

# eHealth Strategies - Scientific review

Report considering national and regional eHealth strategies and results from science

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# Table of Contents

1	Summary.....	2
2	Introduction .....	4
3	Methods .....	4
3.1	National and regional eHealth strategies .....	4
3.2	Scientific conferences.....	5
4	Results .....	5
4.1	Definition of eHealth .....	5
4.2	Findings from national eHealth strategies.....	5
4.3	Findings from scientific conferences.....	6
5	Discussion.....	9
6	Appendix: Selected findings in national and regional eHealth strategies .....	10
6.1	Definitions .....	11
6.2	Goals.....	12
6.3	Actions .....	18
7	Appendix: Selected findings from the scientific community.....	26
7.1	eHealth Summit 2015, Vienna, Austria .....	26
7.2	pHealth 2015.....	28
7.3	MIE 2015 (Medical Informatics Europe).....	31
7.4	eHealth Week Riga 2015.....	36
8	References.....	39
8.1	eHealth strategies .....	39
8.2	Scientific Conferences.....	40

# 1 Summary

The year 2015 was the target year of the then existing eHealth strategy of the city of Vienna, Austria. In late 2015 and early 2016 therefore work was undertaken to establish a new eHealth strategy for the years 2016 and 2017. This strategy is now finalised and publicly available [S11]. The intention was to consider best practices and well established methods within the primary activities, as well as new strategic topics for innovation within the strategic and long term visions and goals.

For this reason, an extensive literature review has been performed including the published eHealth strategies of ten European regions and nations and the publications of four national and international eHealth focused conferences. Results show that integrated person-centred information, patient empowerment, quality of healthcare, national / regional IT infrastructures and financial sustainability of healthcare are represented in the main visions and aims of many strategies. Among the most frequent activities the strategies include electronic healthcare records, semantic interoperability in the form of structured and harmonized document formats, integrated healthcare and support of medical workflows, electronic identity management and application plans for self- and telemonitoring systems.

The papers from the scientific conferences included self- and telemonitoring, mHealth and pHealth, barrier free access, empowerment, syntactic and semantic interoperability, secondary use of data, analytics, privacy and security, and ambient assisted living as the themes that were addressed most frequently.

Looking for visions, goals and actions to consider within eHealth strategies, the results of this work support the following main recommendations:

- **electronic health records (EHRs) and IT infrastructures** have clearly transformed from long term goals to operative, well accepted components of existing healthcare systems. They appear in all eHealth strategies as short term actions. Existing IT infrastructures already generate data that also supports scientific work. They should therefore be addressed as actions in eHealth strategies. In the future, additional applications based on these infrastructures can be expected, e.g. integrated care, decision support, secondary use of data. These themes should be addressed in visions and goals within eHealth strategies.
- **Semantic interoperability including structured and harmonized document formats** is a major element in many eHealth strategies and generates substantial research effort. eHealth strategies should include actions to implement standards based semantic interoperability within selected, well-defined projects. They should also include as a goal the requirement to implement standards based interoperability in all future eHealth applications, starting from the earliest stages of planning.
- **Secondary use and analytics of data, decision support within integrated workflows** are now implemented on larger scales, building on existing IT infrastructures and using

well-established methods. These applications may be addressed in near term actions within eHealth strategies, in any case they should be addressed as long term goals.

- **Mobile applications, self- and telemonitoring, mHealth, pHealth, barrier free access and empowerment of patients** are moving from remote visions to near term actions. They appear in many eHealth strategies and generate a substantial amount of research results. These themes should therefore be addressed in eHealth strategies. They may occur as actions to add the necessary functions wherever national EHRs and IT infrastructures already exist, or as goals where IT infrastructures are only planned.
- **Education and training** is being addressed in high level activities and remains an issue in the scientific community. Evidence exists for a mid-term need of additional skills and work force, as eHealth emerges from its early stages into an accepted element within the health domain. These issues should be considered for the mid and long term in eHealth strategies.

## **2 Introduction**

For a growing and modern city like Vienna, a cutting-edge eHealth strategy has to be possible. International eHealth strategies of nations and regions within Europe have been selected and reviewed for introducing the political and application point of view on a large scale. The introduction of national and international conference proceedings dealing focused on the topic of eHealth and Telemonitoring allowed the inclusion of the state of art of science, showing innovation and ideas, which could be of interest when designing the eHealth strategy for the City of Vienna.

## **3 Methods**

### **3.1 National and regional eHealth strategies**

Literature research has been performed on the basis of finding national and regional eHealth strategies. The inclusion criteria for the strategies to be used in this review was that the English or German language was used and that the documents are available to the general public. Based on these criteria the following 10 strategy documents have been included and reviewed:

- Ireland [S6]
- Switzerland [S7]
- Lithuania [S8]
- Slovakia [S9]
- Austria [S10]
- Netherlands [S3]
- Germany [S2]
- Scotland [S1]
- Sweden [S4]
- Denmark [S5]

Within these strategies definitions for “eHealth” were then identified. Out of these a harmonised definition was generated.

In these selected strategies topics were then identified. The topics were then clustered into themes for a cross-document summary. The themes were ranked according to the number of strategies they occurred in. The recommendations and measures for these themes were then listed as an input into the development of the eHealth strategy of the city of Vienna.

## 3.2 Scientific conferences

In order to review the state of the art from a scientific point of view, the papers published in the proceedings from the following four national and international conferences have been included into the literature survey:

- International Conference on Wearable Micro and Nano Technologies for Personalized Health, phealth 2015 in Vasteras, Schweden [P14]
- eHealth Summit Vienna, Austria 2015 [V21]
- eHealth Week in Riga 2015 [R1] to [R56]
- Medical Informatics Europe Conference MIE 2015, Madrid, Spain [M55]

The conference proceedings were reviewed using a similar method as the eHealth strategies. First, topics were identified within the conference documents. The topics were then clustered into themes for a cross document summary. The themes were then ranked according to the number of papers they occurred in. The approaches for these themes were then listed summarised as an input into the development of the eHealth strategy of the city of Vienna.

## 4 Results

### 4.1 Definition of eHealth

Definitions of eHealth were found in the strategies of Scotland [S1], Sweden [S4], Ireland [S6] and Switzerland [S7]. In summary the following definition was generated:

“eHealth is defined as the use of information and communication technologies (ICT) in healthcare. eHealth intends to support health of individuals as well as healthcare systems for populations. eHealth integrates the processes and data flows involved, efficiently and effectively, with users in leading roles during design and operation. Many professions cooperate in eHealth activities, including medicine, management, administration and engineering. “

### 4.2 Findings from national eHealth strategies

Additional details on the analysis of the eHealth strategies is available in the “Appendix: Selected findings in national and regional eHealth strategies”.

#### 4.2.1 Visions and aims

In summary, the national and regional eHealth strategies that were reviewed, contained the following vision and aims, ranked by the number of occurrences:

- Seven strategies focus on **integrated person-centred information**; (Austria, Scotland, Germany, Netherlands, Denmark, Ireland, Slovakia)
- Seven strategies aim at **patient empowerment** (Austria, Scotland, Netherlands, Sweden, Ireland, Switzerland, Denmark)
- Six strategies aim to **improve quality of healthcare** (Austria, Scotland, Netherlands, Sweden, Ireland, Switzerland)
- Four strategies intend to establish a **national / regional IT infrastructure** for healthcare (Austria, Germany, Sweden, Switzerland)
- Four strategies aim at **financial sustainability of healthcare** (Scotland, Netherlands, Ireland, Switzerland)
- Three strategies aim at **innovation** (Scotland, Ireland, Switzerland)
- Three strategies aim for **telemedicine** (Austria, Denmark, Ireland)
- Two strategies aim at **patient mobility** (Netherlands, Ireland)

#### 4.2.2 Actions

The analysed strategies included the following actions, ranked by the number of occurrences:

- Ten countries implement **electronic health records and IT infrastructures** (Austria, Scotland, Germany, Netherlands, Sweden, Denmark, Ireland, Switzerland, Lithuania, Slovakia). Four countries implement functions for medication (Austria, Germany, Denmark, Ireland)
- Eight countries apply **semantic interoperability** in form of **structured and harmonized document formats** (Austria, Scotland, Netherlands, Sweden, Denmark, Ireland, Switzerland, Lithuania)
- Six of the analysed strategies include **integrated healthcare and support of medical workflows** (Austria, Scotland, Netherlands, Denmark, Ireland, Slovakia).
- Five countries are working on **electronic identity management** using smart cards or mobile signatures (Germany, Netherlands, Denmark, Ireland, Switzerland)
- Four of the countries include **application plans for self- and telemonitoring systems** (Austria, Scotland, Denmark, Ireland)

### 4.3 Findings from scientific conferences

The publications from the four conferences were listed into topics for each conference. These topics were then clustered within themes to enable a cross-conference summary. Table 1 shows an overview of the mapping. See in the “Appendix: Selected findings from the scientific community” for details on this part of the analysis. The following list of themes is ranked in the order of the number of papers that addressed the theme:

- 33 within **secondary use of data, analytics**, (3 at the eHealth Summit Vienna [V21], 30 at MIE 2015 [M55])
- 25 within **integrated care** (9 at MIE 2015 [M55], 16 at eHealth Week Riga)
- 23 within **self- and telemonitoring mHealth and pHealth** (5 at the eHealth Summit Vienna [V21], 9 at pHealth 2015 [P14], 6 at MIE 2015 [M55], 3 at eHealth Week Riga)
- 18 within **syntactic and semantic interoperability** (3 at the eHealth Summit Vienna [V21], 15 at the eHealth Week Riga)
- 15 within **barrier free access, empowerment** (all at eHealth Week Riga)
- 10 within **decision support** (1 at the eHealth Summit Vienna [V21], 3 at pHealth 2015 [P14], 6 at the eHealth Week Riga)
- 8 within **education and training**, (3 at the eHealth Summit Vienna [V21], 4 at MIE 2015 [M55], 1 at the eHealth Week Riga)
- 7 within **privacy and security** (3 at the eHealth Summit Vienna [V21], 4 at the eHealth Week Riga)
- 6 within **ambient assisted living** (3 at the eHealth Summit Vienna [V21], 3 at MIE 2015 [M55])

The mapping was done on a topic level. It therefore may only be considered as a rough numerical indicator, and in no way a measure of “importance” of the themes. In many cases it was not clear how to classify papers, especially in cases where a paper addresses multiple topics. This mapping therefore reflects the views of authors and the context of the work on the eHealth strategy.



		Mapped to Themes								
		Secondary use, analytics	Decision support	Syntactic and semantic interoperability	Self- and telemonitoring, mHealth, pHealth	Privacy and security	Education and training	AAL	Integrated care	Barrier free access, empowerment
Total per Theme		33	10	18	23	7	8	6	25	15
Conference	Topic									
eHealth Summit 2015	Data management	1								
	Decision support		1							
	Syntactic and semantic Interoperability			3						
	Secondary use of data	2								
	Self- and Telemonitoring				3					
	mHealth				2					
	Security					3				
	Education and advanced training						3			
AAL							3			
pHealth 2015	mobile Health				5					
	Decision Support and intelligent systems		3							
	Applications for chronic illnesses				2					
	Tele-rehabilitation				2					
MIE 2015	Information and Knowledge Representation and Processing	10								
	Health information management	6								
	Healthcare services Delivery	7								
	Ambient Assisted Living and Wellbeing							3		
	Research and Education						4			
	Digital Healthcare services								6	
	Advanced Analytics and Big Data in Healthcare	4								
	Digitized public and private Healthcare Enterprise									
	Bioinformatics									
	Mobile Healthcare services				6					
	Empirical Research Methodologies	2								
	Digital Health Improving management of Resources in Healthcare	1								
Digital Networks and services									3	
eHealth Week 2015	Integrated, sector-general health service								16	
	(Barrier-free) access to the healthcare, "Empowerment", Apps									15
	Standards			15						
	Products, technologies				3					
	Security, Privacy, legal frameworks					4				
	Big Data, Clinical Decision Support		6							
	Education						1			

Table 1: Mapping of conference topics to themes

## 5 Discussion

This work reviewed regional and national eHealth strategies as well as papers and presentations from four main scientific conferences with the goal to provide input to the development of the eHealth strategy of the city of Vienna for the years 2016 and 2017 [S11]. The intention of analysing the eHealth strategies was to summarise existing recent strategies in order to assure that the strategy considers well-established and proven approaches in the near term goals. From the scientific papers and presentations, the analysis identified topics that are currently studied, in order to include them in the strategic, long term goals and visions.

Looking for visions, goals and actions to consider within eHealth strategies, the results of this work support the following main recommendations:

- **electronic health records (EHRs) and IT infrastructures** have clearly transformed from long term goals to operative, well accepted components of existing healthcare systems. They appear in all eHealth strategies as short term actions. Existing IT infrastructures already generate data that also supports scientific work. They should therefore be addressed as actions in eHealth strategies. In the future, additional applications based on these infrastructures can be expected, e.g. integrated care, decision support, secondary use of data. These themes should be addressed in visions and goals within eHealth strategies.
- **Semantic interoperability including structured and harmonized document formats** is a major element in many eHealth strategies and generates substantial research effort. eHealth strategies should include actions to implement standards based semantic interoperability within selected, well-defined projects. They should also include as a goal the requirement to implement standards based interoperability in all future eHealth applications, starting from the earliest stages of planning.
- **Secondary use and analytics of data, decision support within integrated workflows** are now implemented on larger scales, building on existing IT infrastructures and using well-established methods. These applications may be addressed in near term actions within eHealth strategies, in any case they should be addressed as long term goals.
- **Mobile applications, self- and telemonitoring, mHealth, pHealth, barrier free access and empowerment of patients** are moving from remote visions to near term actions. They appear in many eHealth strategies and generate a substantial amount of research results. These themes should therefore be addressed in eHealth strategies. They may occur as actions to add the necessary functions wherever national EHRs and IT infrastructures already exist, or as goals where IT infrastructures are only planned.
- **Education and training** is being addressed in high level activities and remains an issue in the scientific community. Evidence exists for a mid-term need of additional skills and work force, as eHealth emerges from its early stages into an accepted element within the

health domain. These issues should be considered for the mid and long term in eHealth strategies.

The co-operation with major stakeholder representatives in the “Wiener eHealth Strategie - Board” added substantially to this work. The real world requirements and the current situation in the region of Vienna are therefore considered in this work. This co-operation influenced the specific selection of references. This should be considered when further using this work for other purposes.

This report summarises a subset of the input to the eHealth strategy of Vienna. Additionally, many discussions and documents provided input into the strategy. It is not the intention of this report to provide a complete record of these processes. This level of detail remains internal to the “Wiener eHealth Strategie - Board”.

The available resources limited the number of strategies that were analysed in this report. This may be considered a limitation. For example, no strategy from Asia was analysed. This work therefore does not represent a complete view. Within the available resources and timeframe and considering that the eHealth strategy of the City of Vienna [S11] covers the years 2016 and 2017 this seems sufficient. Future work will have to revisit the field, in order to reflect the latest developments.

The terms for topics and themes, goals and actions that are used in this work were not mapped to well-established and internationally harmonised terms. On the long term this might help to follow up the evolution of the field by studying the activity within these areas. Such a harmonised nomenclature is however not available today and it remains to be discussed if such a nomenclature is even possible for this purpose, as the field evolves very dynamically over time.

Regarding the scientific conferences, the main question was how far mobile health needs to be considered in the strategy. The four conferences that were analysed each have a distinct and different profile as regards the topics, the authors and the audience. It was in many cases not possible to clearly identify the main theme of a paper. The method used here, ranking the themes by the number of papers and presentations, may therefore not be considered to reflect “importance”. In any case the results from scientific conferences definitely confirm that self- and telemonitoring, mHealth and pHealth are among the important issues to be addressed in the near future.

## **6 Appendix: Selected findings in national and regional eHealth strategies**

This appendix summarises findings from selected eHealth strategies that were studied. For space reasons and in order to consider more recent developments, details should be looked up via the listed references.

## 6.1 Definitions

Definitions of eHealth were found in the strategies of Scotland [S1], Sweden [S4], Ireland [S6] and Switzerland [S7].

### 6.1.1 Scotland

The eHealth Strategy of Scotland defines eHealth as “use of information, computers and telecommunications (ICT) to meet the needs of individuals and improve the health of citizens” [S1].

The strategy covers the following items: [S1]

- electronic information recorded and shared between individuals and healthcare providers
- peer-to-peer communication between individuals and/or healthcare professionals
- organisation-to-organisation transmission
- sharing of information

eHealth encompasses the following functions [S1]: telehealth, telecare, telemedicine, digital health, mobile health, health informatics.

### 6.1.2 Sweden

The Swedish eHealth strategy [S4] defines eHealth as follows:

“The concept of eHealth is based on the World Health Organisation’s definition of health as “a state of complete physical, mental and social well-being”. By adding the prefix “e” to the concept of health, we maximise the possibility of achieving these benefits for the individual through widespread use of information and communication technologies (ICT). The definition of eHealth extends the concept of health from something that primarily concerns a single individual to a change process with the potential to work as a catalyst for reform within the entire health and social care sector. ... The definition of eHealth also emphasises the fact that the strategy now fully incorporates the various activities of the social services.”

### 6.1.3 Ireland

The eHealth strategy for Ireland [S6] uses the definition of eHealth issued by the World Health Organisation: “the combined use of electronic communication and information technology in the health sector.”

eHealth “involves integration of all information and knowledge sources involved in the delivery of healthcare via information technology-based systems for the purpose of exchange between cooperating parties.”

“eHealth is the means of ensuring that the right health information is provided to the right person at the right place and time in a secure, electronic, accessible and meaningful format for the purpose of optimising the quality and efficiency of healthcare delivery.”

### **6.1.4 Switzerland**

The eHealth Strategy of Switzerland [S7] defines eHealth as “integrated usage of information- and communication technologies (IKT) for designing, support and networking of all processes and participants in healthcare”.

## **6.2 Goals**

### **6.2.1 Scotland**

The eHealth aims according to eHealth strategy of Scotland [S1] are:

- To enhance the availability of appropriate information for healthcare workers and the tools to use and communicate that information effectively to improve quality
- To support people to communicate with NHSScotland, manage their own health and wellbeing, and to become more active participants in the care and services they receive
- To contribute to care integration and support people with long term conditions
- To improve the safety of people taking medicines and their effective use
- To provide clinical and other managers across the health and social care spectrum with the timely management information they need to inform their decisions on service quality, performance and delivery.
- To maximise efficient working practices, minimise wasteful variation, bring about measurable savings and ensure value for money
- To contribute to innovation occurring through the Health Innovation Partnership, the research community and suppliers including small and medium enterprise (SME) sector

### **6.2.2 Germany**

No document that describes the federal eHealth strategy for Germany was found. The partner information for Germany from the “eHealth for regions” network [S2] was used.

The German eHealth strategy describes the following main objectives:

- building up a telematics infrastructure (electronic patient card)
- communication between all professionals (hospitals, health insurers, practitioners, dentists, family doctors)
- Cross-linking of all professionals and exchange of all relevant medical documents and data
- an electronic patient record with a lifelong medical history for every patient

The general aims of ICT in healthcare are:

- improving affordability, accessibility and quality of healthcare
- increasing mobility among patients and professionals
- to give shape and form to a trans-border mobility and (preventive) medicine

### 6.2.3 The Netherlands

According to the Dutch eHealth strategy [S3] the aims of ICT in healthcare in the Netherlands are:

- Electronic Health record
  - Electronic Medication Record
    - If healthcare providers have electronic access to all the medication data of their patient, a lot of suffering and inconvenience can be avoided and a large part of this sum can be saved
  - Electronic General Practitioner's Record
    - a summary of the patient's history and consultations are automatically relayed to the regular GP in the form of a locum report
  - Extensions of applications
    - new applications will be prioritized
    - chapters will be added to electronic health record
    - further development of electronic health record components
    - development of an electronic child's record (information on the child, the family situation and the environment)
    - upsize proven eHealth applications by means of various programmes
  - create conditions whereby patients get electronic access to their own record
- Basic infrastructure
  - National registration systems
    - Identification and authentication of patients, healthcare providers, insurers and other care agencies
    - Citizen service number for patient identification
    - unique healthcare professional identification for the identification of care providers
    - unique health insurer identification for the identification of health insurers
    - No patient smartcard with which the care providers can access patient data
  - National Switch Point
    - with a reference index for routing, identification, authentication, authorization and logging
    - traffic control tower
    - all medical data remain in local repositories; exchange via National Switch Point
  - Care Service Providers
    - for communication and services between local environments and central Switch Point
    - environment will require certification
  - Information systems of care organisations

- data must be stored and secured in a structured system
- that local system can connect to national switch point
- meet international security guidelines
- identifiable with a unique nationally applicable number
- Security and authorization
  - identification, authentication, authorization
  - all organisational and technical aspects need to be properly regulated
- Public Key Infrastructure
  - Via NEN norm 7510 (ISO 799)
- Message standards
  - international HL7 v3 standard

## 6.2.4 Sweden

The eHealth strategy of Sweden [S4] describes the national goals as follows:

“Work over the forthcoming years will focus on delivering the benefits of various eHealth services, delivering more personal eServices for all citizens, concentrated efforts to coordinate and develop eHealth in municipal healthcare and social services and greater interaction with adjacent national and international reform processes and initiatives.”

The Swedish eHealth strategy envisages that the following three tasks / groups are supported by the infrastructure (regulatory, legislative and technical):

- Patient Empowerment
- Health Professionals
- Policy Makers

Areas and services of particular importance for future work:

- All citizens shall be able to use secure, personal eServices to access information about their own health and social care interventions
- Services where individuals themselves can document and share information about their own health shall be developed as a resource for both staff and the individual
- Information about quality, accessibility and staff friendliness shall be presented in a customised and user-friendly way to enable people to make free and informed choices.

Under the theme “Knowledge Management, Innovation and Learning” inter alia the following future areas are singled out as important:

- More in-depth knowledge about eHealth services shall be a natural part of the education and training of all care professional groups

- Documentation systems in the healthcare and social services shall as far as possible be designed so that relevant information can be automatically and securely transferred to health data and quality registers in order to improve the prerequisites for research

In the subject area technical infrastructure, the following item is listed to be achieved, among several others by the Swedish eHealth strategy for future objectives:

- global standards shall be applied all across the technical infrastructure

## 6.2.5 Denmark

The Danish eHealth strategy [S5] sets the following objectives:

- Provision and use of consolidated clinical IKT jobs in all regions before the end of 2014.
- Targets for the use of ICT as a support of the Key workflows at municipal level defined and set before the end of 2014.
- Provision and use of the "Shared Medication Record" in all regions by 2013 including the provision in all municipalities until 2014.
- Support of full digital communication between health service providers.
- Progressive provision and use of telemedicine on the basis of the national program.
- Provision of a common terminology in all communities.

## 6.2.6 Ireland

According to the eHealth strategy of Ireland [S6] the following benefits are expected:

- Population wellbeing
- Prevention focused
  - empowered patients allowing consumers managing their own health and their medical information; improvements in health literacy
  - improved patient outcomes due to high quality, relevant, accurate, timely information
  - easier access by managing health services from the home environment
  - greater transparency due to making information available to the patient
  - public health for secondary use of data
- Improved health services
  - efficiencies due to reduction of duplication of services, reduced adverse events and more efficient use of resources
  - safer, less adverse events due to information based workflows and automated processes
  - health services reform; supports system reorganisation
  - increased clinical face time to optimise individual care plans
  - community focus, telemedicine and telemonitoring
- economic development
  - improved economic efficiencies



- export driven job creation → investment locally in eHealth infrastructure and services
- new business and investment opportunities
- increased foreign direct investment

The action plan for eHealth and Independent living contains the following vision and objectives:

- Vision/opportunity:
  - Ireland as a unique environment for the development, validation and implementation of connected health solutions
  - Building on research strengths in ICT, Medical Devices and Life sciences.
  - With engagement of all relevant stakeholders (healthcare professionals, patients, enterprise, academia, Government, etc)
- Objectives
  - Identify areas of overlap between multidisciplinary research strengths and health system needs where pilot eHealth solutions might be developed
  - To ensure effective mechanisms for industry engagement with the health system for exchange of ideas and trialling products
  - To ensure clinical infrastructure is in place to facilitate development, trial and validation of eHealth solutions
  - To ensure a strong supportive regulatory environment for development of eHealth technologies, products and services
  - To ensure any skills gaps in supporting development of eHealth solutions in Ireland are addressed

### **6.2.7 Switzerland**

The eHealth strategy of Switzerland [S7] is based on the following overriding goals of eHealth:

- Improvement of efficiency - coordination of the actors and processes
- Improvement of quality - reduce errors
- Improvement of security
- economic empowerment - emergence of new service sectors

The following vision forms the basis of all eHealth activities in Switzerland:

“The people in Switzerland can provide relevant information about themselves to health professionals of their choice and can draw benefits regardless of location and time. They are actively involved in decisions regarding their health and their health problems which strengthens their health literacy. The information and communication technologies are used so that the networking of stakeholders in healthcare is ensured and that the processes are qualitatively better, safer and more efficient.”

The objectives of the eHealth Strategy Switzerland are divided into the respective fields of action:

- Electronic patient record

- Until the end of 2008 the standards for an electrical extract of treatment-relevant information from the personal medical history is defined. The requirements necessary for the introduction are described.
- 2009 the insurance card is introduced (with voluntary options for personal-medical data).
- Starting 2009 the cantons can perform model tests of the electronic health services on the basis of the insurance card.
- By the end of 2010, the secure authentication and legally valid electronic signature are available for all service providers - they are used for electronic data exchange.
- From the beginning of 2012, the secure authentication is established for all people in Switzerland - with an option for the legally valid electronic signature
- By the end of 2012, the electronic transmission of medical data among the participants is structured, without media disruption and established without loss. All acute somatic hospitals, all integrated supply networks and the majority of private practice doctors use the electronic summary of treatment-relevant information from the personal medical history.
- By the end of 2015, all people in Switzerland can permit the service providers of their choice electronic access to treatment-relevant information. ("electronic patient record")
- Online-Services
  - By the end of 2009 it is clarified which quality standards should be used for grouping health-related online-information in Switzerland.
  - By the end of 2010, the health-related online information supply of the federacy, cantons, municipalities and international organizations are accessible over a common health portal.
  - By the end of 2012, the information supplies of the health portal are quality assured. Private providers may join the portal.
  - By the end of 2015, the secure access of citizens to their electronic patient record over the health portal is linked to the ability to retrieve structured and specific information.
- Implementation of the eHealth strategy
  - The federacy and cantons close a master agreement for the coordinated implementation of the strategy "eHealth" Switzerland in 2007. By 2007, this national coordinating body federacy-canton is operative.
  - By the end of 2007, the actors of the health system are involved in the process of strategy implementation so they can define their role, have positioned themselves and participate in the implementation process depending on their concernment.

- By the end of 2008, the outstanding legal issues have been resolved and legislative procedures to implement the strategy goals have been appointed to federacy and cantons in accordance with their competencies.
- Until the end of 2008, a process of gradual development and expansion of a national eHealth infrastructure is defined.
- By the end of 2008 the framework conditions are clarified under which partnerships between the public and the private sector can be established (e.g. public-private partnership)
- By the end of 2008, a process has been established, so that domestic model tests in the field of eHealth can be evaluated and incorporate national and international knowledge in the implementation and development of the strategy.
- By the end of 2008, it is ensured that a rapid transfer of domestic and foreign research results from science and industry will take place.
- From the beginning of 2009 there are a functional training measures divided in stages, for the professionals working in the health system. (advanced education)
- By the end of 2013, eHealth and the basics of medical informatics are included in the training programs of all health professionals (education and training)
- It is continuously ensured that people in Switzerland are capable of dealing with health and disease-related information and personal data.

## 6.3 Actions

### 6.3.1 Scotland

eHealth Strategic Programme in Scotland [S1] lists the following goals to be reached by 2017 and 2020 :

- Comprehensive Electronic Patient Record for Clinicians
  - 2017
    - Clinical portal available (or equivalent) in primary and secondary care.
    - Access to summary data: 14 clinical items, ECS /KIS / PCS; PMS, Test Results, Clinical Letters.
    - Access to summary of the GP record.
  - 2020
    - Clinical portal (or equivalent) available to all accredited clinicians.
    - Ability to access records for all patients where there is a legitimate relationship.
    - Patient summary information available (possibly utilising a record locator service) from all care sectors: GP summary,
    - Community summary, Secondary care summary(s).

- Drill down to detail information available.
  - Timeline view of patient events available.
  - Substantial clinical guidelines and decision support built into clinical systems with support for integrated care pathways.
- Health and Social Care Integration
  - 2017
    - Sharing of summary information between health and social care.
    - Electronic messaging and referral support within health and social care team.
  - 2020
    - Social care summary an integral part of the Electronic Patient Record view.
    - Sophisticated workflow and alerts to support integrated care pathways and referral and hand-offs between multidisciplinary health and social care teams.
- HEPMA and Medicines Reconciliation
  - 2017
    - Defined strategic plan and, if required, completed procurement for HEPMA and medicines reconciliation solutions.
    - HEPMA implementation underway or complete in some NHS Boards.
    - Medicines reconciliation approach piloted in at least one NHS Board.
  - 2020
    - HEPMA solution implemented across a number of NHS Boards, with common data and messaging standards and national maintenance of drug, device and administration coding structures.
    - Medicines reconciliation implemented across a number of NHS Boards, with common notification and acceptance procedure, and all rekeying of prescription data eliminated.
    - View available of comprehensive patient current medications record and history.
    - ePharmacy systems integrated into the overall electronic medicines management structure.
    - Sophisticated clinical decision support and analysis capabilities from patient interaction through to national intelligence.
- Primary and Community Care Systems Development
  - 2017
    - Single sign-on implemented across Primary Care.
    - GP and community staff have access to the clinical portal for their patients.
    - Online repeat prescriptions, appointment booking and test results implemented in most practices across Scotland.

- SMS widely used for appointment reminders and notification of other 'events'.
  - Some practices providing patients with a summary view of their GP record.
  - KIS data available to all health and social care staff for the majority of appropriate patients.
  - GP record summary view available in clinical portal.
  - New GP systems contractual arrangements in place addressing future functionality and integration requirements.
  - All GP systems moved, or in process of moving, to hosted server environment.
  - Community systems in process of being rolled-out across most of Scotland.
  - Widespread access in the community via mobile devices.
- 2020
  - Completion of implementation of functionality and integration secured through the GP systems contractual arrangements.
  - Community systems support the entire health and social care team with sophisticated workflow to support coordination of care.
  - GP and Community record summary available through clinical portal.
  - All community staff equipped with mobile access.
  - Substantial clinical guidelines and decision support built into GP and community systems with support for integrated care pathways.
- Personal Health Record
  - 2017
    - National approach, business plan and development approach defined.
    - National portal with limited services in place.
    - Various partial and limited proof of concept projects implemented and evaluated to determine citizen usage and preferences.
  - 2020
    - Portal is single route to patient online services.
    - Route of access to GP systems for prescriptions and appointments.
    - Full suite of health information provided through portal.
    - View of Personal Health Record drawn from multiple sources, similar to EPR viewed through clinical portal.
    - Capability for patient contributions to be recorded.
    - Secure messaging for health correspondence.
    - Secure messaging with carers.
    - Capability to download data for personal use in applications and devices.

### **6.3.2 Germany**

Main actions in milestones in Germany as of 2008 and 2009 [S2]:

Level of development 1 (obligatory for insured persons) expected from the end of 2008

- electronic update from the insurance data from the insured persons on the electronic
- patient card european
- health insurance card on the reserve

Level of development 2 (obligatory for insured persons) expected by the middle of 2008

- electronic prescriptions

Level of development 3 (optional for insured persons) expected by the end of 2009

- emergency data set
- pharmaceutical documentation

Level of development 4 (optional for insured persons) expected by the middle of 2009

- electronic patient receipt
- electronic health record
- electronic letter of referral

### **6.3.3 The Netherlands**

Situation in the Netherlands compared to the eHealth Action Plan [S3]:

- Interoperability for message traffic: the Dutch have opted to standardize messages via HL7 version 3, as this is an international standard which offers potential for developing further with one standard from a national EMD/WDH to a national Electronic Health Record.
- Standardization: this is essential in order to realize the eHealth objectives in Europe. The Dutch regard the recommendations of the CEN/ISS ' eHealth Standardization Focus Group' (14 March 2005) as the basis for a collective strategy on standardization.
- European insurance card: the European insurance card was introduced in the Netherlands on 1 January 2006. The card is not yet connected to an electronic functionality. The Dutch government is not in favour of connecting this electronic card to patient identity, nor does it see the card as a key for accessing or supplying medical data.
- The Dutch government is working on a nationwide Electronic Health Record which will make healthcare information available to authorized users regardless of time or place.
- The Nationwide Action Plan for Social Sectors and ICT (2005-2009) is also geared to applications which need broadband (utilization of broadband).
- Conformity tests and accreditation for an eHealthcare market
- In 2006 the basic infrastructure is due for testing in pilot environments.
- In 2007 certification schemes will be ready for the local information systems (GBZ/well-managed healthcare systems) for connection to the National Switch Point.
  
- Upsizing: The Dutch government is encouraging the upsizing of developments in ICT systems and services via a Nationwide Action Plan for the Social Sectors and ICT.

- At the end of 2006 the Dutch will exchange information with other countries on defraying the costs of eHealth.
- In 2005 a portal was set up in the Netherlands offering comparative and health information to members of the public. This portal contains information on hospitals, health insurance, medication, patient interest and medical issues. In 2006 and 2007 the portal is to be further extended with information on, amongst others, GPs, physiotherapists, residential care and nursing homes, homecare, mental health care and care for the handicapped.
- It will be harmonized with the EU portal site in 2006.
- The Netherlands will actively look into the initiatives of other member states to integrate domotica, telemedicine and standardization concerning Electronic Health Records.
- On the issue of patient access to their own medical records the Dutch are focusing on the electronic national identity card which will be introduced in 2007.

#### **6.3.4 Sweden**

In the Swedish eHealth plan [S4] the task of creating and publishing a IKT architecture at a local level has been defined. This contributes to a better usage of IKT in municipalities. Furthermore, the architecture should result in the improvement of the usage of information in the health- and social sector.

#### **6.3.5 Denmark**

The Danish eHealth strategy [S5] recommends among others to implement the following measures:

- Further development and focus on the usage of IKT solutions in hospitals and communities;
- Greater effort in promoting intersectoral communication, including improved monitoring and utilization of the benefits of IKT systems;
- Higher prioritization of joint procurement-, development- and operational processes in common regional IKT solutions through the regions;
- Establishment of a common IKT infrastructure in the public sector for health care;
- Strengthening and broadening of the range of telemedicine and tele-health services (examples: telemedical home monitoring, online booking of hospital appointments, digital communication between the health sector and the citizens);
- Digitizing workflows at the municipal level in order to be able to ensure a high quality of municipal services;
- Introduction and usage of standard based common infrastructure;
- In order to enable mobile access to personal health data, a mobile digital signature will be implemented;

Capitalising on the eHealth opportunity:

- building an eHealth ecosystem
  - “network that encompasses the key stakeholders involved in delivering eHealth deployments providing a common platform for interfacing and rapid access to information and transactions between them”
  - strengthening coordination of all policies related to eHealth
  - promoting mutual learning and sharing of good experiences
  - allowing innovative concepts, products and services
  - accelerating the implementation of existing and proven devices and processes
- support for eHealth innovation
  - identify actions required to position Ireland as a test bed for trial, validation and implementation of new eHealth technologies
  - enabling infrastructure improvements
  - identify discrete areas of need where Ireland can develop technology and enterprise capability and focus research
  - fund public health research in areas of patient behaviour, product usability and benefits and barriers
  - identify and promote convergence opportunities in eHealth
  - investigate business models and channels to market for eHealth technology, products and services where Ireland could become a world leader
- eHealth skills development
  - immediate need to address skills deficit in:
    - use and application of health information systems and technology
    - innovation, development and support of new eHealth systems and technologies
    - national and international shortages of health informatics specialists
  - health informatics training
  - establishment of an R&D base and source
  - identify and address any competency and knowledge deficiencies
  - build capacity within the health service to address these gaps and skills deficits
  - development of structured career paths for healthcare ICT
- building an eHealth service industry
  - possibility for new service models
  - patient-centered health care services
- provision of direct health care support and expertise remotely from a base in Ireland
  - ancillary services provision
    - traditional ‘backend’ office administration functions
    - outsourced

### **6.3.6 Ireland**

The eHealth Strategy for Ireland [S6] lists the following actions:



- Ensure that eHealth is utilised to place the patient firmly at the centre of the new healthcare environment as outlined by the EU's eHealth Action Plan 2012-2020. This will include developing programmes to encourage and strengthen engagement, facilitate informed participation in the care process and increase health literacy.
- Establish over time a dedicated, focused and strongly branded entity 'eHealth Ireland' to oversee Ireland's eHealth journey and ensure maximum return for Ireland's population wellbeing and economy as a whole.
- Potential priority projects:
  - National Health Identifier Infrastructure.
  - ePrescribing Systems.
  - Online Referrals and Scheduling.
  - Telehealthcare - particularly relating to the management of chronic diseases.
  - Development of Patient Summary Records.
  - Online Access to Health Information.
  - National Patient Portal.
- Establish specific functional workstreams involving all appropriate stakeholders to address the major deployment enablers including;
  - Appropriate funding models for programs.
  - Change management and adoption processes
  - Healthcare informatics resources and the development of appropriate health informatics skills.
  - A standards-based, multi-layered information and technical infrastructure to provide a common platform for eHealth deployments.
  - Appropriate legislation around trust, privacy, security and data protection
  - Public engagement, awareness and uptake.
- Establish an eHealth Ecosystem involving the Departments of Health, Jobs Enterprise and Innovation, Education and Skills, Environment, the Healthcare Delivery system, Industry, Academia, the Research and Development communities and the voluntary sector.
- Each government department and agency with a role in exploiting the potentiality of eHealth must develop strategies for actions to realise the economic benefits of eHealth.
- A new IT strategy for the health system as a whole will be published in early 2014 by Health Ireland working closely with the SRG, the Department of Health and other relevant Departments and organisations.

### 6.3.7 Switzerland

The eHealth strategy of Switzerland [S7] defines three fields: electronic patient records, online services and implementation of an eHealth strategy. These three fields of action focus on the development of the following basic modules:

- National coordinating body
- Legal foundations
- eHealth architecture
- Standardization of patient data and interoperability
- Infrastructure for secure identification and authentication of patients and care providers
- Quality criteria for health information and health services

Fields of action:

- Electronic patient record
- Data with a homogeneous structure
- Data electronically exchangeable
- Patients can deal with it, access it online, provide access to care providers of their choice:
- Online-services
- Patient empowerment
- Strengthening of the individual health literacy
- Promotion of quality ensured online-information and online-services
- Implementation of the strategy
- Active implementation only if actively monitored, continuously further developed and supported by accompanying measures
- National coordination
- Creation of legal foundations
- Inclusion of research
- Education and training of experts
- Measures for the population

Priority actions according to the eHealth strategy of Switzerland:

- national coordination body
- Achieving a common goal orientation of the actors involved in health care in relation to eHealth
- Setting the concrete plan for the implementation and development of the strategy
- Ensuring the coordination and interoperability among the cantonal model tests
- Definition of Switzerland-wide consistent standards and an eHealth architecture, necessary for interoperability
- Development of a basis for necessary law amendments

- Evaluation of cantonal model tests, which take national and international developments into account
- Promotion of information exchange and human networking among the pilot projects (pooling of know-how) and at an international level
- Support of the federacy and cantons in measures to promote the acceptance of eHealth and with the communication
- following working groups should be created:
  - Legal basics
  - eHealth architecture
  - Standard "electronic summary of treatment-relevant information from the personal medical history"
  - Online-services
  - Coordination model tests
  - Communication, acceptance management
  - Preparation of a legal bases
  - Draft law
  - Protection of the person and data protection
  - Shared competences of the federacy and canton.

## **7 Appendix: Selected findings from the scientific community**

This appendix summarises findings from meetings of the scientific community that were studied. For space reasons and in order to consider more recent developments, details should be looked up via the listed references.

### **7.1 eHealth Summit 2015, Vienna, Austria**

At the eHealth 2015 in Vienna [V21] the following topics were particularly frequent:

- Data management
- Decision support
- Syntactic and semantic Interoperability
- Secondary use of data
- Self- and Telemonitoring
- mHealth
- Security
- Education and advanced training
- AAL

### **7.1.1 Data Management**

- Data is existing and was provided [V1]
- Access to data sources [V1]
- Still inexperience about Data management → buildup of qualification and infrastructure for data analysis [V1]

### **7.1.2 Decision support**

- It is functioning if it is offered in the workflow [V2]

### **7.1.3 Syntactic and semantic interoperability**

- Quality assurance is an important factor to measure, preserve and develop medical quality [V3]
- Standardization of documentation forces harmonized, complete and transparent data acquisition [V3]
- Communication requirements with regard to exact data transfer have the highest priority [V4]
- Support of retrieval-oriented navigation within the whole patient's documentation, where the challenge consists of making the unstructured information usable [V5]

### **7.1.4 Secondary use of data**

- The data which was collected within clinical studies is also valuable for other research questions [V6]
- Wish for the "use" of existing data arises → Discovering of new connections [V7]

### **7.1.5 Self and Telemonitoring**

- Large number of telematic and telemedicine projects in Germany [V8]
- No technological regulations for telemonitoring [V9]
- Self monitoring with the help of apps [V10]

### **7.1.6 mHealth**

- Application for the management of cardiac insufficiency [V11]
- Development of a mHealth strategy for the KAV → mobile applications for different users and areas of application in the GW [V12]

### **7.1.7 Security**

- Decentralized administration of identities, authentication and authorizations [V13]
- Security by Design [V14]

- Ensured data security with simultaneous use of relevant data in research is demanded (encryption, pseudonym) [V15]
- eIDs and personalised Health needs data security, Cyber Security, semantics (especially for application in the European context) [V15]

### **7.1.8 Education and advanced training**

- Periodic training of users and sensitisation to ensure compliance with the safety objectives [V14]
- The use of data management requires the buildup and training of personnel qualification [\[V1\]](#)
- Continuous and intensive development of education and training offers in the field eHealth [V17]
- Lack of information and training in the field of assistive technologies [V18]

### **7.1.9 AAL**

- The ALL marked is in a early stage of development [V19]
- Demographic change, AAL enables care in a familiar setting [V19]
- Quality is important [V20]

## **7.2 pHealth 2015**

At the pHealth in 2015 [P14], among other things publications fitting to the following topics were particularly frequent:

- mobile Health
- Decision Support and intelligent systems
- Applications for chronic illnesses
- Tele-rehabilitation

[P1] Off these named subjects areas the paper to a keynote from Malin Hollmark et al. is committed to the subject of the difficulties and implementation of eHealth in Sweden.

- Tools for patient self welfare and empowerment are represented by technological innovations.
- Economical- and technical-development considers, initiated development of mHealth solutions an open and integrated market create patient connection ways, care for new mHealth tools and at the same time lowers the expenses. Examples of such solutions are connected online diaries as well as software with code client development platforms.
- The progressive development of guidelines for the use of eHealth solutions as well as the development in direction of self welfare and prevention are important to be integrated into national eHealth solutions.

## 7.2.1 mobile Health

[P2] is concerned with the status, the demands and the strategies for the use of mHealth solutions.

- mHealth projects already exist for diagnostics, prevention, control, science, training and others and among other things have already shown that they can contribute to the improvement of public health programs.
- The solutions are used for "diagnosis and management of diseases " as well as for "management of risk factors and prevention"
- Convincing studies should still be executed which are based on appropriate sets of rules for judgement.

[P3] is concerned with the use of mobile applications for the Screening of depressions.

- Three solutions for mobile Depression screening are presented (BeWell, MONARCA and emotion scythe) and confronted with their own system (Psychologist in a Pocket) .

[P4] demonstrate a possibility by "serious games" to support for example the ability to see or hear after a trauma. A Smartphone should be used for a solution attempt, to evaluate the vision and sense of hearing of older persons in the domestic environment. The application allows the evaluation of the vision on the basis of 4 acknowledged test procedures, while the sense of hearing is checked by two different tests.

Three other publications from the pHealth2015 are concerned with mobile health applications. [P5] systematically reviews different mobile EKG systems for a applications dealing with patients with cardiovascular risks. [P3] presents a mobile EEG system that allows a transportable EEG capture and analysis by a connection with a mobile terminal. The terminal serves for the collection and storage of data as well as for the execution of the visual and acoustic stimuli. [P6] describes the early stage of a project with a mobile system EMG which is used to check the quality of hygiene of washing hands. The system finds its application in medical training.

## 7.2.2 Decision Support and intelligent systems

- Two of the presented papers put their focus on the group of elderly people.
- [P7] refers to the use of some characteristic vital data of elderly patients after hospitalization, to be integrated into a system for decision support for clinics. Changes or certain conditions of this data should be possible to be used in a web-based system for early recognition of potential danger.
- In the work [P8] a personalized health monitoring system is presented, which is based on a combination between registered vital parameters, the physical and mental activity as

well as a set of rules and a collection of cases. Additionally it delivers feedback, recommendations and alarms to the user. The usability of the system could be raised by the personalization of threshold values and messages.

- [P9] presents a system for decision support for the use in the public health sector. Due to the necessity that decisions in the public health sector and the appropriate measures are dependent on the topicality of the data leading to the decision, a decision support-system was developed that uses the latest data for every case to make a fast answer and action possible.
- Other contributions from this subjects area are on the one hand concerned with a personalized decision support-tool for the modeling of clinical practice directives and, on the other hand, for example, with the use of a machine-learning algorithm for the diagnosis of the stress Levels for drivers.

### **7.2.3 Applications for chronic illnesses**

- Two of the contributions published in this conference put the focus on diabetes mellitus type 2. From [P11] the different aspects of an architecture for an adaptive, interoperable and intelligent nursing system for such patients is presented. In this development the focus lies on the use case of the pharmacotherapy for the monitoring of the blood sugar level.
- In connection with the metabolic syndrome which is a frequent cause for cardiovascular illnesses and / or diabetes type 2, a PHR (personal health record) was presented in the paper [P2] which is laid out for the support of physical activity of the patient as well as for the improvement of a healthy diet.

### **7.2.4 Tele-rehabilitation**

Two Papers published on pHealth2015 put their focus on systems for the support of the tele-rehabilitation of stroke patients.

- [P12] shows a Kinect based system for the support of motor exercises for stroke patient in a domestic environment.
- [P13] shows an integrative solution for the use of instrumented insoles and a mobile terminal which makes the telemonitoring of the rehabilitation progress in the domestic environment possible.

Some of the publications pHealth2015 have in common that the motivation and the self-capability of the user represent an essential key factor the use of innovative systems in personalized environment. Additionally it is shown that interoperability is inevitable and support as well as instructions by public bodies are necessary for the real implementation of more innovative eHealth solutions.

## 7.3 MIE 2015 (Medical Informatics Europe)

The following topics were submitted to the MIE2015 [M55] particularly frequent and, therefore, were also divided as such in the program:

- Information and Knowledge Representation and Processing
- Health information management
- Healthcare services Delivery
- Ambient Assisted Living and Wellbeing
- Research and Education
- Digital Healthcare services
- Advanced Analytics and Big Data in Healthcare
- Digitized public and private Healthcare Enterprise
- Bioinformatics
- Mobile Healthcare services
- Empirical Research Methodologies
- Digital Health Improving management of Resources in Healthcare
- Digital Networks and services

### 7.3.1 Information and Knowledge Representation and Processing

- Information must be understandably for the nonprofessional, especially if online services are used. This can be solved, for example by a browser plugin. [M1, p10] A similar approach applies to the clear presentation of personal medical information from EHR for patients [M2, p80].
- Health information technology can only be implemented successfully, if the context-related effects and the behavior in the implementation is considered and not only the architecture, or the structure stands. In the process of development usability aspects must also be considered . [M3, p115], [M3, p200]
- IKT Systems in the health-care sector, for example EHR, but also PHRs must be adequately tested before their use. This can only happen reliably if realistic data is available.[M4, p35]
- Possibility for the use of real medical data for scientific purposes, by the extraction of numerical values and the subsequent association with the appropriate drafts. [M5, p50]
- Improvement and adaptation of paths of treatment by the use of patient's data and vouchers for the directives.. [M6, p70]
- Interoperability of the communication between the different stakeholders of the modern healthcare system, can only be reached if among other things a common architecture and defined ontologies are available and are used together. [M7, p100]
- Some tele-medical services for children with diabetes type 1 are already available. An evaluation of the satisfaction of the members and the efficiency shows that these can be used well and meaningful. [M8, p105]



- For the purposes of interoperability and comparability of medical data, care information on a national standard should also be adapted. This can take place, for example, with the subset of SNOMED CT. [M9, p140]
- The joining of common terminologies (terminology server), the electronic health record (EHR) and a possible decision support-system can raise the patient's security. [M10, p150]
- With the rising importance and number of healthcare mobile applications a classification of these applications is necessary. This can be carried out on the basis of use cases. [M11, p175]
- Early warning systems for diabetes and cardiovascular illnesses can be created with simple means (Excel), because the data necessary are usually gathered once per year. Until now this data is not put into context automatically. [M12, p230]

### **7.3.2 Health Information Management**

- An Evaluation of eHealth services for four chronic conditions (heart diseases, high blood pressure, diabetes and strokes) has shown that the affected city in Japan could save money due to services for the diseases high blood pressure and diabetes. However, it is also shown that such solutions only function well if they first are accepted and supported by everyone involved and it is about stable patients. [M13, p246]
- A security mechanism is presented for a public cloud storage for medical images. [M14, p251]
- Use of a web based disease management services including municipality pharmacy's as a users. [M15, p261] and [M15, p464]
- eHealth Stakeholders must use common terminologies and have common basics about eHealth technologies, as well as design methods, clinical models of information and clinical terminologies, so that an eHealth system is also accepted and applied by all partners.[M 16, p281]
- A Review about the secondary use of the patient's data from different EHRs has shown that this can only be reached if the data is stored in complete and interoperable EHRs. [M17, p291]
- Due to the frequently evolved antibiotics resistances, a tele consultation system was introduced which is used for the administration of the medication of antibiotics. Experienced doctors can be consulted and integrated into the process of treatment in addition to the installed decision support-system. [M18, p296]

### 7.3.3 Healthcare Service Delivery

- Cloud application for the monitoring of pregnant women in the third trimester. A Cardiotocograph sends measurement results in real time via a Smartphone to a Cloud. The data can be queried in a specific application by the treatment doctor in the appropriate hospital. Alarms or necessary interferences can therefore be introduced more rapidly. [M19, p354]
- Drug side effects are automatically shown in the system with the prescription of new drugs for a patient and must be confirmed by the prescribing doctor if acceptable. [M20, p359]
- EHR data can be used to identify patients with similar parameters or behaviors in the therapy and to generate possible therapy suggestions. [M21, p369]
- Retrograde use of EHR data for the evaluation of the compliance with the directives for the prevention of thromboembolism with auricular fibrillation. The study has shown that in less than 50% of the cases the the guidelines were complied. [M22, p394]
- A web based exercise system for brief intense interval training for diabetes type 2 patients was evaluated. The study has shown that the patient accepted the system well and were able to use it. [M23, p.404]
- One weave based tool is presented with witch nation-wide (France) retrograde information of implantation patients were analyzed over a period of six years. The focus was on the analysis of complications of implanted medical devices including a geographic display. [M24, p409]
- A system for Telemonitoring and nursing support for 200 COPD patients was introduced at a field test (Norway). The architecture was developed considering the Continua reference architecture. [M25, p455]

### 7.3.4 Ambient Assisted Living and Wellbeing

- A tele rehabilitation system for elderly patients after a hip fracture is analyzed. The results shows an improved mobility, higher quality of life and improved patient's satisfaction after 30 days of use. [M26, p469]
- Inclusion of multimedia data in clinical data archives. Professionals have access via EHR and the patients via PHR. Data silos connect individuals and professionals to generate a higher exploit. [M27, p474]
- The use of mobile terminals like Tablets for the rehabilitation of backbone injured persons has a positive influence on the rehabilitation results. The playfully processed exercises have led the patients to a greater improvement of the condition compared to the normal exercises. [M28, p479]

### 7.3.5 Research and Education

- Social networks contain various information of users. These networks were used as a source for identification of the frequency of side effects. A Data Mining tool was applied.

The system is able to find appropriate information. However, the significance has yet to be evaluated. [M29, p526]

- To promote social innovation on a national level, some requirements are created. However, the citizens must be included just as the enterprises and the health service offerers. Entrepreneurs are unwilling produce and finance a service simultaneously. [M30, p546]
- In the multidisciplinary field of eHealth all partners must have a certain basic knowledge. This knowledge can be summarized according to groups of users, into profiles. These knowledge profiles contain subjects areas like terminology, standards, interoperability and usability as well as fundamental basics. [M31, p556]
- In the area eHealth participants should have a basic knowledge about IT. This should also be standardized for the purposes of the comparable compatibility. Efforts already exist, see the EU US healthcare workforce. [M32., p561]

### **7.3.6 Digital Healthcare Services**

- A tool for the assistance of categorization of a question at a "Ask the Doctor service" is presented. The lengthy and fault-prone process of categorizing questions and subject areas should thereby be simplified by the patient. [M33, p572]
- eHealth solutions and participants focus more and more on patient's perspectives. However, this centring fails mostly, because understanding gaps exist within the context and complexity of the persons and their relations, interests and activities. [M34, p582]
- Clinical simulations are a promising area for the understanding of diseases, as well as their structure and treatment effects. [M35, p612]
- The continued existence of transnational health systems are dependent on the ability of producing shared procedures for the exchange of patient's data. This data flow must correspond to the demanded security, interoperability- and legal demands. [M36, p617]
- Rising number of mobile and portable devices for measuring long-term activities [M37, p657]
- An understanding gap exists between medical data and the doctors which want to use the data as a basis for medicine based evidence. This gap is closed mostly inconvenient by statistician which leads to suboptimal results. [M38,p681]

### **7.3.7 Advanced Analytics and Big Data in Healthcare**

- Nursing quality and decision support can be improved by analyzing the change of patterns of clinical paths. [M39, p692]
- Business process management and service oriented architecture can support a flexible, dynamic and cloud-based infrastructure, therefore the analyzis of commercial processes

can be used for the production of useful looks at enormous amounts of brute data. [M40,p697]

- The re-use of medication data is essential in a lot of medical research areas, but the semantic integration of these data is challenging in a Clinical Data Warehouse very much. [M41,p702]
- The measurement of data quality mostly uses the indicators: completeness, correctness and exactness. [M42, p712]

### **7.3.8 Digitized Public and Private Healthcare Enterprise**

- The automatic processing of non-English-speaking clinical documents is hindered by a lack of publicly available resources for medical language for training, testing and evaluation of NLP components . [M43, p734]

### **7.3.9 Bioinformatics**

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### **7.3.10 Mobile Healthcare Services**

- mHealth Apps with a Touch Screen interface must be adapted to the mostly impaired abilities and special needs of elderly patients. Existing Guidelines for mHealth Apps do not consider these barriers that elderly users have with Touch Screen based applications. (Usability not given) [M44, p783]
- New ways to support ambulatory patients with chronic illnesses and an improvement of the agreement of the patients for these treatments must be found. [M45, p788]
- A study in Sweden proves that so far only a few doctors recommend mobile applications to their patients. However, they have a mostly positive attitude. In their opinion evidence based content and support of multilingualism is lacking. In addition the adjustment of such Apps should take place on the bases of the MDD to guarantee quality and patient's security. A reinforced communication is recommended between doctors and App developers. [M46, p793]
- A comparison study in Israel and Portugal has shown that the implementation of eHealth services strengthens the patient empowerment. [M47, p813]
- The supply of privacy is a key subject for the successful access to health information of patients. Present approaches do not always provide the possibility of suitable rules for the access to the patient's information. [M48, p823]

### **7.3.11 Empirical Research Methodologies**

- The successful integration of Big Data is dependent on semantic interoperability. [M49, p840]

- Usability is inevitable for a durable, efficient and satisfactory application of telemedicine applications. [M50, p845]

### **7.3.12 Digital Health Improving Management of Resources in Healthcare**

- Semantic interoperability is the biggest challenge of the development of applications which have the necessity to share and the re-use data. [M51, p887]

### **7.3.13 Digital Networks and Services**

- The reliable transmission of specific and relevant facts (in addition to education) is a key factor for securing lasting quality in the care. Mobile devices can catch hidden care knowledge and show gaps in the current knowledge. [M52, p899]
- An intuitive, web based knowledge platform that can be optimized, by the final user, was developed (for the use on a mobile device) which catches the challenges of change in staff and new Guidelines by the maintenance of clinical protocols, Workflows and management of information. This platform serves for the consolidation of knowledge data banks, standardization of assistant's trainings and optimization of the flow of information. It improves the maintenance of information and simplifies the transfer of current clinical protocols to new staff. [M53, p909]
- Collaborative platforms need the possibility of parallel treatment and synchronized data communication. [M54, p919]

## **7.4 eHealth Week Riga 2015**

### **7.4.1 Program overview**

In addition to the "High level Conference" in Riga from 11-13 May 2015, the "mHealth Summit", several meetings of technical and regional working groups and numerous smaller meetings, fairs and workshops took place.

#### **7.4.1.1 eHealth Week / WOHIT 2015**

The eHealth week and the World of Health IT (WOHIT) runs numerous sessions. The program is available online at <http://www.ehealthweek.org/ehome/98290/214360/>

The presentations are available online at <http://www.ehealthweek.org/ehome/98290/2015-presentations/?&>

The references were marked with "EHEALTH WEEK 2015"

#### **7.4.1.2 mHealth summit**

Program: <http://www.mhealthsummit.eu/ehome/100808/273885/?&&>

Presentations: <http://www.mhealthsummit.eu/ehome/100808/2015-presentations/?&&>

## **Ranges of topics**

### **Demographic change**

The demographic change determines a big part of the activities in the EU [R1] [R2], [R3]. The number and size of projects with specific conversion at regional and national level is also currently rising [R4], [R5], [R6], [R7], [R8], [R9].

### **Integrated, sector-general health service**

The integrated, cross-sectorial healthcare with IT support is enforced and also successfully implemented, e.g. in France [R10], Finland [R5], [R11], [R12], [R13], Spain [R14], [R15], Andalusia [R16], Estonia [R17], Scotland [R18], [R19], in the Czech Republic [R9], in the USA [R20] and in numerous other regions [R21]. A financial payment for with eHealth and mHealth applications produced performances is assumed by GDAs to be a necessary condition ([R22], [R23], [R24]. The indispensable contribution of the interoperability - standards for the integration of the IT systems is often emphasized (e.g., [R25]).

### **(Barrier-free) access to the healthcare, "Empowerment", Apps**

mHealth technologies make it possible for the patients to actively co-create the whole medical process, independent of place and time. This is enforced [R26] and also successfully implemented [R13], [R26], [R27], [R28], [R29]. "Gamification" is a valuable means [R19].

The change from a "doctor-centred" to a "patient-centred" system is not implemented yet. It is recommended to support the development of freely accessible, validated Apps and overall systems whose functional character is defined clearly and also accepted by patients and GDAs. [R23], [R24]. In addition, initiatives are already started, in the EU ([R30], [R16], [R31], [R18], [R7], [R32]) and also in the USA [R33]. On the other hand, resistance against the system change exists with funders and GDAs .[R34].

## **7.4.2 eHealth innovation jam**

Other industries have already implemented the structural change. The health care lags years behind the available technologies [R34]. Some initiatives explicitly aim at higher dynamics e.g. in Greece [R35] and Lithuania [R36].

In some countries mobile technologies are about to be implemented, e.g. in Scandinavia [R37].

### **Active role of the EU for the implementation in the practice**

The EU pursues over different programs coordinated measures which support the basic research for the implementation in the practice [R1]. The EU project Trillium Bridge already has data transfer between the EU and the USA [R38]

### **7.4.3 Standards**

Interoperability based on standards is still a key element for the implementation according to the EU ([R22], [R23], [R24]) as well as in numerous projects and initiatives ([R39], [R40], [R41], [R42], [R32]). In some countries standards based implementations are already running at national level, e.g. in Scandinavia [R37], Lithuania [R43] and Spain ([R25]). Additionally, more and more quality seals and certificates are applied for interoperability, e.g. in Denmark [R44], Andalusia [R16], the USA [R33].

As a central IT standard for health record - systems the "IT Infrastructure Technical Framework" (IHE ITI) prevails internationally, e.g. in Taiwan [R45].

### **7.4.4 Products, technologies**

Products with mobile technologies are increasingly available on the market ([R46], [R43], [R47]).

### **7.4.5 Security, Privacy, legal frameworks**

The Joint Plenary Green Paper on mHealth: "Conclusions and Actions" of the EU recommends to guarantee enough privacy and security, within the framework of legal bases ([R22], [R23], [R24]). In the USA these subjects are of high priority in activities at a national level ([R33]).

Security and privacy are the most essential parts that have to be addressed sufficiently.

### **7.4.6 Big Data, Clinical Decision Support**

Data analysis as a basis for decision-support (Notes Analytics, Big Data, Evidence Based Medicine) appear necessary ([R23], [R24]) is addressed in numerous projects [R48] and increasingly reaches the clinical practice ([R33], [R49], [R50], [R51]).

### **7.4.7 Coordination with the USA, international cooperation and exchange of health data**

Besides the Trillium Bridge Project the EU increasingly starts activities to cooperate in data exchange ([R52], [R53]), particularly with the USA ([R54], [R55]).

### **7.4.8 Education**

The aim is to define eHealth related fields of knowledge clearly and define appropriate training programs [R56]. This is also an essential element for the cooperation of the EU with the USA. One major activity within the "EU-US eHealth Cooperation Initiative" in the years 2014 and 2015 mapped skills and knowledge of staff in healthcare related professions (see <http://wiki.siframework.org/EU-US+eHealth+Cooperation+Initiative>).

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## 8.2 Scientific Conferences

### 8.2.1 eHealth Summit 2015, Vienna, Austria

The papers of the Austrian eHealth Summit 18-19.6.2015 are published in the conference proceedings [V21].

The presentations of the Austrian eHealth Summit 18-19.6.2015 are available online: <http://www.ehealthsummit.at/ehome/ehsat16/downloads/>

[V1]	W. Leodolter: Potenzial zur Nutzung des "Datenschatzes" eines großen Healthcare-Unternehmens. See Presentations.
[V2]	H. Cordes: Entscheidungsunterstützung durch Big Data– Perspektiven und Chancen für die Zukunft. See Presentations.
[V3]	J. Varghese, S. Schulze Sünninghausen and M. Dugas: Standardized Quality Assurance Forms for organ Transplantations with multilingual Support, Open Access and UMLS Coding. In [V21]
[V4]	R. Pahontu, A. Will, B. Bergh: Towards Communication Requirements in the Operating Room and Clinic IT. In [V21]

[V5]	M. Kreuzthaler, P. Daumke, S. Schulz: Semantic Retrieval and navigation in Clinical Document Collections. In [V21]
[V6]	N. Hochedlinger, M. Nitzlader, M. Falgenhauer, S. Welte, D. Hayn, L. Koumakis, G. Potamias, M. Tsiknakis, D. Saraceno, E. Rinaldi, R. Ladenstein, G. Schreier: Standardized Data Sharing in a Paediatric Oncology Research Network - A Proof of Concept Study. In [V21]
[V7]	W. Hackl, F. Rauchegger, E. Ammenwerth: A nursing intelligence system to support secondary use of nursing routine data. In [V21]
[V8]	M.D. Alscher: Wie kommt die Telemedizin in die Regelversorgung. See Presentations.
[V9]	R. Modre-Osprian: Kollaborative Herzinsuffizienz-Versorgung mit mobilfunkbasiertem Telemonitoring in Tirol. See Presentations.
[V10]	A. Steinert: Smartphone Apps zur Steigerung der Therapieadhärenz bei Senioren. See Presentations.
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[V12]	H. Toth: Entwicklung einer mHealth-Strategie für den KAV. See Presentations.
[V13]	J. Caumanns: Security Design Pattern für eHealth-Plattformen. See Presentations.
[V14]	V. Kraus: Sicherheit in vernetzten Gesundheitsinformationssystemen – Versuch einer ganzheitlichen Betrachtung. See Presentations.
[V15]	R. Scharinger: Anforderungen und Lösungsansätze für eine zweifelsfreie elektronische Identifikation beim grenzüberschreitenden Gesundheitsdatenaustausch in Europa. See Presentations.
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[V18]	P. Mayer, K. Hauer, E. Schloffer, B. Leyrer: Assistive Technologies along Supply Chains in Health Care and in the Social Services Sector. In [V21]
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[V20]	K. Hauer: Quality of Assistive Technologies in the Home Care for Elderly. In [V21]
[V21]	D. Hayn, G.Schreier, E. Ammenwerth, A. Hörbst (Eds): eHealth2015 – Health Informatics Meets eHealth. Held on 18-19.6.2015 in Vienna, Austria. IOS Press, Amsterdam, Netherlands, 2015, ISSN 0926-9630 (print), ISSN 1879-8365 (online).

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[M53]	M.Finkelstein,A.Siddiqui,T.Pak,K.Hu,C.Ciccariello,V.Knabben,D.Chiang,D.C.Thomas,Y.S.Meah,"A user-Editable Web Based Platform to Streamline Clinical Information Flow",EFMI,2015, in [M55]
[M54]	B.Ionescu,C.Gadea,B.Solomon,D.Ionescu,V.S.Tivadar,M.Trifan,"A Cloud Based Real-Time Collaborative Platform for eHealth",EFMI,2015, in [M55]
[M55]	R. Cornet, L Stoicu-Tivadar, A. Hörbst, C. L. Parra Calderon, S. K. Andersen, M. Hercigonja-Szekeres (Eds.): Digital Healthcare Empowering Europeans: Proceedings of Medical Informatics Europe 2015 (MIE 2015), Madrid, 27.05. - 29.05.2015. IOS Press, Amsterdam. 2015. ISBN 978-1-61499-511-1 (print), ISBN 978-1-61499-512-8 (online). Available online <a href="http://ebooks.iospress.nl/volume/digital-healthcare-empowering-europeans-proceedings-of-mie2015">http://ebooks.iospress.nl/volume/digital-healthcare-empowering-europeans-proceedings-of-mie2015</a>

#### 8.2.4 eHealth Week 2015, Riga, Latvia

The e-Health Week 2015 was held in Riga, Latvia, 11-13 May 2015, in cooperation with the the mHealth Summit Europe. The presentations of the e-Health Week are available online at the following URL: <http://www.ehealthweek.org/ehome/98290/2015-presentations/?&>

The presentations of the mHealth Summit Europe are available online at the following URL: <http://www.mhealthsummit.eu/ehome/100808/2015-presentations/?&&>

[R1]	K.Marcus „AAL Programme and EU Initiatives“; mHealth Summit Europe; 2015
[R2]	B.O.Alves, L.Gatzoulis; “An update on the EIP on active and healthy ageing”; EHEALTH WEEK, 2015
[R3]	A.Carriazo; “EIP AHA Action Group A3 Prevention of Frailty & Functional Decline”; EHEALTH WEEK, 2015
[R4]	C.Wings; “OAS - Supporting elderly to carry out an active life”; mHealth Summit Europe; 2015
[R5]	J.Renko; “AAPOTTI - A Finnish approach to unifying patient data with social care“; mHealth Summit Europe; 2015
[R6]	D.Henderson; “EIP-AHA Action Group B3 on Integrated Care”; EHEALTH WEEK, 2015
[R7]	A.Pavlickova; “EIP-AHA B3 Toolkit to support scaling up in Europe”; EHEALTH WEEK, 2015
[R8]	F.Avolio; “Maturity Model for scaling up (Self-assessment exercise from Puglia Region); EHEALTH WEEK, 2015

[R9]	Z.Gutter; "Maturity model for scaling-up – Experience of Olomouc Region – Czech Republic"; EHEALTH WEEK, 2015
[R10]	E.Lobel; "A secured exchange infrastructure for healthcare professionals in France"; EHEALTH WEEK, 2015
[R11]	A.Kallio; "eHealth supporting Citizens and Healthcare Services"; EHEALTH WEEK, 2015
[R12]	A.Iivanainen; "APOTTI-Programme Organizational strategy"; EHEALTH WEEK, 2015
[R13]	M.Korhonen; "National eHealth Architecture – From Strategy to Practice"; EHEALTH WEEK, 2015
[R14]	M.Alborg; "INCA Pro-Active and Co-ordinated Socio-Sanitary Management"; EHEALTH WEEK, 2015
[R15]	R.Sotoca; "Manises Hospital Pilot"; EHEALTH WEEK, 2015
[R16]	J.Ferrero; "Quality and safety strategy for mobile health applications"; mHealth Summit Europe; 2015
[R17]	R.Mill; "Estonian National Health Information System"; EHEALTH WEEK, 2015
[R18]	D.Henderson; "EIP-AHA Action Group B3 on Integrated Care"; EHEALTH WEEK, 2015
[R19]	M.de Graaf; "Games for Health"; EHEALTH WEEK, 2015
[R20]	J.Ferguson; "Perspectives on Health Information Technology"; EHEALTH WEEK, 2015
[R21]	P.de Raeve; "mHealth Modernising Clinical Pathways"; mHealth Summit Europe; 2015
[R22]	P. Zilgalvis; "Joint Plenary Green Paper on mHealth: "Conclusions and Actions""; mHealth Summit Europe; 2015
[R23]	EU Commission; "GREEN PAPER on mobile Health ("mHealth"); Brussels, 10.4.2014, COM(2014) 219 final
[R24]	Summary Report on the Public Consultation on the Green Paper on Mobile Health. <a href="https://ec.europa.eu/digital-agenda/en/news/summary-report-public-consultation-green-paper-mobile-health">https://ec.europa.eu/digital-agenda/en/news/summary-report-public-consultation-green-paper-mobile-health,</a> <a href="http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=8382">http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=8382</a>
[R25]	Raul Martins; "Born in the Digital Age" EHEALTH WEEK, 2015
[R26]	L.Letina; "Focus on user and all else will follow"; EHEALTH WEEK, 2015
[R27]	W.Atzori; "Redefining empowerment from a patient perspective"; EHEALTH WEEK, 2015
[R28]	M.de J.Fintelman; "Patient participation and Personal Health Records"; EHEALTH WEEK, 2015
[R29]	B.Eklund; "Experience from Sweden during the SUSTAINS project"; EHEALTH WEEK, 2015
[R30]	M. Wrigley; "A new European approach to mHealth"; mHealth Summit Europe; 2015



[R31]	E. Vollebregt; “Workshop from Garage to Market“; mHealth Summit Europe; 2015
[R32]	J.Cornet; “Transforming Healthcare with mHealth Solutions“; EHEALTH WEEK, 2015
[R33]	D.Gottlieb; “From Garage to Market: US Regulation of mHealth“;mHealth Summit Europe; 2015
[R34]	M.D.Madaus; “mHealth — Star Trek Tricorder or Game Changer for Healthcare?“; mHealth Summit Europe, opening Keynote; 2015
[R35]	C.Papanikolaou; “Milestones of the Greek Ecosystem and the Thematic Network“; EHEALTH WEEK, 2015
[R36]	S.Baltina; “Transcending Borders, Rethinking eGovernment“; EHEALTH WEEK, 2015
[R37]	H.Blindheim; “Towards a Nordic plug’n play public mHealth market“; mHealth Summit Europe; 2015
[R38]	C.Chronaki; “Trillium Bridge and Beyond: State of Play and Future Prospects“; EHEALTH WEEK, 2015
[R39]	H.Merkle; “EIP-AHA: Actions towards governance of Interoperable Specifications“; EHEALTH WEEK, 2015
[R40]	K.Bourquard; “EIP-AHA: Actions towards Governance of Interoperable Specifications“; EHEALTH WEEK, 2015
[R41]	A.Kung; “Action Group (C2) on Independent Living Systems“; EHEALTH WEEK, 2015
[R42]	R.Wichert; “EIP-AHA: Actions towards Governance of Interoperable Specifications“; EHEALTH WEEK, 2015
[R43]	T.Gornik; “Health Data Platforms: Open data, open APIs“; mHealth Summit Europe; 2015
[R44]	C.Nielsen; “Implementing a fast track test infrastructure to facilitate innovation and rapid deployment“; mHealth Summit Europe; 2015
[R45]	Min Huei (Marc) Hsu; “Building a National Electronic Exchange System, Experiences in Taiwan“; EHEALTH WEEK, 2015
[R46]	H.Sjöstrand; “IBM MobileFirst Platform“; mHealth Summit Europe; 2015
[R47]	L.Kalfhaus; “Transforming Chronic Care Delivery“; mHealth Summit Europe; 2015
[R48]	A.Sinaci; “SALUS- Enabling the Secondary Use of EHRs for Post Market Safety Studies“; EHEALTH WEEK, 2015
[R49]	B.Delaney; “Creating and applying knowledge in electronic health record systems“; EHEALTH WEEK, 2015
[R50]	B.Claerhout; “EHR4CR Deploying Innovative Clinical Trial Services“; EHEALTH WEEK, 2015
[R51]	J.L.Cruz; “Is it worth it trying to get to Stage 7?“; EHEALTH WEEK, 2015
[R52]	J.Halamka; “Cost Effectiveness of the Deployment/implementation of eHealth/Health IT“; EHEALTH WEEK, 2015

[R53]	K.Tuminaro; "Investing in the United States"; EHEALTH WEEK, 2015
[R54]	M.Cleary; "Building on the EU US Roadmap"; EHEALTH WEEK, 2015
[R55]	M.Hein; "US Perspectives on Advancing Transatlantic Innovation through eHealth"; EHEALTH WEEK, 2015
[R56]	J.Fellows; "Horizon scanning for future healthcare it skills and competencies in Europe"; EHEALTH WEEK, 2015