

Barriers to overcome for the Implementation of Integrated eHealth Solution in Luxembourg

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Abstract: Since health is becoming a major priority for the European Union, the development of global national eHealth platform has been adopted as a solution in order to meet the EU recommendations in several countries. However, to reach this objective, governments have to integrate a large variety of specificities inherent to their country and to the continent. In this paper, we report about the results of a wide investigation that took place in Luxembourg in 2009. This survey aimed at learning about the situation of health professional regarding the use of Information and Communication Technology as well as their expectation with respect to health information exchange. The outcomes showed some opportunities and some existing barriers to overcome for the development of the eHealth platform in Luxembourg. This paper focuses on the barriers and illustrates them through the analysis of two case studies, based on the creation and adaptation of e-services.

1. Introduction

In the past decade, interest in health care has grown up until becoming one major concern for many countries. This is why the European Union has strengthened its position regarding health and has released a set of guidelines that describes the long term agenda for the development of global integrated solutions for improving the quality of health care in Europe. Moreover, the EU is pushing its members to adopt these guidelines in order to define their own road map in terms of health development in general to harmonize and facilitate the management of health care at a national and continental level. To reach these ambitious objectives, several European countries are implementing a national eHealth platform [7, 6]. This is also the case of Luxembourg who decided in 2006 to conceive the eSanté platform [4]. It consists in a telematic platform with different applications to favour exchanging and sharing of health related data. This aims at both supporting health care at a national and continental level as well as containing the evolution and transparency of the health expenses. However, the development of such software solution requires a good knowledge of the situation in the country regarding the use of ICT by health professionals as well as their needs in terms of information exchange in order to draw the concepts of the eHealth platform. Furthermore, Luxembourg has also some specificities like its small size, cosmopolitan population and its position with respect to foreign countries that must be taken in account for the design of the eSanté platform.

In order to gain the desired information from the right users, all the actors of the health scene have to be mobilized which, in turn, requires the implementation of an efficient investigation using the most suitable Medias to touch them. Actually, such an investigation

requires the definition and use of a rigorous methodology [3] in order to first, educate health professionals and patients about the benefits of such an integrated solution and, second, to gather the most relevant information from them. The exploitation of the collected data allows the clear identification of the current situation in the country regarding the degree of computerization of medical practices, pharmacies, laboratories, hospitals, long term care institutes and physiotherapist practices, as well as the real needs of health professionals and patient associations in terms of health information exchange and communication means. The set of collected information is crucial since it is exploited, in a second phase, in order to lay down the foundation of the national eHealth platform which is the ultimate objective of the project. In our context, the various feedbacks we got have permitted to define the specifications of the eHealth platform. However, to be efficient, we decided to set up an incremental approach for developing the final platform. This is done through the development of realistic case studies [5] that constitute the first software components of the future national platform. These are devoted to the implementation of a national solution to share laboratory exams results as well as a national solution to share medication history.

In this paper we report on both the methodology and the results of the investigation we have set up in 2009 in order to identify the real needs of health professionals and the existing barriers to overcome towards the development of the Luxembourgish integrated eHealth platform. The key idea of the Luxembourgish approach is to implement the national solution step-by-step, starting by simple and realistic case studies in order to gather experience and then, progressively add more functionalities to the system up to have a national Electronic Health Record (EHR) with a constellation of services useful for all the users. We therefore describe the two case studies that have been implemented in order to verify the level of realization and the required services that should be modified for the achievement of the final objective. Moreover, we provide a discussion about the barriers we identified through this particular experience. We believe that it should be of interest for other countries having the same final objective and that share some common points with Luxembourg. The security as well as the interoperability aspects will be the main focus of our discussion since critical health information is manipulated and exchanged between health professionals within the country but also, by virtue of Luxembourg characteristics, between physicians of the foreign countries that surround the great duchy of Luxembourg and thus the access and sharing of this critical information must be done in a controlled way.

The remainder of the paper is structured as follows: Section 2 introduces the methodology we proposed to gain information about health professionals needs with respect to the use of ICT and information exchange. It also presents the results of this investigation. Section 3 details the two case studies we have built based on the results of our investigation presented in section 2. Section 4 contains a discussion about the highlighted barriers and gives some hints to overcome them. Finally, we wrap up in section 5 with concluding remarks.

2. Identification of barriers for the implementation of the Luxembourgish integrated eHealth platform

Our first step toward the implementation of a national eHealth solution was, on one hand, to clearly identify what is the current situation regarding ICT (hardware and software) and their use by the various actors of the domain and, on the other hand, to identify healthcare professionals' real needs and priorities to lay down the foundation for the development of the Luxembourgish eHealth solution. This was the main objective of the wide investigation set up in 2009. For this study, the following healthcare stakeholders were contacted:

physicians, pharmacists, physiotherapists, patients, laboratories, hospitals and long term care institution.

The work started with the contact with associations of professionals. We prepared a presentation with the goals of the project in a short, medium and long term, then we explained the reason of the survey and highlighted the opportunities to work together to define the new eHealth platform. The second phase consisted in the elaboration of a questionnaire that has been sent to all professionals of a selected domain (paper survey) or has been used in the interviews of representative of professionals (interview survey). This section details the preparation of the questionnaire and discusses the outcomes of the survey. The four steps adopted to prepare the questionnaire are:

1. **Conception.** 10 categories of questions were selected (Figure 1) and the questions were prepared to profile the different stakeholders, to determine the ICT tools used by them and to identify their needs and priorities.
2. **Validation.** This phase consisted in contacting the representatives of the Luxembourgish health domain for refinement and validation of the questions.
3. **Implementation.** The first method, the paper survey, consisted in sending the questionnaire to a target public. This public, composed of physicians and pharmacists, received a letter from the Health Ministry and from their representatives (e.g., medical or pharmacy associations) to introduce the questionnaire and to explain the usefulness of the survey. The second method, the interview survey, was performed in collaboration with physiotherapists' and patients' representatives. A member from the Health Ministry also participates to the interviews in order to support the work and clarify general questions of stakeholders. For the institutions (laboratories, hospitals and long term care) we had applied a mix of the two methods. First, we interviewed the directors of the institutions (administrative and medical directors) and then some questions, related to specific subjects, were sent to contact people, identified during the interviews.
4. **Data analysis.** The collected data was analyzed and the outcomes were published in the web page of the project [1].

As result of the adopted methodology, we notice that 31% of physicians and 50% of pharmacists answered the questionnaire, all associations were interviewed, and 80% of the hospitals were interviewed and send back the answers of complementary questions. It represents an improvement of over 300%, compared with the last survey performed by CRP Henri Tudor with healthcare professionals. This methodology also had shown some limits and we discuss them in section 4.

The outcomes of data analysis had shown that the current state of medical data exchange is manly based on paper forms. We notice that electronic versions of documents exist, but they are generated to be used internally and, regarding to semantics, they need improvements to be shared with other healthcare professionals. Other outcomes from the survey reveals that 86% of physicians use a software to manage their practice (more than 50

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| A – General Questions (Age, work region, specialty, etc.) |
| B – Informatics Tools used |
| C – Utilization of Internet (Connection type, documents exchanged, searches, dialogues, etc.) |
| D – Security Tools/processes (Passwords, backups, antivirus, encryption, maintenance, etc.) |
| E – Main Functionalities of the Patient Mgt Software (Doc Mgt, Images, prescription, billing, agenda, e-mail, etc.) used |
| F – Utilization of an electronic medical record (Identification of patients, % patients with EMR, used codification, etc.) |
| G – Use and Needs of functionalities to support prescription (Current medication, codification, forms, allergies, drug doses, clinical guidelines, etc.) |
| H – Drugs Database (Use, updates, on-line DB) |

Figure 1: Topics addressed in the GP questionnaire

variety of softwares were stated); long term care institutions are specifying and installing informatics solutions; 100% of pharmacies, laboratories and hospitals use information system; 4% use a standard to diagnosis (ICD10) and 84% use free text. This overview shows that the health sector is equipped to beneficiate from new technologies, but there still have a lot of works to do to specify and implement a national platform to exchange medical data. During the interviews, the representatives of institutions were unanimous to say that a national coordination of activities is necessary to avoid redundancy or concurrency between projects. They also requested a well-establish security strategy that minimize the consequence of hacker attacks, assure the authenticity of data, and guarantee users' privacy without increase the complexity to find and use medical data.

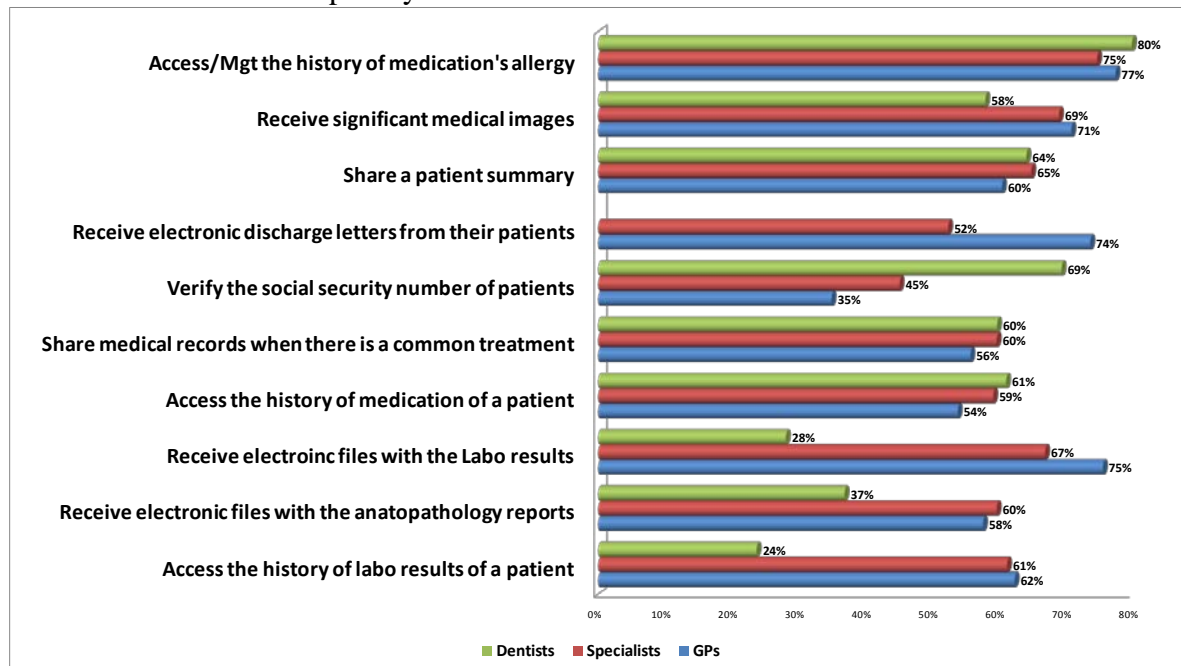


Figure 2: Overview of the needs of the physician

Satisfying these demands will have an impact over the current work process of healthcare providers and on their investments on infrastructure. For example, in order to evaluate the current level of security of ambulatory and pharmacy systems, we had considered five indicators: the use of passwords to access the system; the presence of anti-virus; if the firewall is activated; the frequency of backup of data; and if they have a maintenance contract for software and hardware. The analysis shows that only 51% of physicians and 63% of pharmacists had a satisfactory level of security, what can be considered as a risk to the proposed security strategy for the eHealth platform.

Other requests from healthcare professionals were determined and classified according to their priorities. Figure 2 illustrates the top 10 priority list according to the dentists, specialists and general practitioners. Based on these outcomes, we had defined two case studies: One that considers the elaboration of a new service (the medication history) and one that considers de modification of an existing service (the laboratory results history).

3. Case studies

In order to describe the case studies, the following terminology is used:

Consumers can be patients or parties who may be acting for, or in support of, a patient in the activities of receiving healthcare (e.g., caregivers, patient advocates, family members...)

Health care provider is the individual who deliver the care directly to the patient (e.g., physicians, nurses, clinical supervisors, pharmacists, physiotherapists...)

Data providers are primary systems that acquire healthcare data from the patient and send it to the platform. They may include LIS (laboratory information systems) for laboratories, HIS for hospitals, PIS for pharmacies, PMS (practices management systems) for physicians or any other information system used by health care providers to these purposes.

National Authorisation Service for Health (NASH) is the organisation that offers identification and authorization services to the platform. It builds up a mapping between consumers' identity and access rights. It is requested during the users' identification process and the access rights verification process.

Trusted Third Party (TTP) is the organisation that offers anonymisation/pseudonymisation services to the platform. It supports secure and reliable network transmission of patient demographic data and builds up a map between patient identifying data and pseudonyms.

Medical Data Management Party (MDMP) is the organisation that offers medical data management services to the platform. It supports secure and reliable network transmission of medical data between providers and consumers. It also builds up and maintains maps between pseudonyms and clinical information sources (health records).

The case studies were defined with respect to the following prerequisites to use the national eHealth platform [2]:

- It must satisfy at least one of the highest priorities services presented in Figure 2
- Consumers and Data providers need to be registered in the NASH. The registry includes validation of identity, signature and the public encryption key
- Data providers must split patient demographic data and medical data into two messages, one to be sent to the TTP and the other to be sent to the MDMP
- Medical data's exchanges are based on standard protocols (semantic and technical interoperability are defined, for the time being, at national level)
- A patient summary is part of the platform and can be shared between authorized consumers. It considers that inside of MDMP there is a centralized repository with a copy of a selected set of medical data
- The consumers and data providers' activities are logged.

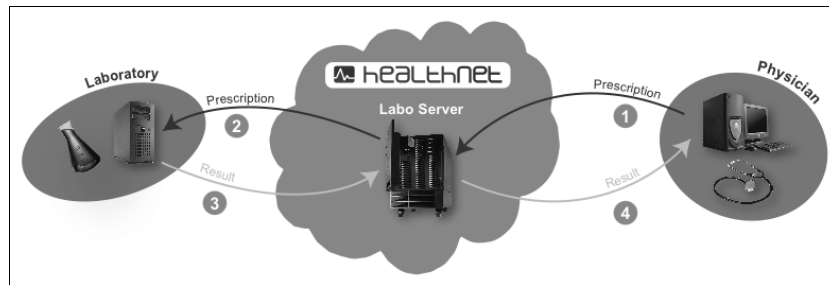
In order to evaluate the general concept of the platform, two scenarios were chosen: Medication History and Laboratory Exams History.

Medication History scenario addresses access to current prescribed medication and dispensed medication. This service is not offered in Luxembourg and the proposition is to design it from scratch, taking into account the facilities of the eHealth platform, and validate the concepts with potential users before starting the implementation. The data providers are PMS (for outpatients), HIS (for inpatients) and PIS. It focuses on providing physicians and pharmacists with information about each patient's medications not just from local documentation, but also from other ambulatory clinicians, hospitals, long-term care facilities or pharmacies. This solution will help patients since they will not to take care of the paper based prescription anymore and will speed up the reimbursement of the medication by the social security. Moreover, it will facilitate the work of pharmacists because it will be easier for them to understand (from the typographic point of view) the prescription.

Laboratory Exams History scenario addresses access to current prescribed exams and results from performed laboratory exams. This scenario intends to evaluate the complexity to change an existing service (LABO) in order to make it compliant with the platform's properties (prerequisites). The data providers are LIS (for outpatients) and HIS (for inpatients). The current version provides a way to asynchronously send (via VPN and ftp) the results of exams (encrypted files) from the laboratories to ambulatory clinicians (the prescriber) using as intermediary repository the LABO server. The idea is to transform this solution into a more sophisticated one that allows storing medical data into a database and

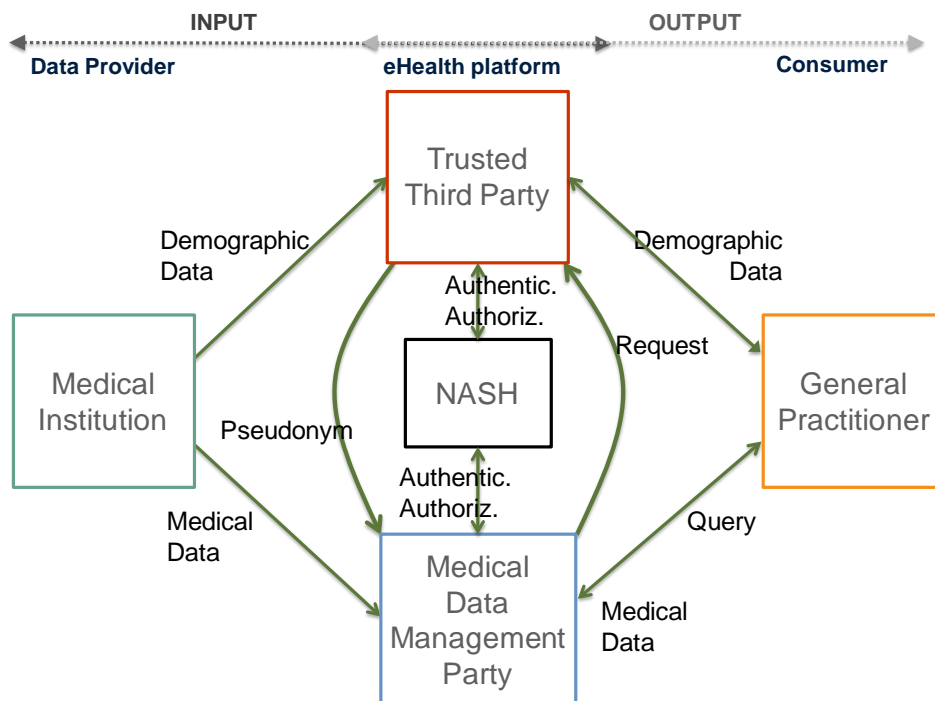
sharing it with authorized consumers. This will largely facilitate the exchange of results between laboratories and physicians and the semantic description of the data using LOINC will make the development of decision support system possible. It will provide better treatments to patients.

An overview of the LABO scenario version 1 is illustrated in Figure 3 and version 2 is illustrated in Figure 4. For the scenario medication history, we can assume that the processes (prescription submission, prescription access, and medical data request) are quite similar to the scenario LABO version 2. Because of space restrictions, the exchange processes are detailed.



- (1) Prescription generation (paper or electronic format)
- (2) Prescription acquisition (data need to be entered into the LIS)
- (3) Results generation (XML file, encrypted with the prescriber public key)
- (4) Results import (decryption and integration to the PMS)

Figure 3: LABO version 1



- (1) The prescriber is identified and his authorization is checked
- (2) Prescription generation (paper and XML)
- (3) Send demographic data to TTP and the prescription to MDMP
- (4) The electronic signature is verified
- (5) MDMP requests a pseudonym to TTP and associate to the prescription
- (6) With the prescription given by the patient, the lab searches the XML file and imports it to the LIS
- (7) Results generation (anonymous XML file)
- (8) The biologist is identified and his authorization is checked
- (9) Demographic data is sent to TTP and the labs results are sent to MDMP
- (10) The electronic signature is verified
- (11) MDMP requests a pseudonym to TTP and associates it to the results
- (12) The healthcare provider requests the results (sending the demographic data of the patient to TTP and the query to MDMP – access not limited to the prescriber)
- (13) MDMP requests the pseudonym list to TTP
- (14) MDMP searches for results and encrypt them with the physician public key before

Figure 4: LABO integrated in the eHealth Platform

These scenarios had been presented to different representative of health and security (for patient privacy) sector. The results of this evaluation are presented in the next section.

4. Discussion

The implementation of the survey had highlighted some barriers to motivate stakeholders to actively participate in the definition of the future eHealth platform. Typical examples are the acceptance of the impacts of a national eHealth platform over the current workflow, the allocation of human resource to follow up (and comment) the design phase, and conflicts of interest between stakeholders. We are trying to overcome these barriers by improving our communication strategy, promoting workgroups and defining an organizational structure where stakeholders can participate to decision-making.

The communication strategy consists on several meetings with the representative of the stakeholders of the health sector. We listen what they understand by and expect for a national eHealth platform and we realized that their opinions do not match. Thus, we had presented the roadmap of the eHealth program (which aims at coordinating different projects) which describes the planned organization structure, the concrete goals, and the timelines, shows where the platform would improve the current activities, how services will be selected and designed, and how they will be progressively deployed.

The adopted roadmap did not answer all questions (e.g., who will fund it?, who will implement it?, etc) and some stakeholders are still not convinced to join the program. It is important to notice that Luxembourg is not a big country and the number of healthcare professionals constitute a small market to some industries. Developing specific solutions to this market is not well accepted by them and it can be a barrier to effectively use the national eHealth platform. Our approach to solve this problem is to associate with other countries (e.g., participate to European projects) or contribute to standard organizations in order to get a common (or standard) solution. Some specific domains (e.g., LOINC, HL7, radiology reports, drug-drug interactions, etc.) were selected to demonstrate the feasibility of these tasks and to promote collaboration between actors.

The definition of cases studies is also part of this strategy. The evaluation of them stressed a set of barriers that need to be overcome:

In general:

- The absence of agreement upon semantic interoperability: the content of the files/messages and the organization of the patient summary.
- Multi-language countries need standard reports to describe exams results. Laboratories are not confident with it and justify that some exams need complementary explanation.

- The degree of deployment of security technologies.
- Absence of a unique patient identifier or a patient identifying process.
- Absence of agreement on the responsibilities during the process.

For the patient:

- Lack of access or difficulty to use new technologies (e.g., Internet).
- Loss of privacy if information is shared inappropriately.
- Lack of clarity about patient summary management and data consistency responsibilities.

For healthcare providers:

- Changes in workflow including checking (or failing to check) information that may be in the patient summary and the receipt of inaccurate information.
- Need of investment in infrastructure (equipment, license, maintenance ...) that are not compensate by simplification of their tasks.

For software editors:

- The number of users in Luxembourg does not justify high investments to specific solutions.
- The evolution of software's deployment is slow. Editors will wait until having a stable eHealth platform before implementing changes (they already had invested to be compliant to the current version of LABO).

This analysis also shows the differences between implementing a new service and improving existing one. Bugs and weak points of existing services are well know and technical solutions can be deeper evaluated. However, the resistance to change existing services is bigger than to create new ones. Often, users are confident to the existing services even with the known limitations. They request that changes are incrementally implemented and that the compatibility with previous versions be guaranteed. In the other side, software producers prefer avoiding frequent changes. A potential solution for this paradox can be that the country funds the development of intermediary versions and offers it as open source software. Thus, users can test and get use with the new properties of the service while software producers can reuse the code to include the service in their softwares.

5. Conclusions

In this paper we have presented the current state of our works towards the definition of a national eHealth platform. The wide investigation we had organized reflects the opinion of different categories of users about the functionalities such an eHealth platform should provide and highlights the barriers that must be overcome. We also have presented some technical, semantic and organizational aspects that have to be considered in order to implement services that use the national platform through the presentation of realistic case studies. Finally, we have pointed out the complexity to balance data protection and data access in order to improve the quality of care without violated the privacy of patients. Our future work will be devoted to the development of new services (sharing of medical images) and to select the most appropriate standards in accordance with EU recommendations to overcome some of the barriers highlighted in this paper.

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