the state of warfare that existed in the country at the time between rival tribal factions.

The other limitation in this study is that the framework has not been used in practice to see where it does not work, so that it can be improved. This is because it would require a lot of money to test it that is not currently available in Libya, though when the researcher presented his findings to experts in Libya it was received positively.

A lot of the limitations inherent in the research technique and methodology have already been covered in the writings above. Further factors affecting the efficiency of the research were the time limitations imposed by the LNHS and the Libyan culture itself. The reason for employing the methods of questionnaire and interview in this study was to enhance the level of confidentiality that the participants would enjoy. That a high level of privacy was maintained was of utmost importance. Another hurdle placed in the researcher's way in carrying out the interviews was that of gender. Because of the restrictions within Libyan culture regarding the mixing of males and females, the researcher being male needed to employ females to carry out such tasks. It was expected that by placing guarantees of anonymity the participants would therefore feel more relaxed and deliver answers that were more accurate, confidential and honest. Time presented a serious limitation to the researcher due to healthcare institutions allowing interviews to be for no longer than 25 minutes. This was because the

LNHS authorities did not want the medical staff's private time intruded upon, hence limiting interview time to that reserved for giving lectures, thus placing a limitation upon the quantity of variables that could be harvested.

The fact that the participant's confidential details were self reported creates yet another limitation to the study. This is because it may create inaccuracies, thus information that is technologically, socially, culturally or medically influenced, may need to be considered as differing somewhat to reality when medical ISs are being planned.

9 CONCLUSIONS

After having reviewed the available literature on Ehealth technology, assessing the healthcare institutions selected for Ehealth readiness and analysing the results, this paper will now set out the conclusions reached by the researcher, namely that: all the healthcare institutions were at level 0 on the Ehealth maturity curve and their ICT infrastructures would need integrating so that medical staff could communicate within their healthcare institutions and with other healthcare institutions, therefore benefitting from Ehealth solutions that might be implemented at some future date. The researcher therefore concludes that, for the successful implementation of Ehealth systems into the LNHS, the ICT infrastructures within the healthcare institutions of the LNHS need to be interconnected so that E-consultations can be carried out to aid medical staff in treating patients more efficiently when they do not have the training for a specific condition, but can source this information from a colleague in another healthcare institution. The researcher also came to the conclusion that all the various systems and patient healthcare data need to become interoperable and brought together into an efficient and effective system. To conclude, this paper has laid out a provisional Ehealth framework that, if followed, will lead to the healthcare institutions of the LNHS moving from level 0 on the Ehealth maturity curve to a level 2, thus enabling healthcare staff to provide improved levels of healthcare to their patients.

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