

Country Brief: Luxembourg

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About the *eHealth Strategies* study

The *eHealth Strategies* study analyses policy development and planning, implementation measures as well as progress achieved with respect to national and regional eHealth solutions in EU and EEA Member States, with emphasis on barriers and enablers beyond technology. The focus is on infrastructure elements and selected solutions emphasised in the European eHealth Action Plan of 2004

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Executive summary

Currently, preparatory work for eHealth conceptual development is done by a dedicated research unit within the “Centre de recherché public Henri Tudor.” The so called SANTEC Research unit collaborates to /works for the Ministry of Health, proposes a platform and EHRSystem Concept . It is playing the role of a scientific competence centre in Luxembourg for questions in medical informatics and eHealth.

The EHR in Luxembourg is still in a planning stage. However, the infrastructure of the Healthnet, which began to be established in 1998, already provides a platform to healthcare professionals, hospitals and pharmacies, which allows the secure exchange of health and administrative data in digital form. The evolution of the GIE Healthnet – the management body of the Healthnet - into an eHealth Agency is currently under discussion. This Agency would be mandated to set up the eHealth infrastructure and implement its application such as the shared electronic patient record.

Although all pharmacists in Luxembourg use a computer for internal management and billing, no work has been undertaken on ePrescription. Nevertheless it has been identified as one of the key applications in the future and should therefore become one of the major “construction sites” in the next years.

Recent strategic decisions in Luxembourg have focussed on the adoption of IHE profiles for work on the Luxembourg EHR and the introduction of a healthcare reform law. It will lay down the legal and organisational framework of the future eHealth platform including its applications; this will also launch the eHealth Agency, which will be in charge of the platform and the interoperability aspects.

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1 Introduction to the report

1.1 Motivation of the eHealth Strategies study

Following the Communication of the European Commission (EC) on “eHealth – making healthcare better for European citizens: An action plan for a European eHealth Area”¹ Member States of the European Union (EU) have committed themselves to develop and issue national roadmaps – national strategies and plans for the deployment of eHealth applications addressing policy actions identified in the European eHealth Action Plan.

The 2004 *eHealth Action Plan* required the Commission to *regularly monitor* the state of the art in deployment of eHealth, the progresses made in agreeing on and updating national eHealth Roadmaps, and to facilitate the exchange of good practices. Furthermore, in December 2006 the EU Competitiveness Council agreed to launch the *Lead Market Initiative*² as a new policy approach aiming at the creation of markets with high economic and social value, in which European companies could develop a globally leading role. Following this impetus, the Roadmap for implementation of the “eHealth Task Force Lead Market Initiative” also identified better coordination and exchange of good practices in eHealth as a way to reduce market fragmentation and lack of interoperability³.

On the more specific aspects of electronic health record (EHR) systems, the recent *EC Recommendation on cross-border interoperability of electronic health record systems*⁴ notes under “Monitoring and Evaluation”, that “in order to ensure monitoring and evaluation of cross-border interoperability of electronic health record systems, Member States should: consider the possibilities for setting up a monitoring observatory for interoperability of electronic health record systems in the Community to monitor, benchmark and assess progress on technical and semantic interoperability for successful implementation of electronic health record systems.” The present study certainly is a contribution to monitoring the progress made in establishing national/regional EHR systems in Member States. It also provides analytical information and support to current efforts by the European Large Scale Pilot (LSP) on cross-border Patient Summary and ePrescription services, the epSOS- European patients Smart Open Services - project⁵. With the involvement of almost all Member States, its goal is to define and implement a European wide standard for such applications at the interface between national health systems.

Earlier, in line with the requirement to “regularly monitor the state of the art in deployment of eHealth”, the EC already funded a first project to map national eHealth strategies – the eHealth ERA- “Towards the establishment of a European eHealth Research Area” (FP6

¹ European Commission 2004

² European Commission 2007

³ European Communities 2007

⁴ European Commission 2008

⁵ European Patients Smart and Open Services (epSOS)

Coordination Action)⁶ and a study on "Good eHealth- and a project on exchange of good practices in eHealth"⁷ mapping good practices in Europe - both of which provided valuable input to the present *eHealth Strategies* work and its reports. Member States' representatives and eHealth stakeholders, for example in the context of the *i2010 Subgroup on eHealth* and the annual European High Level eHealth Conferences, have underlined the importance of this work and the need to maintain it updated to continue to benefit from it.

This report on Luxembourg includes main findings and an assessment of progress made towards realising key objectives of the eHealth Action Plan. It presents lessons learned from the national eHealth programme, planning and implementation efforts and provides an outlook on future developments.

1.2 Survey methodology

After developing an overall conceptual approach and establishing a comprehensive analytical framework, national level information was collected through a long-standing Europe-wide network of national correspondents commanding an impressive experience in such work. In addition, a handbook containing definitions of key concepts was distributed among the correspondents to guarantee a certain consistency in reporting. For Luxembourg, relevant information on policy contexts and health system situation, policies and initiatives as well as examples for specific applications was collected by the overall project lead - empirica in Bonn, Germany.

The key tool to collect this information from the correspondents was an online survey template containing six main sections:

- A. National eHealth Strategy
- B. eHealth Implementations
- C. Legal and Regulatory Facilitators
- D. Administrative and Process Support
- E. Financing and Reimbursement Issues
- F. Evaluation

Under each section, specific questions were formulated and combined with free text fields and drop-down menus. The drop-down menus were designed to capture dates and stages of development (planning/implementation/routine operation). In addition, drop-down menus were designed to limit the number of possible answering options, for example with regard to specific telemedicine services or issues included in a strategy document. The overall purpose was to assure as much consistency as reasonably possible when comparing developments in different countries, in spite of the well-known disparity of European national and regional health system structures and services.

⁶ empirica 2006

⁷ European Commission; Information Society and Media Directorate-General 2009

Under Section B on eHealth implementation, questions regarding the following applications were formulated: existence and deployment of patient and healthcare provider identifiers, eCards, patient summary, ePrescription, standards as well as telemonitoring and telecare.

The data and information gathering followed a multi-stage approach. In order to create a *baseline* for the progress assessment, the empirica team filled in those parts of the respective questions dealing with the state of affairs about 3 to 4 years ago, thereby drawing on data from earlier eHealth ERA reports, case studies, etc. to the extent meaningfully possible. In the next step, national correspondents respectively partners from the study team filled in the template on recent developments in the healthcare sector of the corresponding country. These results were checked, further improved and validated by independent experts whenever possible.

Progress of eHealth in Luxembourg is described in chapter 3 of this report in the respective thematic subsections. The graphical illustrations presented there deliberately focus on key items on the progress timeline and cannot reflect all activities undertaken.

This report was subjected to both an internal and an external quality review process. Nevertheless, the document may not fully reflect the real situation and the analysis may not be exhaustive due to focusing on European policy priorities as well as due to limited study resources, and the consequent need for preferentially describing certain activities over others. Also, the views of those who helped to collect, interpret and validate contents may have had an impact.

1.3 Outline

At the outset and as an introduction, the report provides in chapter 2 general background information on the *Luxembourg* healthcare system. It is concerned with the overall system setting, such as decision making bodies, healthcare service providers and health indicators data

Chapter 3 presents the current situation of selected key eHealth developments based on detailed analyses of available documents and other information by national correspondents and data gathered by them through a well-structured online questionnaire. It touches on issues and challenges around eHealth policy activities, administrative and organisational structure, the deployment of selected eHealth applications, technical aspects of their implementation, legal and regulatory facilitators, financing and reimbursement issues, and finally evaluation results, plans, and activities

The report finishes with a short outlook.

2 Healthcare system setting

2.1 Country introduction⁸

⁸ Data from Evidence-based support for the design and delivery of user-centred online public services

The box below summarises the key facts about the Luxembourg healthcare system:

Key figures about the Luxembourg healthcare system:

Population: 502 100 (2010)⁹

Life expectancy at birth: 80.6 years (OECD 2008)

Healthcare expenditure as % of GDP: 7.2% (OECD 2008)

Public sector healthcare expenditure as % of total healthcare expenditure:
81.7% (OECD 2007)

2.2 Healthcare governance

2.2.1 Principal characteristics of the Luxembourg healthcare system

Based on the values of solidarity, general access and equity of treatment, the system is in particular characterized by:

- * general coverage of the population through compulsory health insurance and care insurance
- * a compulsory convention by the authorized providers to practice a profession or an activity in health and the obligation for the provider to respect the rates set with the National Health Fund (Caisse National de Santé, CNS, formerly UCM)
- * a mainly independent practice of medicine with the doctor as an initiator of all services enforceable against the health insurance,
- * Free choice of a provider by the patient and direct access to a specialist,
- * Planning of hospital and pharmaceutical sector
- * Equity of treatment of providers (morale or legal persons) irrespective of their status.¹⁰

2.2.2 Organisation of the healthcare system¹¹

One of the main principles of the health system in Luxembourg is the free choice of provider by the patient.

The provision of medical care is organised around several players:

- * physicians,
- * social centres,
- * hospitals,
- * emergency services,
- * pharmacies

⁹ Le Portail des Statistiques du Luxembourg [The Statistics Portal of Luxembourg] 2008

¹⁰ Grand-Duché Luxembourg Portail Santé [Grand Duchy Luxembourg Health Portal] 2009

¹¹ Grand-Duché Luxembourg Portail Santé [Grand Duchy Luxembourg Health Portal] 2009

* welfare and care institutions

* networks of home care.

General practitioners provide basic care. It is mainly a matter of prevention and less specialized diagnostic and treatment of diseases in form of consultations. The structures of healthcare such as hospitals, but also specialised doctor's offices provide secondary care. It is mostly about advices, diagnosis, treatment and specialized care.

Welfare institutions and networks of care or home care provide tertiary care, most often after hospitalization.

2.2.3 Healthcare system financing

On the one hand, the financing of the health system is ensured by social security contributions through employees' wages and contributions paid by employers and on the other hand by a contribution from the state. Contributions from employers and employees represent about half of the revenue. The State's contribution is mainly based on general tax revenues.

The resources needed to finance the health system consist primarily of contributions, except for the funding of maternity benefits and family leave, which are paid by the State.

Each year, the National Health Fund (CNS, formerly UCM) establishes the overall budget of health and maternity insurance for the following year. The budget comes with a multi-annual programming prospectively indicating the financial evolution of health-insurance.

The National Health Fund (CNS, formerly UCM) negotiates annual budgets with hospitals for operating costs.

The National Health Fund (CNS, formerly UCM) enters into agreements with various professional groups regarding the rates of benefits, in order regulate the relationship between the health insurances and healthcare providers who legally carry out their profession in Luxembourg.

As for the financing of long term care insurance, all working persons and all pensioners pay a special contribution of 1.4% on all their earned income (wages, pensions and annuities) and all heritages. This contribution is completed by a contribution from the state and by a contribution from the energy sector.¹²

2.3 Recent reforms and priorities of health system/public health

A healthcare reform law is currently under discussion. The aims of the reform are:

- To preserve the universality of the health system, to promote quality of healthcare services and to facilitate coordination of care.

¹² Grand-Duché Luxembourg Portail Santé [Grand Duchy Luxembourg Health Portal] 2010

- To contain the increase of costs and maintain the sustainability of the health system.
- To improve data management: improve quality through completeness, transparency, reliability and standardisation and facilitating comparability and exchange of data.

In a press release from the Minister of Social Security and Health, the priorities for a new healthcare reform bill due to be passed by parliament in autumn include¹³:

- The introduction of a voluntary gatekeeper function for GPs, which seeks to provide guidance for the patient,
- Development of personal health records in electronic form, which would aim to inform citizens about treatments provided for patients,
- Lowering of drug reimbursement costs, by promotion of generic substitution and reimbursement based on the less expensive drug,
- Reorganisation of hospital services: promotion of integration and synergies to create skill centres and managed care chains Better coordination of the hospital sector (total budget, cost accounting, business federation etc),
- Modifications in regulation of laboratory medicine

Figure 1: Important features of primary healthcare organisation in Luxembourg

Political/administrative unit responsible for primary healthcare	The Ministry of Health and the Ministry of Social Security are co-responsible for primary healthcare. Whereas the Ministry of Health is mainly responsible for health policy, public health and licensing of healthcare providers, the Ministry of Social Security is responsible for financing issues and supervision of the health insurance. Resident population is by very large majority covered by the National Health Insurance (CNS - Caisse Nationale de Santé) under a mandatory health insurance scheme.
Consumer Choice	Patients have in principle the free choice of healthcare providers.
Financing	The healthcare system is mainly financed through public funding. Funding is mainly assured through the mandatory health insurance scheme (one single national health insurance fund financed from contributions of employers and employees). A substantial part is co-funded by tax money through tax contributions to the budget of the national health insurance fund and direct funding of substantial investments (subsidies for hospitals and major equipments etc).
Public or private providers	Most of the GP's are independent, including specialists practising in hospitals. All doctors having a private practice are independent. Except for one hospital, all doctors attached to a hospital remain in an independent status but are bound through a collaboration contract with the hospital. In one major hospital doctors are employees of the hospital.
Gatekeeping function of the GP	Referral by GP of the patient. The Gatekeeper is however not foreseen to be mandatory.

¹³ Informations et actualités du gouvernement luxembourgeois [Information and news of the Luxembourg Government] 2010

Integrating health: initiatives for coordination	In certain fields integrating initiatives exist: cardiology, cancerology ... the above mentioned healthcare reform proposal foresees the constitution of coordinated competence centres with integration of the main providers concerned by the activity of the competence centre.
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2.4 ICT use of general practitioners

This section provides a brief overview of relevant ICT related infrastructure and services data. It draws on earlier studies commissioned by the EC, notably the Indicators eHealth Study . Although the results of this study date from 2007 and may therefore not reflect latest changes, a more recent pan-European survey is not available.

In terms of infrastructure, Luxembourg displays a slightly unusual picture: while use rates for computer and Internet stay at a comparatively low level (80% and 64% respectively), broadband connections are quite common. They are used in 62% of Luxembourg's GP practices which means that only 2% of the practices in Luxembourg use narrowband. Broadband can therefore be regarded as the common form of Internet access in Luxembourg.

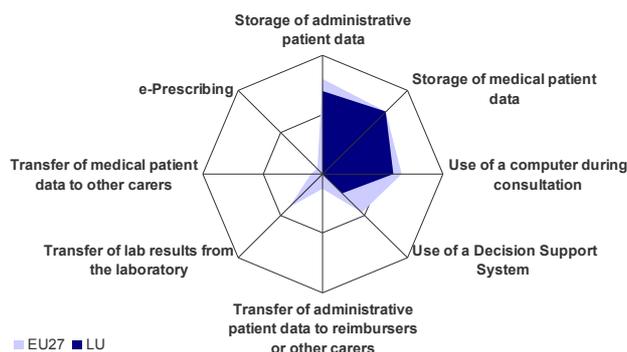
When it comes to the use of eHealth solutions, Luxembourg displays its best results in the areas of administrative and medical data storage as well as with relation to the use of a computer for consultation purposes: 70% of GP practices store administrative patient data, 65% store at least one type of medical patient data and 59% use a computer for consultation purposes.

The use of Decision Support Systems is not very common. They are used for diagnosis of prescribing purposes in around 40% of Luxembourg's GP practices.

Patient data has not yet arrived on the agenda of GPs in Luxembourg. Luxembourg's GP practices generally don't exchange electronic administrative data via networked connections with other carers. Healthcare costs outside of hospital is pre-financed by the patient and reimbursed to the patient through a paper-based procedure. The exchange of medical data via networked connections is equally little prevalent: no GP practice uses networks in order to exchange electronic medical data with other care providers. However, already one out of four of the GP practices participating in the survey receives laboratory results via network connections.

ePrescribing is still not a reality in most European Member States. This holds true for Luxembourg as well where none of GPs participating in the survey reported using ePrescribing.

While several eHealth projects have already been implemented in Luxembourg, an encompassing strategy has only been decided on in 2006.

Figure 2¹⁴: eHealth use by GPs in Luxembourg

Indicators: Compound indicators of eHealth use (cf. annex for more information), % values.

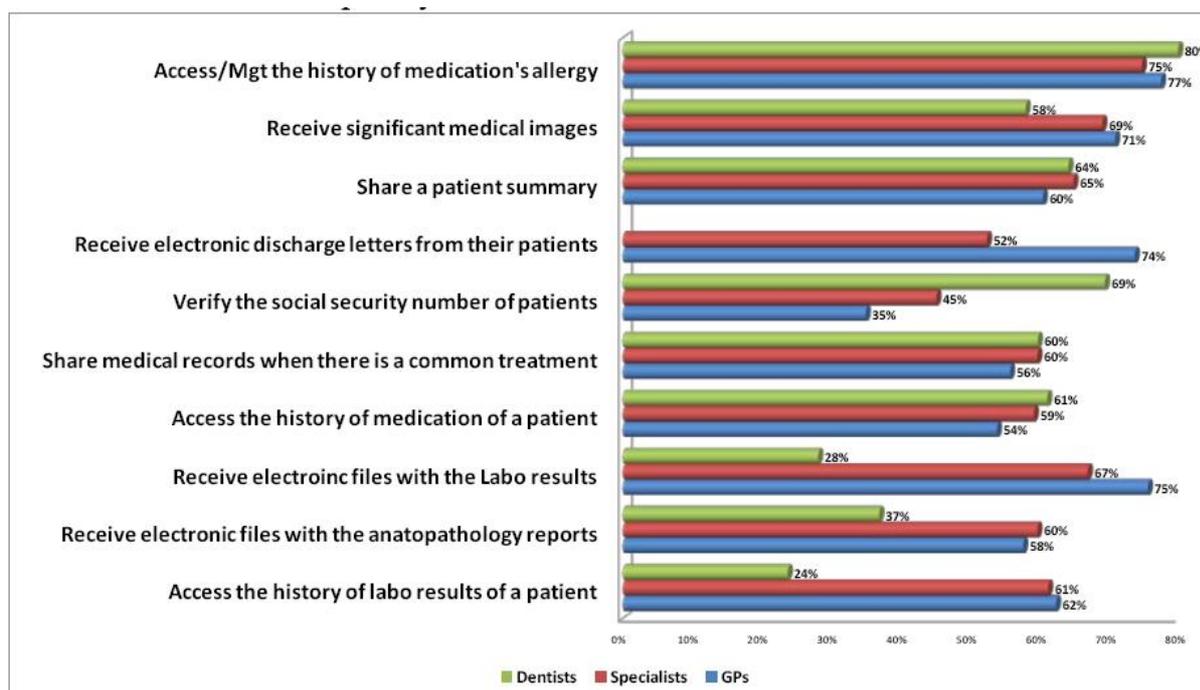
Source: empirica, Pilot on eHealth Indicators, 2007.

A more recent survey executed in Luxembourg shows that the current state of medical data exchange is mainly based on paper forms. We notice that electronic versions of documents exist, but they are generated to be used internally and, regarding semantics, they need improvements to be shared with other healthcare professionals. Other outcomes from the survey reveal that 86% of physicians use software to manage their practice (more than 50 different software 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 benefit from new technologies, but there is still a lot of work to do to specify and implement a national platform to exchange medical data. During the interviews, the representatives of institutions were unanimous in saying that a national coordination of activities is necessary to avoid redundancy or concurrency between projects. They also requested a well-established security strategy that minimizes the consequences of hacker attacks, assures the authenticity of data, and guarantees users' privacy without increasing the complexity to find and use medical data.¹⁵

An overview of the key applications sought by different healthcare professionals is provided in 3 below

¹⁴ The notion of „compound indicator“ designates an indicator built from a set of other indicators/survey questions regarding the same topic. The compound indicator reflects an average calculated from different values. (see Annex) The final results of the study on eHealth Indicators are available at www.ehealth-indicators.eu.

¹⁵ Extracted from [advance copy made available by the author]

Figure 3: Overview of healthcare professional needs in Luxembourg

The survey carried out by SANTEC also revealed that the existing eHealth infrastructure, the HEALTHNET is only used by a minority of GPs. It is only used by 5% of doctors and the most used service is the reception of electronic versions of laboratory results. The main barriers to the development of this network seems to be the registration costs, the (few) quantity of services offered via HealthNet, and some restrictions imposed to guarantee the security level.¹⁶

3 eHealth Strategies survey results

The following sections present the results of the eHealth Strategies country survey. In a first section, the eHealth policy actions undertaken in Luxembourg are presented. This is followed by a presentation of administrative and organisational measures taken. Section 3.3 presents results on key eHealth applications. Section 3.4 focuses on the technical side of eHealth, namely the role of patient and healthcare provider identifiers and the role of eCards. Legal and regulatory facilitators as well as financing and reimbursement issues are presented in the following chapters, 3.5 and 3.6. The report concludes with evaluation activities (0) in the country and an outlook (4.).

3.1 eHealth policy action

The eHealth strategies of EU and EEA countries are not always labelled as such. Some countries may indeed publish a policy document which refers to the ICT strategy in the healthcare sector. Other countries such as France and Germany have enshrined the

¹⁶ Pruski C. et al 2010

central eHealth activities in legislation governing the healthcare sector. In Germany, the relevant law is the law on the modernisation of healthcare; in France the introduction of an electronic medical record is included in a law concerning social security.

Sometimes, also documents from domains such as eGovernment or Information Society strategies may contain provisions which concern eHealth. In cases where the healthcare system is decentralised, i.e. where power is delegated to the regional level, there may even be strategy documents regarding eHealth from regional authorities.

3.1.1 Current strategy/roadmap

Important Policy Document

Luxembourg has a detailed eHealth Action Plan since 2006. (Plan d'action eSanté, dated July 5th 2006). This plan had set-out to achieve the following major objectives:

- Improve the quality and performance of healthcare services
- Help to contain healthcare expenditure
- Provide more and better health data for statistical and research purposes
- Guarantee interoperable healthcare information systems to ensure seamless care for mobile patients and the exchange of medical expertise across borders

The following eHealth infrastructure components were at the time envisaged:

- a) A technical (interoperability) platform to enable secure exchange and sharing of healthcare data between healthcare professionals. The already existing platform Healthnet was at the time planned for gradual extension.
- b) A citizen eCard: proposed as means to authenticate the user, encrypt data and sign documents in the context of eHealth services; the eCard would not be itself a storage medium. As a starting point, the card would be based on the model developed by the company Luxtrust (see below).
- c) A healthcare professional Card, with eventually biometric security mechanisms.

Building on these core components, the eHealth services to be provided are:

- a) A secure exchange of healthcare data via standardised messages.
- b) An online verification of a patient's social security affiliation.
- c) An electronic billing system for healthcare services.
- d) Electronic prescription of medication (including the electronic capture of the prescription by the GP either online or in his/her practice software and the electronic retrieval of the drug in the pharmacy and subsequent transfer of billing information to the health insurance company).
- e) An electronic health record for citizens containing essential healthcare information; this record would contain administrative data such as contact data. The record would contain, as a subset of the data, an emergency care summary.

Other services envisaged at the time were: drug interaction warnings, vaccination reminder service, blood donation reminder service, infant and school health surveillance, telesurveillance, telemedicine applications, public health use of data, a health portal and

access to knowledge bases for continuous professional development of healthcare professionals.

Building on this strategy document, a further important step was taken in 2009 with a wide investigation to gain information about the situation of health professionals regarding the use and needs of Information and Communication Technologies (ICT) for health purposes and mainly for the follow-up of patients which, in turn, serve to pave the way for the implementation of an integrated eHealth solution in Luxembourg. This investigation, carried out by the SANTEC Research unit from the “Centre de recherche public Henri Tudor” covered most of the health sectors (i.e. all physicians, pharmacists, physiotherapists, laboratories, hospitals and long term care institution). Its results show that information technologies are widely used by health professionals. However, mostly by virtue of Luxembourg’s specificities (small size, cosmopolitan population, multilingualism...), many important aspects have been highlighted and have to be taken into account for the implementation of an ICT-based health solutions. Among them, the need for sharing and exchanging health data between health professionals is confirmed and must be addressed in priority. This aspect underlines three major barriers all related to interoperability. First, interoperability is a matter of organisational aspects and security. If health professionals use software elements that aim at protecting their software systems, they are rarely developed in a way to support electronic exchange of data. Therefore electronic exchange of data is rather an exceptional than general phenomena. Then the technical aspect of interoperability comes into play. It deals with the use of existing standards for allowing the exchange of data in a heterogeneous ICT environment. Since health professionals are not equipped with hardware and software systems based on largely widely accepted standards it is hard and sometimes impossible to make these components communicate. Lastly, the survey has shown that semantic issues have also to be taken into account and will become unavoidable in a near future. It aims at making health data human and machine understandable which will support health professional in establishing their diagnosis and facilitates the mutual exchange of medical expertise, thus enhancing the quality of care. This investigation was of key importance to identify the barriers for the implementation of eHealth solutions Luxembourg.

3.2 Administrative and organisational structure

First ideas on the appropriate management and governance structure for eHealth in Luxembourg were sketched out in the 2006 eHealth Action Plan¹⁷.

Currently, preparatory work for eHealth conceptual development is done by a dedicated research unit within the “Centre de recherche public Henri Tudor.” The so called SANTEC Research unit collaborates to /works for the Ministry of Health, proposes a platform and EHRSystem Concept¹⁸. It is playing the role of a scientific competence centre in Luxembourg for questions in medical informatics and eHealth.

Currently the creation of a dedicated eHealth Agency has been decided by the Council of Government. The legal changes necessary to implement this decision are part of the

¹⁷ see chapter 5, pp. 34ff

¹⁸ Benzschawel S. et al 2010

healthcare reform bill mentioned under section 2.3. It is foreseen that this Agency will be mandated to set up the eHealth infrastructure and implement its applications. It should as well promote interoperability of health information systems and support healthcare providers during the adaptation of the information systems to the interoperability framework.

In parallel to the eHealth structures, the efforts undertaken in the field of eHealth are supported by the “Centre des technologies de l'information de l'Etat”, a body responsible for ICT in the public sector and dealing with eGovernment processes.¹⁹ It provides coordination, planning and assistance to government bodies in the field of ICT. It is also responsible for implementing the Government Program and the Master Plan for Electronic Governance. These comprise the preparation and updating of a normative framework for IT projects and the modernisation of the State.²⁰

3.3 Deployment of eHealth applications

As a first major step of the national eHealth program, the Health Ministry of Health launched the national health portal in April 2009²¹. Initially, it contains mostly information and basic services from the health and social sectors aimed at citizens and healthcare professionals. It provides advice on how to stay healthy, a dictionary of illnesses, symptoms and treatments, information on reimbursement of medical expenses, information on working in the health sector, a register of professionals and instructions in the sector, up-to-date information on emergency services, news, agenda and a catalogue of publications from institutions in the health sector. The portal is meant to become more interactive and provide online access to health or administrative data in the future.²²

3.3.1 Patient summary and electronic health record (EHR)

In this study, the epSOS project's definition²³ of a patient summary was used as a general guideline. There a patient summary is defined as a minimum set of a patient's data which would provide a health professional with essential information needed in case of unexpected or unscheduled care (e.g. emergency, accident), but also in case of planned care (e.g. after a relocation, cross-organisational care path).

Lacking a standard definition, a patient's electronic health record (EHR) is here understood as an integrated or also interlinked (virtual) record of ALL his/her health-related data independent of when, where and by whom the data were recorded. In other words, it is an account of his diverse encounters with the health system as recorded in patient or medical records (EPR or EMR) maintained by various providers like GP, specialists, hospitals, laboratories, pharmacies etc. Such records may contain a patient

¹⁹ Portail de la Fonction publique Grand-Duché de Luxembourg [Public Portal Grand Duchy of Luxembourg] 2009

²⁰ European Union- epractice 2009-10

²¹ Grand-Duché Luxembourg Portail Santé [Grand Duchy Luxembourg Health Portal] 2010

²² European Commission 2010

²³ European Patients Smart and Open Services (epSOS)

summary as a subset. As of yet, fully-fledged EHR systems rarely exist, e.g. in regional health systems like Andalucia in Spain or Kronoberg in Sweden, or in HMOs (health maintenance organisations) like Kaiser Permanente in the USA.

It should be noted that in most policy documents reference is made simply to an "EHR" without any explanation of what is meant by it, thereby in reality even a single, basic electronic clinical record of a few recent health data may qualify. As a consequence, this section can only report on national activities connected to this wide variety of health-related records without being able to clearly pinpoint what (final) development stage is actually aimed for or has been reached so far.

At the moment, planning for a Luxembourg wide EHR are still ongoing and have not yet led to concrete pilots. However, Luxembourg already disposes of core infrastructure, the HealthNet.

HealthNet Luxembourg is a secure telematic network for healthcare professionals in the Grand-Duchy of Luxembourg. Important efforts and investments, which can be capitalized in the HealthNet project, have been undertaken since 1988. Finally in September 1995, the pilot phase of HealthNet Luxembourg project was started. HealthNet was launched to develop and install a national, value added network offering telematic services to all professionals working in healthcare and/or social security. Since September 2005, HealthNet has been constituted in GIE (economic grouping of interest). Today, around 1000 users are connected to HealthNet (all the hospitals of the Grand Duchy, some laboratories and an increasing number of physicians).

The main objectives of GIE HealthNet are:

- Maintain a technical and logistical infrastructure for the secure exchange and sharing between actors in health and social security, health and administrative data in digital form.
- Provide basic applications for exchange of data.
- Promote the development and implementation of new applications and support the integration of medical applications, particularly in the field of medical imaging, electronic exchange of lab results²⁴.

At current stage of the discussions, the future eHealth Platform is foreseen to be based on a security concept relying on a separation of medical data and patient identifying data. There would be a functional and organisational splitting between the eHealth platform hosting depersonalised medical information or links to medical information stored under a pseudonym. The patient identifying data is foreseen to be kept by a trusted third party. Exceptionally, data that can not be de-identified would be stored in an encrypted form. Encrypted data and the encryption key must not be available to the same person or organisation (e.g. server manager). The results of a query would only be readable by the requester; no administrator of servers should interfere in the communication channels.

Other features of the eHealth Platform would be:

²⁴ Grand-Duché Luxembourg Portail Santé [Grand Duchy Luxembourg Health Portal] 2010

- Structured and unstructured file formats should be supported, and data should be accessible via secured connections over the Internet.
- All users must be identified and access rights of users are predefined. Services should be available according to the users' rights.
- Patient's consents for any access to his/her data are foreseen. Access may be restricted to episodes, medical cases, professionals, organisations, or group of professionals, organisations exceptions will be foreseen for emergency cases.
- Statistic evaluations should be possible on pseudonymized medical data.
- Technically the platform is foreseen to be based on the IHE-XDS profile with centralized registry and centralized as well as decentralised data repositories, using IHE-XDR for the exchange of data.
- This platform design is enriched by pseudonymization, encryption, a transparent re-encryption, and identity guaranteeing signature features.

The evolution of the GIE Healthnet into an eHealth Agency is currently under discussion. This Agency would be mandated to set up the eHealth infrastructure and implement its application such as the shared electronic patient record. Around the years 2013/14 an incremental implementation of the EHR is foreseen, based on the availability of data; not all data locally held will be taken onboard. The EHR will thus be a compromise between a patient summary and a lifelong Electronic Health Record.

3.3.2 ePrescription

In the framework of this study and following work in epSOS²⁵, ePrescription is understood as the process of the electronic transfer of a prescription by a healthcare provider to a pharmacy for retrieval of the drug by the patient. In this strict sense, only few European countries can claim to have implemented a fully operational ePrescription service.

All pharmacists in Luxembourg currently use computers in their pharmacy, which serve internal management purposes, such as the management of sales and the electronic transmission of dispensation data for reimbursement to the National Health Insurance Fund (Caisse National de Santé, CNS). Recommendations derived in the framework of the eSanté EFES study with regard to ePrescription include: deployment of value-added services on the national level such as pharmaceutical care record, allergy notification record and mechanisms to make the existing software systems interoperable.²⁶

Currently no work has been undertaken on ePrescription. Nevertheless it has been identified as one of the key application in the future and should therefore become one of the major "construction sites" in the next years.

3.3.3 Telemedicine

The use of telemedicine applications is recognised as beneficial to enable access to care from a distance and to reduce the number of GP visits or even inpatient admissions.

²⁵ European Patients Smart and Open Services (epSOS)

²⁶ p. 12-13

Commission services define telemedicine as “the delivery of healthcare services through the use of Information and Communication Technologies (ICT) in a situation where the actors are not at the same location”²⁷. In its recent communication on telemedicine for the benefit of patients, healthcare systems and society, the Commission re-emphasises the value of this technology for health system efficiency and the improvement of healthcare delivery²⁸.

A pilot project between the Grand Duchy and the German Land Nordrhein Westfalen is carried out in the field of telemedicine (Heart Failure).

A large scale project has been developed in conjunction with the renown “Herz und Diabetes Zentrum Bad Oeynhausen” in North Rhine-Westphalia, Germany and its “Institut für angewandte Telemedizin” (IFAT). The project will examine cross-border telemedicine - specifically in the field of cardiology. This project will apply results gained from the LuHF (Luxembourg Heart Failure) project in the field of heart transplantation (HTX). New competencies will be built up in the field of tele-monitoring patients with heart valve disease under blood anticoagulation therapy.

The application at the heart of the LUHS project (with a patent protected in Luxembourg) communicates with the patient and collects automatically standardised data to be used in a disease management program. Pulse Transit Time (PTT) is collected in the home-monitoring service. This is a unique feature, which allows an early detection of decompensation status.²⁹ The service was evaluated together with the university hospital of Saarbrücken and Nancy.

Following this evaluation, cooperation with the “Herzzentrum Bad Oeynhausen” was set-up. Target group: Pre-implantation patients and post-implantation patients. The telemonitoring service allows for a targeted selection of patients who should be moving upwards on a waiting list for heart transplants.

The Bad Oeynhausen heart centre provides anti-coagulation treatment surveillance services. The INR value (measuring the thinning of the blood) is measured with patients in Luxembourg and then transferred to Bad Oeynhausen, where treatment advice is provided.³⁰

Next to the telemedicine activities in Heart Failure, the telemedical service MENSANA for food allergy patients should be mentioned. Instead of measuring physiological parameters, a Smartphone based Personal Allergy Assistant (PAA) allows patients to keep an electronic patient diary by scanning the barcode of the consumed food products. For diagnostic purpose, the diary is regularly transmitted to the allergist's electronic patient record. To further support the individual diet management, the PAA gives a warning before consumption of allergenic food. Computer readable food ingredient lists are required for the PAA diet management. To collect this kind of information, a dedicated web-based "virtual community" of food consumers and producers (www.wikifood.eu) has

²⁷ Europe's Information Society 2009

²⁸ European Commission 2008

²⁹ Wagner D. ; Rösch N. et al 2010

³⁰ N. Rösch et al 2008

been established. This volunteer network complements an independent product database. Up to now, more than 13.000 food descriptions are public available within wikifood.eu.³¹ The project partners are based in Köln, Germany, Geneva and the Charité hospital in Berlin.

The future eSanté platform is also conceived as a platform for disease management programs, allowing a collaborative treatment of patients by accessing patient data and updating it.

3.4 Technical aspects of implementation

A key prerequisite for the establishment of an eHealth infrastructure is the ability to uniquely identify citizens/patients and healthcare professionals. This part of the survey deals with identifiers and how they are stored. This section does not deal with the tokens through which identification can or will take place. One such possibility would be via an eCard. This topic is dealt with in the following section. The current section focuses solely on whether or not unique identifiers are in place in Luxembourg and for which purpose.

3.4.1 Unique identification of patients

The Plan d'Action eSanté of 2006 had underlined the importance of dealing correctly with the problem of patient identification and guaranteeing that data are safe but can still be exchanged and shared.³² A recent research paper published by the SANTEC group however underlines the “absence of a unique patient identifier or patient identifying process” as a continued barrier to eHealth implementation in Luxembourg.³³

A national Master Patient Index is in discussion to solve the problem of patient identification.

The 2006 eHealth strategy had envisaged to introduce a citizen health card (“carte santé”) with a micro-chip which may store a limited amount of information or a pure access card. Today the orientation is towards a pure access card, allowing strong authentication and electronic signature. Two choices are still under discussion:

1st a specific ehealth card

2nd strong authentication and electronic signature are assured by an already existing card like the Luxtrust Smartcard or equivalent solutions (eID card), already available or in the future to citizens.

LUXTRUST is a company providing trusted eServices. The government of Luxembourg, in line with its eGovernment Action Plan and in the framework of the SAFE-e project, offered a free electronic signature tool, the LuxTrust Smartcard, LuxTrust signing stick, a USB key which authenticates the applicant's data and allows citizens to sign a document electronically.³⁴

³¹ Rösch N. et al 2010

³² Plan d'Action eSanté, p. 17

³³ Pruski C. et al. 2010

³⁴ European Commission 2010

3.4.2 Unique identification of healthcare professionals

An unambiguous identification is necessary to build up access controls for the applications of the future ehealth platform in Luxembourg.

Currently a national identifier exists for reimbursement purposes; however a coherent and unambiguous register for healthcare providers is missing. For the purpose of the eHealth platform it is necessary to build up a register of healthcare professionals and institutions from different sources of information.

There are different registers at the moment:

- One for professionals, hospitals, pharmacies and laboratories in the Health Ministry
- An electronic register for long-term and home-care institutions is under development.

Huge work has been done to build up a register available through the health portal, but efforts have to be continued to build up a register that supports coherent identity management. Based on this health professional and institution register, security services are foreseen to be building up: strong authentication, electronic signature, eventually encrypting features. Currently, 2 basic solutions are under discussion: issue of a dedicated healthcare professional card (HPC) or usage of an already existing card, like Luxtrust Smartcards.

Usage of Smartcards for authentication and electronic signature inside institutions risks being too difficult to apply. Alternatives should be envisaged while assuring sufficient safeguards for data security.

3.4.3 The role of eCards

It is envisaged that patient and healthcare professional identification in Luxembourg will be managed through registers. eCards will be mainly a tool for strong authentication and electronic signature.

3.4.4 Standards

Standards are not only crucial to enable interoperable exchange of meaningful information in the healthcare system; they also ensure secure access to patient records by healthcare providers and citizens. This study aims to identify, among other usage, standards related to the domain of health informatics, such as the SNOMED Clinical Terms or the LOINC terminology.

Luxembourg currently envisages relying on the IHE XDS profile for the sharing of its clinical documents. The IHE XDS profile (Cross Enterprise Document Sharing) defines a way for registering and sharing electronic health record documents between healthcare enterprises, ranging from physician's offices to clinics to acute care in-patient facilities. The exchange is foreseen to be based on the IHE-XDR profile (Cross-enterprise Document Reliable Interchange). This profile defines a way of transporting documents and metadata about documents from a document source to a document recipient.

As part of its work to define the Luxembourg eHealth platform, the IHE XDS standard and its specialisations (XD-LAB, XDS-I, XDS-SD) were proposed to provide a central registration point for documents (central registry and central repository: both physical repository of data and reference system to decentralised data). The profile would be extended to a pseudonymisation service attached to a Master Patient Index, which allows a high level of privacy. The pseudonymisation service would be provided by a so called Trusted Third Party (TTP), which makes sure that the clinical data stored in the IHE XDS repository only refers to pseudonyms, while the TTP can provide the matching to actual patient identities, but does not hold any medical data itself.

For the clinical documents, the HL7 Clinical Document Architecture (version 2) (CDA) is foreseen to be proposed as a general document standard to the sector.

The use of SNOMED Clinical Terms in Luxembourg to represent the clinical content of the electronic health record has been considered, but will probably not be generalized in the short term.

The use of LOINC has been proposed and its adoption in the field of laboratory results exchange is very likely.

ICD-10 (3 digit) is currently in use in hospitals for coding diagnostics on discharge letters (considered however as insufficient by the professionals themselves).

In sum, it should be stressed that the Grand Duchy is bound to adopt international health informatics standards due to its geographic location and multinational residents. A local representation of HL7 in Luxembourg is under negotiation.

3.5 Legal and regulatory facilitators

Legal and regulatory issues are among the most challenging aspects of eHealth: privacy and confidentiality, liability and data-protection all need to be addressed in order to make eHealth applications possible. Rarely does a country have a coherent set of laws specifically designed to address eHealth. Instead, the eHealth phenomenon has to be addressed within the existing laws on professional liability, data protection etc.

The current regulations in Luxembourg with regard to data protection and liability regulations are based on EU directives.

A new law proposal about patient rights and obligations is in elaboration. Among other questions, it foresees a clarification of obligations and rights with respect to access to personal health records and data.

Currently a new healthcare reform law is focussing upon the organisation of the healthcare system. In the field of ehealth it is addressing two key questions:

- Implementation of a shared patient record based on an ehealth platform with some general rules for access and patient consent.
- Creation of a national ehealth agency

3.5.1 Patient rights

Patient rights, as far as the ehealth services are concerned, will be detailed in the near future. The above mentioned laws will lay down a legal framework.

3.6 Financing and reimbursement issues

Currently most of the activities in the domain of ehealth were financed by the government through the general eGovernment budget, funds from the Ministry of health or R&D funding. The legal health insurance contributes to the HealthNet infrastructure.

In addition, the Fonds National de la Recherche Luxembourg (FNR) is a national agency that provides different funding instruments that directly support R&D in Luxembourg. The CRP Henri Tudor - CR SANTEC, its healthcare informatics department, has worked with the support of the FNR to create innovative and valuable R&D projects.

The financing of the platform and the Agency is currently under discussion.

3.7 Evaluation results/plans/activities

From a public policy perspective, evaluation is a key activity in the policy-cycle. It provides insights into the success or failure of a policy or project and leads to new policy goals and new methods of implementation. The need for evaluation of eHealth policies and projects has been stressed time and again by the EC, not least in order to further the spread of eHealth in the process of healthcare delivery.

No real evaluation for ehealth projects has been put in place so far.

4 Outlook

eHealth in Luxembourg is in a phase of transition. As already mentioned, a new healthcare reform law is in preparation. It will lay down the legal and organisational framework of the future eHealth platform including its applications; this will also launch the eHealth Agency, which will be in charge of the platform and the interoperability aspects. With adoption of the law and the launch of the Agency, implementation work should start, based on the technical concepts elaborated for the Ministry of Health by CR Santec³⁵.

³⁵ Contact: Ministry of Health; Mike Schwebag mike.schwebag@ms.etat.lu +352 2478 5518 and René Krippes rene.krippes@ms.etat.lu + 352 2478 5679, or CR Santec; Stefan Banzschawel stefan.banzschawel@tudor.lu +352 425991 889.

5 List of abbreviations

CDA	Clinical Document Architecture
CNS	Caisse National de Santé [National Health Fund]
CR	Centre de Recherché [Research Centre]
CRP	Centre de Recherché Public [Public Research Centre]
DRG	Diagnosis Related Group
EC	European Commission
EEA	European Economic Area
EHR	Electronic Health Record
EMR	Electronic Medical Record
EPR	Electronic Patient Record
epSOS	European Patients Smart and Open Services
ERA	European Research Area
EU	European Union
FNR	Fonds National de la Recherché Luxembourg [National Research Fund Luxembourg]
GDP	Gross Domestic Product
GIE	Economic Grouping of Interest
GP	General Practitioner
HCP	Healthcare Provider
HL7	Health Level Seven International (authority on standards for interoperability)
HTX	Heart Transplantation
LuHF	Luxembourg Heart Failure Project
HMOs	Health Maintenance Organisations
HPC	Health Professional Card
ICT	Information and Communication Technology
ID	Identification (e.g. number, card or code)
IFAT	Institut für Angewandte Telemedizin [Institute for Applied Telemedicine]
IHTSDO	International Health Terminology Standards Development Organisation

INR	International Normalized Ratio (measures thinning of the blood)
IT	Information Technology
LPS	Large Scale Pilot
MENSSANA	Mobile Expert and Networking System for Systematical Analysis of Nutrition Based Allergies
OECD	Organisation for Economic Co-operation and Development
PAA	Personal Allergy Assistant
PHS	Personal Health System
PTT	Pulse Transit Time
R&D	Research and Development
TTP	Trusted Third Party
WHO	World Health Organization

6 Annex

6.1.1 Annex 1: Compound indicators of eHealth use by GPs

Compound indicator name	Component indicators	Computation
Overall eHealth use	<ul style="list-style-type: none"> - Electronic storage of individual medical patient data - Electronic storage of individual administrative patient data - Use of a computer during consultation with the patient - Use of a Decision Support System (DSS) - Transfer of lab results from the laboratory - Transfer of administrative patient data to reimbursers or other care providers - Transfer of medical patient data to other care providers or professionals - ePrescribing (transfer of prescription to pharmacy) 	Average of component indicators
Electronic storage of individual medical patient data	<ul style="list-style-type: none"> - A2a - Symptoms or the reasons for encounter - A2c - Medical history - A2c - Basic medical parameters such as allergies - A2d - Vital signs measurement - A2e - Diagnoses - A2f - Medications - A2g - Laboratory results - A2h - Ordered examinations and results - A2i - Radiological images - A2j - Treatment outcomes 	Average of component indicators
Electronic storage of individual administrative patient data	<ul style="list-style-type: none"> - A1 - electronic storage of individual administrative patient 	A1 value
Use of a computer during consultation with the patient	<ul style="list-style-type: none"> - B2 - Computer use during consultation 	B2 value
Use of a Decision Support System (DSS)	<ul style="list-style-type: none"> - B3a - Availability of DSS for diagnosis - B3b - Availability of DSS for prescribing 	Average of component indicators
Transfer of lab results from the laboratory	<ul style="list-style-type: none"> - D1e - Using electronic networks to transfer prescriptions electronically to dispensing pharmacists? 	D1e value
Transfer of administrative patient data to reimbursers or other care providers	<ul style="list-style-type: none"> - D1a - Using electronic networks to exchange of administrative data with other healthcare providers - D1b - Using electronic networks to exchange of administrative data with reimbursing organisations 	Average of component indicators
Transfer of medical patient data to other care providers or professionals	<ul style="list-style-type: none"> - D1c - Using electronic networks to exchange medical data with other health care providers and professionals 	D1c value
ePrescribing (transfer of prescription to pharmacy)	<ul style="list-style-type: none"> - D1d - Using electronic networks to transfer prescriptions electronically to dispensing pharmacist 	D1d value

(Dobrev, Haesner et al. 2008)

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