

ANALYSIS OF E-HEALTH DEVELOPMENT IN SLOVENIA

Dalibor Stanimirović¹, Mirko Vintar²

Abstract

Although the basic informatization of the health care system was established relatively early, Slovenia still does not have an interoperable and comprehensive health information system (HIS). Fragmentation of information systems (IS) and their limited interoperability significantly compromise further development of the health care system and adversely affect the quality of health care services. Overcoming the aforementioned challenges requires the progressive implementation of eHealth project, which is one of the key long-term goals of Slovenian public sector. The main objective of eHealth is the comprehensive integration of distributed IS and connection of a widespread network of stakeholders within the health care system. Paper presents the review of eHealth project in Slovenia and provides a comparative analysis of the eHealth development in Slovenia, Austria and Denmark. Focusing on situation in Slovenia, paper outlines main deficiencies in the current eHealth settings, and eventually suggests guidelines for further development and implementation of eHealth in Slovenia.

Key words: eHealth in Slovenia, Austria and Denmark, infrastructure components, comparative analysis, development guidelines.

1. Introduction

Slovenian health care system has been facing serious structural problems in recent years. Due to objective circumstances (Pomerleau et al., 2008) these problems cannot be avoided and will require fundamental changes in the current health care arrangements. The health care system reform is becoming a social imperative, which calls for innovative approach in the next years. One of the fundamental structural reforms that would allow for successful and effective tackling of challenges facing the Slovenian health care system is comprehensive informatization (Marušič et al., 2004; Ministry of Health, 2005 and 2008) representing one of the key long-term goals of public sector. Experience of the most developed countries shows that successful implementation of health care informatization projects is of immense strategic importance for further development of the health care system (European Commission, 2008 and 2011; Chaudry et al., 2006) but also displays important implications for the increase in social welfare (Jakubowski and Busse, 1998; Godlee et al., 2004; WHO, 2009), economic development (Berg, 2001; Ammenwerth et al., 2003; Goldzweig et al., 2009) and evolution of information society (Grimson, 2001; Sandford et al., 1992). Majority of existing IS in Slovenian health care have been developed within individual health care organizations and are designed specifically to meet their own needs (Marušič et al., 2004; Ministry of Health, 2008) while they are not adequately interoperable and do not provide complete, relevant and timely information (Marušič et al., 2004; Ministry of Health, 2005 and 2008). The already initiated national project of health care system informatization from 2005, known as eHealth (Ministry of Health, 2005) should be able to integrate all fragmented IS and offer a complete solution benefitting all interested parties. eHealth entails the inclusion of stakeholders into the functional network, reconstruction of health care system business model as well as integration and harmonization of many information subsystems at different levels (Islam, 2007; Lafond and Field, 2003). Informatization of the Slovenian health care system should provide opportunities for high quality and professional work with patients and long-term development, whereas relevant and reliable economic, administrative and medical data provided by eHealth should facilitate better quality planning, control and management of individual health care organizations and health care system in general (Ministry of Health, 2005 and 2008).

The main objectives of the paper comprise the comparative assessment of the eHealth progress in an international context, identification and analysis of the key eHealth components and success factors, and production of applicable guidelines for further development and implementation of eHealth in Slovenia. In achieving the aforementioned objectives we have been focusing primarily on the following interrelated research questions:

- [1] Review of the eHealth strategies and related documents in Slovenia, Austria and Denmark.
- [2] Analysis of the development of eHealth projects in Slovenia, Austria and Denmark.
- [3] Identification of main deficiencies in the current setting of eHealth in Slovenia and provision of guidelines for further development.

¹ University of Ljubljana, Faculty of Administration, Institute for informatization of administration, Gosarjeva ulica 5, 1000 Ljubljana, Slovenia, dalibor.stanimirovic@fu.uni-lj.si

² University of Ljubljana, Faculty of Administration, Institute for informatization of administration, Gosarjeva ulica 5, 1000 Ljubljana, Slovenia, mirko.vintar@fu.uni-lj.si

Methodologically speaking, the paper represents a comparative analysis of the eHealth development in Slovenia, Austria and Denmark. The comparative framework was established on the basis of document analysis and information retrieval focusing on in-depth investigation of various electronic and written sources instating eHealth projects in three countries, and ultimately facilitating the identification and characterization of the most important infrastructure components of eHealth. Selection of the research methods was adapted to the research field (Yin, 2003; Patton, 1990) given the complexity and scope of eHealth initiatives.

Following the introduction, the second section of the paper presents the state of the art in the field and conceptual implications of eHealth. The third section outlines eHealth projects in Slovenia, Austria and Denmark, and provides a comparative analysis of the eHealth development in selected countries, and eventually identifies the main deficiencies related to eHealth development in Slovenia. Lessons learned and recommendations for more effective further development and implementation of eHealth in Slovenia are presented in the fourth section. The last section contains the review of the overall comparative analysis, discussion on its practical applicability, limitations and future work, and subsequently submits the final arguments and observations regarding the research results and future development of eHealth in Slovenia.

2. State of the art

Considering the multifaceted nature of health care systems and related IS, the body of knowledge in this field is relatively extensive, as well as the number of various definitions depicting the concept of eHealth. Gaining international recognition in the last decade (Della Mea, 2001; Oh et al., 2005), definitions of eHealth are normally derived from the classifications of IS with the addition of certain features which are associated with the specific nature of health care services and health care system status, being one of the most important segments of the public sector in general. While some definitions of eHealth are rather general, others are more narrowly focused converging on individual aspects of ICT and health care interaction.

Eysenbach (2001) is referring to the term of eHealth as a general "buzzword", which is used to characterize virtually everything related to computers and medicine and interprets e-health as an emerging field in the intersection of medical informatics, public health and business, denoting health services and information delivered or enhanced through the internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology (ICT). Marconi (2002) defines eHealth as the application of internet and other related technologies in the healthcare industry to improve the access, efficiency, effectiveness, and quality of clinical and business processes utilized by health care organizations, practitioners, patients, and consumers in an effort to improve the health status of patients. According to Healthcare Information and Management Systems Society (HIMSS, 2003), being one of the leading authorities in the field, eHealth represents a patient-focused framework including various dimensions such as: delivery of key information to healthcare partners, provision of health information delivery services, facilitation of interaction between providers and patients, acceleration of the integration of healthcare industry-related business processes, both local and remote access to healthcare information, support for employers and employees, payers and providers. And conversely, there are a number of definitions which are more narrowly targeted and focused on individual aspects of the eHealth research. They are outlining the concept of eHealth as the process of providing health care via electronic means, in particular over the internet. It can include teaching, monitoring (e.g. physiologic data), and interaction with health care providers, as well as interaction with other patients afflicted with the same conditions (Pretlow, 2000), internet technologies applied to health care industry (Wysocki, 2004), all that's digital or electronic in the health care industry (Strategic Health Innovations, 2005), internet related health care activities (Joint Healthcare Information Alliance, 2004).

As noticed by several authors (Della Mea, 2001; Oh et al., 2005) the term eHealth has a highly variable and interchangeable usage, while its evolution in recent years is constantly mapping the changes in health informatics and health care in general (Della Mea, 2001; Ahern et al., 2006; DeLuca and Enmark, 2000). eHealth term has been used to depict anything from application of computers in health care and digitalization/informatization of health care processes (Eysenbach, 2001; ITU, 2008), up to the usage of internet in health care services and management (HIMSS, 2003; Eysenbach and Diepgen, 2001; Ball and Lillis, 2001). Besides often overlapping with other aspects within the field of health informatics, eHealth is frequently used as a synonym for HIS, medical informatics, health informatics, health telematics, telehealth and other related concepts. Summarizing different definitions, eHealth concept can be generally regarded as a comprehensive mechanism based on internet and other related ICTs, expected to facilitate integration of all stakeholders and

evidence-based decision making at all levels, in order to improve quality of health care, administrative and managerial processes as well as related outcomes in the health care system.

Current state of affairs in the field of eHealth research, encompassing diversity of research approaches biased by the different stakeholders' perspective on the field, significantly complicates the establishment of the development framework of eHealth, identification of its implications as well as its substantive characterization and distinction from other related concepts. Due to frequently ambiguous objectives and lack of development momentum from the health policy in most countries, eHealth concept has failed to gain significant attention in terms of applicable guidelines for its development and implementation in practice. Strategic documents and action plans are often considering the development and implementation of eHealth as exclusively technical issues without paying adequate attention to its health-centered, organizational, cultural, policy and other societal aspects. These issues later in practice often prove to be one the most important factors for successful deployment of eHealth projects and their application by healthcare professionals and patients, as well as their ability to generate expected benefits to all stakeholders involved.

In addition, there are hardly any extensive empirical studies systematically identifying, monitoring and analyzing the general implications of eHealth projects on the health care system reform and structural problems, its impacts on public health and public finance aspects and issues related to transformation of existing business models, and long-term development of the health care systems. Majority of the identified studies are usually focused on selected aspect of eHealth, its implications on certain health care service/product or particular institution within the health care system. The latter reasons considerably hinder the research of the very concept of eHealth on the one hand, and, on the other hand, they prevent evaluation of the actual effects of eHealth on business and health outcomes of the health care system.

2.1 eHealth implications

Regardless of their definition and research perspective, virtually all authors emphasize that the main goal of eHealth should be the contribution to a high-quality, efficient patient care and effective performance of the health care system (Berg, 2001; Oh et al., 2005; Winter et al., 2007; Haux, 2006; Wilson, 2000; Lippeveld and Sapirie, 2000, etc.). eHealth could empower patients and help in exceeding information asymmetry between main stakeholders while ensuring that reliable and timely health care information is available for operational and strategic decision making providing better health care services and enhancing public health (Wilson, 2000; Lippeveld and Sapirie, 2000). eHealth systems and services combined with organizational changes, process reengineering and development of new skills can act as key enabling tools facilitating considerable enhancements in access to care, quality of care, as well as efficiency and productivity (Danzon and Furukawa, 2001) of the health care system. Implementation of eHealth is expected to reduce costs and improve productivity in such areas as 1) billing and record-keeping, 2) reduction in medical error, 3) alleviation of unnecessary care, and 4) savings achieved by business-to-business e-commerce (Danzon and Furukawa, 2001; Goldsmith, 2000; Wang et al., 2003).

Given the innate complex nature of health care activities, specificity of health care-related IS and the number of stakeholders involved, there are a reasonable number of requirements, constraints and risks associated with the implementation of eHealth project. The quality introduction and performance of eHealth depend not only on technical determinants such as data quality, system design, or adequate use of ICT (Stansfield et al., 2008; Braa et al., 2004). Other factors are also involved, such as 1) organizational and environmental determinants that relate to the information culture within the country context (Lungo, 2003; Braa et al., 2001; Pappaioanou et al., 2003), the structure of eHealth (Winter et al., 2003; Jensen and Pedersen, 2004; Hübner-Bloder et al., 2005), the roles and responsibilities of the different actors and the available resources for eHealth (Leonard, 2004; Titlestad et al., 2009; Jones et al., 2005), and 2) the behavioral determinants such as the knowledge and skills, attitudes, values, and motivation of those involved in the production, collection, collation, analysis, and dissemination of information (Walker, 2005; Perreault et al., 2002; Sapirie, 2000). For successful implementation and utilization of eHealth, certain prerequisites need to be in place, such as (Islam, 2007):

- Information policies - referent to the existing legislative and regulatory framework for public and private providers, use of standards;
- Financial resources - investment in the processes for the production of health, information (e.g., collection of data, collation, analysis, dissemination, and use);
- Human resources - adequately trained personnel at different levels of government;
- Communication infrastructure - infrastructure and policies for transfer and management or storage of information;

- Coordination and leadership - mechanisms to effectively lead the eHealth.

Ultimately, if all preconditions were met successfully, a fully functional eHealth should be able to provide a series of indicators that relate 1) to the determinants of health, including socioeconomic, environmental, behavioral, and genetic determinants or risk factors; 2) to the health care system, including the inputs (public health and public finance resources) used in the provision of health care services and products; and 3) to the general health status (before/after entering the health care system) of the population (Lucas, 2008). The list and type of required indicators should be defined by the users of information at different decision making levels (institutional, government agency or policy level, etc.) in a consensus-building process.

However, despite its potential and importance for evidence-based decision making (Haux et al., 2004; Kissinger and Borchardt, 1996; Stroetman, 2007), practice reveals that planning, development and implementation of eHealth are riddled with major problems, even in countries with relatively well-developed health care systems (Protti, 2007). Furthermore, the information generated and retrieved from inadequately conceptualized eHealth is often not helpful for health care management decision-making, because information is not applicably clustered; it is frequently disparate with predefined indicators, while modalities and jurisdiction on management and transaction of information can be ambiguous and unrelated to priority tasks and functions of health care professionals (Bush et al., 2009; Heeks, 2006; Karsh et al., 2010). In other words, poorly defined and unstructured eHealth projects have a tendency to be data and information driven, instead of action driven (Sandford et al., 1992). In order to avoid these threats, the entire eHealth project, including its long-term and wide-ranging implications, must be well thought out, while its contextual role and functions within the health care system must be clearly defined, yet flexible and adaptable to requirements and continuous changes in health care ecosystem and broader social environment.

Notwithstanding some open questions acknowledged by all stakeholders, the transformations in the way health care is delivered are creating new opportunities for innovative application of ICT (European Commission, 2004; Haux et al., 2008). New health care delivery patterns and business models which emerged, are becoming increasingly supported and often even dependent on successful implementation of eHealth projects and operative use of ICT in health care system. Far-reaching potential of eHealth projects lies not in the ICT itself, or even in the generation or exchange of data and information, but in the ability to develop human networks of competence and expertise in the field of health care (ITU, 2008; Kiel, 2005), reconceptualize health care services and enable the empowerment of citizens.

3. eHealth in Slovenia, Austria and Denmark

Section presents the review of eHealth strategies and related documents, and provides a summary of the up-to-date development of eHealth projects in Slovenia, Austria and Denmark.

3.1 eHealth in Slovenia

Ministry of Health has been dealing with the informatization of Slovenian health care system for almost two decades. eHealth project from 2005 in its latest form consists of 17 sub-projects aiming at extensive renewal and integration of information and communication systems in health care domain. Strategic objectives within the eHealth strategy should be implemented by the year 2023 facilitating fully integrated national IS enabling monitoring of the on-going treatments and related costs, faster access to medical data, medical services as well as cost evaluation, online ordering and coordination of waiting lists, increase of efficiency and transparency of the health care system and optimization of the business processes taking place in health care institutions (Ministry of Health, 2005 and 2008). Based on the Strategy for informatization of the Slovenian health care system 2005-2010 (Ministry of Health, 2005) and the Resolution on the National Health Care Plan for the period 2008-2013 (Ministry of Health, 2008), all activities in the field of Slovenian health care system informatization are aiming at realization of eHealth, whereas summary of its development goals is presented below:

1. The establishment of basic ICT infrastructure including: network used for communication and data exchange, Diagnosis Related Groups (DRG) and standardized definitions of health and social data required for development and management of Electronic Health Records (EHR) and e-prescription as well as improvement of the health care Smart card functionalities (Smart card allows access to medical data containing information on: the cardholder, the person liable for health insurance contribution, compulsory health insurance, voluntary health insurance, selected personal physician and General Practitioner (GP), issued medication, issued prosthetic equipment, potential organ and tissue donation for transplantation etc. After all functionalities of eHealth are implemented, smart card will allow all users to remotely access to their own health data via Personal Health

Record – PHR). Currently, EHR content is still not defined explicitly, while its structure comprises free text, preventing its full exploitation. Existing diagnosis as well as medical procedures are standardized and structured according to ICD 10 AM classification, whereas EDIFACT, HL7 and XML are current data standards for transfer of messages.

2. Integration and merging health and social IS into a national HIS and establishing a central, unified health information portal that will allow all stakeholders within the health care system secure and reliable exchange of data, execution of electronic services as well as standardized and transparent information and interoperability with similar systems in the European Union (EU).

3. Introduction of e-business as standard way of conducting operations and processes in the Slovenian health care system and promoting and encouraging the use of eHealth applications by all health care system stakeholders.

eHealth project is thus divided into three substantially separate, yet related areas. The first area is the establishment of a national IS, comprised of Health Network (hNET), a health portal (hAOP) and EHR. The second area represents the establishment and operation of Center for health care informatics, undertaking the central role in governing of IS. This area also includes upgrading and maintenance activities of the entire project after its completion. The third area will enable the improvement of health care processes, access to health care services as well as education and training of target groups. Although the eHealth project is still deep in the implementation phase, the Figure 1 presents the projected infrastructure of eHealth, which should become fully operational sometime after 2020 (Ministry of Health, 2005).

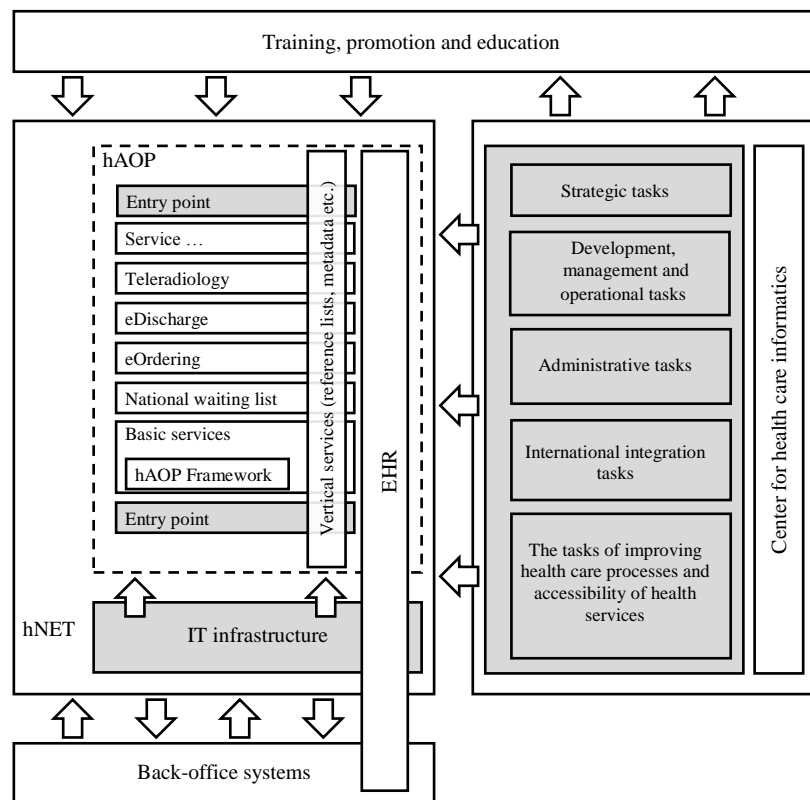


Figure 1: Planned infrastructure of eHealth in Slovenia

The implications of eHealth will presumably be twofold. First, significant changes can be expected in the field of informing, empowerment and inclusion of patients in the health care process, and second, well-designed eHealth should facilitate timely access to relevant data and information and consequently initiate better supported decision-making at all health care, administrative and management levels. According to project objectives, the fully functional version of eHealth should provide standardized bi-directional connections between the designated entities of the health care system, network synergies and substantial improvements in information and resource flows. Nevertheless, despite ambitious eHealth strategy and objectives, most of the project goals presented above, have remained unfulfilled. Namely, the current infrastructure of eHealth includes components facilitating only a few peripheral functionalities (Smart card, Professional card), which do not yield tangible benefits neither for patients nor for health care workers and health care system managers. Due to leadership

issues and lack of coordination as well as financial restrictions and technical problems, the eHealth development has stagnated in the recent period on almost all key areas, while the main project deliverables in the form of infrastructure building blocks have not reached the desired level of development according to the schedule. Consequently, the current infrastructure of Slovenian eHealth (Marušič et al., 2004) presented in Figure 2 is nonfunctional and causes time and resource losses.

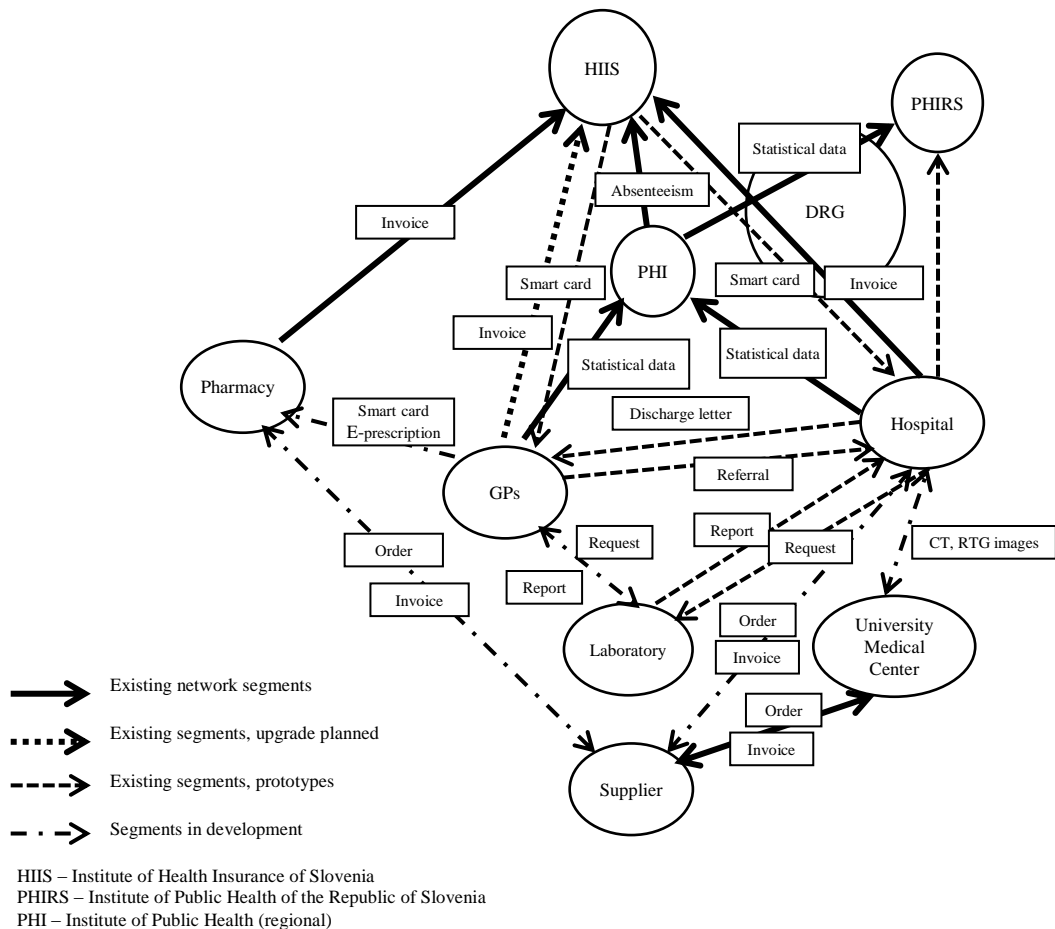


Figure 2: Current infrastructure of eHealth in Slovenia

3.2 eHealth in Austria

Development of eHealth in Austria has been founded on the eGovernment Act from 2004 (Government of Austria, 2004) and the Health Care Reform Act from 2005 (Government of Austria, 2005), including the Health Telematics Law (Government of Austria, 2005), which focuses on the secure exchange of medical data. The Health Care Reform Act emphasizes the role of ICT in the future development of Austrian health care system and outlines the informatization of the health care system as one of the public sector priorities (Government of Austria, 2005). The main coordinating body responsible for promoting the use of ICT and mechanisms for planning, financing and management of informatization projects is the Ministry of Health (Bundesministerium für Gesundheit). Strategic framework for the health care system reform has defined eHealth as a set of business models and information tools, which should provide improved health care and health care system performance in general while facilitating effective implementation of the priorities listed in the strategic documents from the field. In accordance with the objectives of the i2010 initiative and some other documents, issued by the European Commission (European Commission, 2005 and 2007; Pfeiffer et al., 2010), Austria has established the Information Society Development Program, comprising activities for the harmonization of projects and mechanisms within eHealth and e-government areas. Significant results in this program have been achieved especially in the management of e-identities and electronic signatures. Austrian Citizen Card issued by the federal government in 2008 is considered one of the leading e-identity projects implemented in the EU. In accordance with the informatization strategy, the e-card (health insurance card) was delivered to more than 8 million policyholders and more than 12.000 GPs since 2005 (European Commission, 2008). As in Slovenia, the

e-card initially contained only information about the health care insurance of citizens, in the second phase, however, which lasts from 2006 onwards, e-card contains an integrated suite of medical information which is complemented and updated sequentially.

Despite significant achievements in the field, the most important sub-project of eHealth remains development and implementation of a national EHR called Elektronische Gesundheitsakte (Government of Austria, 2009 and 2010). Development of EHR began in 2006 when a thorough analysis of the Austrian health care system and a feasibility study were conducted. In 2009 the institutional framework for the project was established, and a national health care portal (www.gesundheit.gv.at) was created in 2010. In parallel with development activities, the technical standards, interoperability framework and guidelines for further development of health care enterprise architecture were established and adopted. Actual implementation of national EHR started in 2011 through the realization of three pilot projects which were carried out at the regional level. In its first implementation phase, EHR will be mainly focused on e-prescribing and dispensing of e-prescriptions, along with gradual integration of the increasing number of medical data on e-card, in the years ahead. This should lead to the greater exploitation of medical data and higher quality of medical treatments as well as considerable elimination of the contraindications, reduction of allergic reactions and side effects. On the other hand, the implementation of e-prescribing should facilitate control over costs of medical treatments, prevent duplication of prescriptions, establish transparent functioning of the pharmacy market and provide an overview of the types and quantities of prescribed pharmaceuticals, as well as simplify their supply and distribution.

Notwithstanding the legitimate caveats highlighting primarily the protection of personal data and privacy as the most problematic areas of Austrian health care system informatization, development of EHR is undoubtedly an important asset for all policyholders and the entire health care system, while its long-term benefits will only be seen in the following years, when all planned applications and functionalities of eHealth become operative. Effective implementation of national eHealth strategy in the coming years will require a parallel restructuring of the entire health care system and coordinated action at the medical, information and legislative level, as well as the execution of activities to raise awareness of the health care professionals and citizens and to promote greater use of ICT solutions in health care. Under the latter assumptions, the Austrian health care policy is focusing particularly on the following activities:

- Achieving the overall interoperability and definition of standards for technical, semantic and organizational interoperability within the strategy for informatization of the health care system as well as the development of information society in general;
- Building of trust, protection of patient rights and ensuring responsibility of physicians and personal data protection in the process of EHR management;
- Development of national strategy and specific guidelines in order to facilitate safe and long-term archiving of EHR;
- Gradual elimination of semantic problems and implementation of common terminology for communication and data exchange, as well as monitoring and control of treatment procedures, patient requirements and satisfaction, and comparison of health care services and their quality nation-wide;
- Promotion and upgrading of a user-friendly health care portal accentuating prevention and citizens' participation in caring for their own health and well-being;
- Establishment of the health care provider networks and ICT infrastructure for the provision and execution of integrated social and health care services;
- Implementation of telemedicine projects for home therapy and assistance for disadvantaged population groups.

3.3 eHealth in Denmark

Denmark has a long history in the development of eHealth, which dates back to 1996, when implementation of the strategy for informatization of the health care and development of EHR began (Government of Denmark, 1996). Other initiatives for health care reform and introduction of advanced ICT solutions in health care are embodied in National Strategy for Information Technology in Hospitals from 1999 (Government of Denmark, 1999) and National Strategy for Information Technology in Health Service 2003-2007 (Government of Denmark, 2003). The last set of strategic guidelines in the field of eHealth development and implementation is contained in Danish Policy Strategies with eHealth relevance, which refers to the Action Plan from 2003 and includes 29 projects connecting many different public institutions. MedCom is national institution responsible for realization of the eHealth project and acts as coordinator of project activities between health care policy, health care professionals, citizens and ICT service providers. MedCom manages the process of informatization in the Danish health care system, issues certificates of safety and quality in health data exchange and promotes

integration of HIS in hospitals and pharmacies. Within the Danish health care system 4 million messages are exchanged every month, including 80 percent of all prescriptions. MedCom also controls electronic data interchange and manages patient identities and safety of personal data through integrated three tier system, which includes the public key infrastructure and allows the traceability of each entry to the system. A key part of the strategy and the ultimate goals of the Danish health care system informatization are the development of integrated HIS and implementation of EHR (Doupi et al., 2010), whereas the future activities within eHealth are focused primarily on:

- Extension of existing applications in the eHealth scheme, more effective integration of the local HIS and e-prescriptions with the aim of developing a personal health profile of the patient, which would be stored on a national medical data server, further improvement of e-prescribing;
- Promotion, upgrading and enhancement of national health portal Sundhed.dk, awareness-raising between citizens and health care professionals, facilitating the full functionality of the national health portal and general accessibility by using the digital signature;
- Upgrading of health data networks, information infrastructure and personal data protection system, effective intersectoral communication that includes the exchange of more than 40 different types of standard documents (e-prescriptions, e-referrals and e-lab tests, specialist e-referrals, etc.);
- Effective further implementation of the electronic health card project (Common Medication Card - FMK) throughout the country, inclusion of wider range of medical and administrative data on the electronic health card and promotion of its functionality for both patients and health care professionals;
- Effective transfer of medical and administrative patient data across regional boundaries in order to ensure the quality of health care throughout the country, further development and implementation of telemedicine projects for chronic patients, and deployment of cross-border health care networks in the region.

Danish health policy makers have managed to attract a wide range of stakeholders collaborating in the development and implementation of eHealth. Political will and stakeholders' commitment as well as their coordinated action have provided necessary resources, professional and technical support and adaptation of legislation, being some of the reasons for their success. For example, in 2005 the tax legislation was adjusted, which allowed a separate agreement between the government and owners of the regional hospitals, who required equal access to EHR and e-prescriptions throughout the country. The regulatory framework of health care has been adapted as well, since the Act on health care from 2008 (Government of Denmark, 2008) had to take into account the specific requirements in the area of confidentiality and protection of personal data, referring to the implementation and use of eHealth. Among other factors, which influenced the development and intensive use of eHealth applications in Denmark, some other aspects could be exposed, such as: the construction of high-quality ICT infrastructure and health information network, which was built on existing infrastructure building blocks of e-government and the establishment of the National Health Portal (Sundhed.dk), which provides uniform access point to health care services for both citizens and health care professionals. The National Patient Index and The National Health Record will provide health care professionals and patients with access to more complete overview of existing patient data. This will benefit health care professionals and patients in several ways by facilitating (Government of Denmark, 2012):

- A clinical tool that enables digital sharing of data across borders and sectors in the health care system;
- A tool for gaining digital access to patient data not already stored in local EHR systems;
- Support in decision-making in relation to referral, elucidation and treatment of a patient;
- Giving citizens access to a broader range of own health data thereby establishing a foundation for improved dialogue, better insight in their own health condition and improved possibility for active involvement in their own treatment.

3.4 Comparative analysis of the eHealth development in Slovenia, Austria and Denmark

The comparative analysis of the eHealth development in Slovenia, Austria and Denmark was conducted in the first half of 2012. During that time we carried out extensive document analysis and information retrieval through in-depth investigation of primary and secondary online resources, policy papers, strategies, project reports and records, action plans and other forms containing eHealth related contents in the selected countries. Reflecting the substantial scope, complexity and various settings, as well as the asymmetrical development of the individual thematic and organizational areas within, comparing the development of the entire eHealth projects was unfeasible. Therefore we had to apply the structural decomposition, through which we identified and extracted comparable components from designated eHealth projects. Structural decomposition revealed 12 relatively comparable infrastructure components within all three eHealth projects in selected countries. Subsequently, by

evaluating the development level of selected components, we transformed these components into 12 equally weighted indicators (see Table 1), which in sum reflect the actual development level of overall eHealth projects in selected countries. Development level of the individual components, and ultimately the overall development of eHealth, was evaluated applying the following grades (see their explanations in parentheses):

- 1 – Conceptual phase (Component and its operations are based only on the conceptual design; its development, sourcing and implementation procedures have not yet been defined or started).
- 2 – Development phase (There is a concrete blueprint for the construction of the component encompassing all planned operations. Development, sourcing and implementation procedures have been defined, initiated and monitored).
- 3 – Partly functional (Some of the planned component operations are implemented, functional and applied in practice within the health care environment).
- 4 – Functional (All of the planned component operations are implemented, functional and applied in practice within the health care environment).

Finally, based on the assigned grades, the calculation of the average score of the components' development level was carried out, facilitating the determination of overall development level and associated comparative ranking of eHealth projects in the selected countries (Table 1). The nominated components within eHealth projects were defined and selected partly on the basis of EU research and guidelines (European Commission, 2008, 2009 and 2011) striving to identify the most important factors for development of comprehensive eHealth projects. Comparative analysis was conducted combining different techniques (Yin, 2003) of qualitative research methods. The initial part of the comparative analysis has focused on the document analysis through in-depth investigation of existing eHealth-related sources, whereas deriving from obtained investigation results, the conclusive part of the comparative analysis is striving to integrate theoretical and practical aspects regarding the research subject and provide applicable guidelines for further development and implementation of eHealth in Slovenia.

Table 1: Main components of eHealth projects in Slovenia, Austria and Denmark

Component	Slovenia	Austria	Denmark
Integration of stakeholders (reports, data exchange, education and training etc.)	3	3	4
EHR / PHR	2	3	4
Interoperability framework	2	3	4
Data standards	3	3	4
E-prescription	1	2	4
Smart card	3	2	4
Professional card	4	4	4
Telemedicine	1	1	2
Performance evaluation of eHealth	1	3	3
Health care system performance indicators	3	3	3
National Health Portal	3	3	4
Legal regulation	2	3	4
Overall rating of eHealth development in selected country	2.33	2.75	3.67

Although, unlike the Danish, both Slovenian and Austrian eHealth projects are deep in the implementation phase and will not become fully functional for some time (Doupi et al., 2010; Ministry of Health, 2011; Pfeiffer et al., 2010), either because of inadequate planning and technical difficulties, or because of fiscal constraints and weak policy support, the research revealed some interesting findings. Comparative analysis confirms the undisputed supremacy of Denmark (average score 3.67, std. deviation 0.65) in the field of eHealth projects development in comparison with Slovenia (average score 2.33, std. deviation 0.98) and Austria (average score 2.75, std. deviation 0.75). Although relatively successful in the field of eHealth development, according to our comparative analysis Austria achieved comparatively lower results than Denmark in most of the categories compared. Slovenia showed the least progress in the field of eHealth development and achieved the lowest score in the comparative analysis, considerably lagging behind the Denmark and Austria as well. Danish eHealth project achieved superior results in almost all comparative categories. The most visible gap involving the comparison of strategies and documents related to the development of eHealth comprises the very start of the eHealth project in Denmark, which was initiated nearly 10 years before eHealth projects in Slovenia and Austria. In addition, the number of strategies and documents concerning the national project of eHealth and general

promotion of ICT application in health care exceeds the number of similar documents from Slovenia and Austria. Relating to the number of stakeholders involved, which is comparable to the numbers in Slovenia and Austria, Denmark has obviously managed to dispel the conflicting views and other barriers between them, and establish their quality cooperation, coordination and commitment to the eHealth initiative, proving that development and implementation of such complex and important projects require broad social consensus and close interdepartmental collaboration. From the comparative perspective, eHealth in Denmark achieved notable results in almost all categories, except in the areas of Telemedicine, Performance evaluation of eHealth and Health care system performance indicators, which comparatively accomplished relatively lower results. Denmark is producing excellent comparative results at the level of the EU27 as well, often dominating the top rankings in various classifications of eHealth development (European Commission, 2008, 2009 and 2011).

Slovenian eHealth project has encountered a series of obstacles and setbacks in the course of development and implementation, consequently the date of its completion, earlier planned for 2023, is rather difficult to determine. However, the comparative analysis revealed significant deficiencies in the overall up-to-date development of eHealth in Slovenia and a large gap between Slovenia on one hand, and Austria and Denmark on the other hand, especially regarding the development of individual components of eHealth. Namely, 5 out of 12 selected and compared components of eHealth in Slovenia reached a lower development level than in Austria; however there is even bigger difference compared to Denmark, where Slovenia has achieved a lower development level in 10 of the 12 components compared. Especially concerning is the fact that according to some estimates, eHealth development in Slovenia considerably lags behind the EU27 average, as well (European Commission, 2008 and 2011; Ministry of Health, 2011). Based on the comparison of eHealth development in Slovenia, Austria and Denmark (Table 1), the explicit deficiencies related to particularly underdeveloped eHealth components (listed components were graded with scores less than 3 - Partly functional) are summarized and defined below:

- EHR / PHR – Two of the most important components of eHealth are in the development phase and currently do not provide required functionality enabling database connectivity for patients migrating from primary to secondary and tertiary health care level);
- Interoperability framework – Component is in the development phase and currently does not facilitate operationalization of adopted standards and integration of existing IS within health care, laboratory and radiology departments (lab results, Picture Archiving and Communication System – PACS etc.);
- E-prescription – Component is in the conceptual phase and the time frame for its construction and subsequent inclusion in the eHealth infrastructure is still indeterminate;
- Telemedicine – Component is in the conceptual phase and although contained in the Slovenian eHealth strategy from 2005, development activities in the telemedicine field have not been specified, let alone launched;
- Performance evaluation of eHealth – Component is in the conceptual phase, since health policy in Slovenia has not established a methodology including appropriate indicators for evaluating the performance of already implemented operational components of eHealth and monitoring of the components in the development process;
- Legal regulation – Component is in the development phase lacking several important regulations for the eHealth application, especially regarding the transfer of medical data, personal data protection, privacy, interoperability standards, liability and risk issues within the usage of EHR / PHR, Telemedicine and E-prescription. Given the existing political debate focused predominantly on economic issues and stringent austerity measures, lack of support and incentives for legislative amendment in the field of eHealth is likely to remain unchanged for some time.

Listed components are in early development stages. Taking into account the complexity of developing such components, time required for their transfer into operational use and current budgetary restrictions, it is clear that operations depending on these components, and consequently the entire eHealth project, will not become fully functional for a long time. This is certainly a broader systemic problem and given the scope of health care system, its relations and interdependencies with other segments of the society (European Commission, 2005), it should be noted that eHealth is only a part of the complex social system (European Commission, 2007), while its perception and subsequent application are deeply rooted in the social mode of behavior (Chaudry et al., 2006; Berg, 2001; Haux, 2006; Lippeveld and Sapirie, 2000) and working practices of organizations and people.

The deficiencies within the development of eHealth in Slovenia, which obviously extend to several areas, such as policy-regulatory, financial, institutional and technological area, could have been mitigated by taking appropriate measures in the course of its conceptualization, planning and implementation. Nevertheless, exposed deficiencies have significant impact on overall performance of eHealth, and consequently do not allow its effective utilization for improvement of health care services and evidence-based management of the health care system. The most significant deficiencies revealed by our research are summarized below:

- Absence of top-down support for implementation of eHealth;
- Poorly defined health care policies and eHealth project objectives;
- Unadjusted and hyper-regulated normative framework;
- Insufficient funding, lack of management skills and human resources;
- Fragmentation and large number of diverse legacy IS on all three levels of health care system;
- Partially defined communication network standards and data exchange standards;
- Lack of standardized definitions of health and social data required for development and management of EHR, PHR and DRG;
- Disregarding interoperability perspective while procuring an increasing number of narrowly specialized IS;
- Inadequate and vague evaluation practice in the field of major ICT projects;
- Lack of experience in the execution of complex and long-term national (ICT) projects;
- Unawareness of the potential benefits of eHealth and lack of skills within the scope of ICT by the healthcare professionals;
- Lack of consensus on development priorities as well as cooperation and coordination between key stakeholders.

4. Lessons learned and recommendations

Assessing the development and future trajectory of the eHealth has proven to be a very difficult task, given the complexity of the eHealth projects themselves and lack of appropriate evaluation metrics. Therefore, it is not surprising that in Slovenia, as well as in the international arena, there are only a very small number of research attempts concerning evaluation of the eHealth development, especially through the international comparison. Notwithstanding the state of affairs in the research field, certain preliminary conclusions can be drawn. It is evident that problems in the development of Slovenian eHealth extend to various areas, reflecting in the unsatisfactory development level of individual infrastructure components and overall eHealth project, whereas on-going financial and economic crisis just revealed the magnitude of pertaining problems, additionally undermining public trust and stakeholders' engagement. Health care systems which strive for the successful development and implementation of eHealth projects have to generally overcome difficulties with the political, legal/regulatory and technical constraints, provide appropriate funding for material and immaterial resources, and precisely specify the course and objectives of the eHealth projects.

Analyzing current situation in the field of eHealth in Slovenia, we identified various deficiencies which have in our opinion substantially affected the development of eHealth. Some of the problems associated with eHealth development and implementation have been expected, given its scope and complexity, while the other complications appeared unpredictably and were merely the results of poor planning and inaccurate project analysis. Synthesis of the research results and derived deductions are presented in the form of recommendations and guidelines and summarize the inconsistencies in the development of Slovenian eHealth. Deriving from the comparative analysis, issues listed below have not been properly and fully addressed, while they seem to be very important segments of successful strategy for development and implementation of eHealth:

- Acquire political support, bring together stakeholders from the public sector, not-for-profit organizations and the private sector, and prepare viable strategy documents and action plans (assess the current ICT infrastructure, departmental IS, legacy IS, interoperability issues, specify the health information standards, education and training of the medical staff, analyze different informational needs of primary, secondary and tertiary health care level, check the financial construction and financial projections related to the budget of eHealth in the medium and long-term, examine the potential obstacles to eHealth realization and conduct a sensitivity analysis, etc.);
- Examine current and projected health care issues, incorporate country specificities, determine national health care priorities, and provide an action plan clearly specifying how eHealth will contribute to the solution of national health care priorities, as well as enable desired reorganization and restructuring of the health care system itself;
- Select a top manager and a quality project team with experience in large ICT projects, clearly structure the project plan, project phases and deliverables for each phase, determine the timeline of the project by reaching mutual consensus with all stakeholders, distribute the assignments and strictly monitor and inspect the work on the project;
- Ensure adequate resources before the start of each phase of the project and make realistic plans within both temporal as well as financial terms;

- Mobilize all stakeholders to ensure commitment, material and moral support, encourage their participation and constructive criticism, provide an inclusive plan for permanent education of the stakeholders and communication between the project team;
- Enhance the preparation and implementation of public tenders (materially and procedurally) related to procurement of ICT equipment and realization of smaller individual ICT projects within the overall eHealth project;
- Perform a constant supervision and strict control of the already executed project tasks with respect to the substantive and temporal objectives, and ensure close monitoring of the tasks which are in the execution phase;
- Inform and sensitize the public, promote project achievements so far, organize marketing campaign to popularize the eHealth project and increase user acceptance of eHealth services, gain support from the media, experts and citizens; eHealth is a socio-technical project.

Presented research results cannot be easily transferred into action, while the poor progress in development of eHealth in Slovenia is related to several factors. Delays in eHealth development require a detailed analysis of the current situation, accommodation of new resources and well-coordinated implementation of operational tasks, which will gradually bring the development of eHealth to its final phase. These measures usually necessitate a radical change in the project management and government financial stimulus. Alarming socio-economic situation could jeopardize the latest efforts and compel the government to focus on predominantly short-term economic issues and lower the investments for development of eHealth and health care system in general, which could result in far-reaching and irreversible implications for public health in the future. Better exploitation of ICT in health care and eventual provision of medical and economic benefits as well, will therefore require the mobilization of all stakeholders and experts in the field, definition of clear and measurable objectives and a broad consensus about the necessary public expenditures.

5. Conclusions

Considering the potential and almost unparalleled role of ICT in the modern health care systems, eHealth currently represents a very hot topic and could define the main trajectory of health care system action in the future and articulate its long-term goals in general. Conducting a comparative analysis of the eHealth development has emerged as a very challenging mission. So far there is no universally-acknowledged methodology for evaluating the development of overall eHealth projects or their individual components, while the efforts trying to provide at least some kind of comparative framework or conduct international comparative analysis of eHealth development are extremely limited. Although reasonably susceptible to subjectivity and arbitrary interpretations, comparative analysis in hand provides a valuable insight into the development of individual components of eHealth and general progress of eHealth in Slovenia, Austria and Denmark. Main limitations of the study probably concern the adequacy of performed weighting process and the fact that development level of individual eHealth component was actually defined on the basis of primary and secondary sources investigation without empirical testing and practical validation of each component in health care environment. Accordingly, the issues of equal weights assigned to designated indicators and objective definition of development level raise some questions of principle, while the results of the comparative analysis may therefore be arguable and misleading. These issues should be properly resolved in further research and succeeding experiments trying to establish a theoretical-based and balanced framework for evaluation and comparative analysis of eHealth development in national and international context. Despite certain methodological dilemmas and limited resources, conducted comparative analysis reveals the dynamics of eHealth development, related deficiencies and barriers, and while based on designated guidelines, it may eventually provide the groundwork for further development and implementation of the intractable and costly eHealth projects, and useful assistance for enhanced allocation of project management resources.

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Analyzing the current situation in the field and conducting a comparative analysis on the development of eHealth in Slovenia, Austria and Denmark, we identified various deficiencies, which have substantially affected the development of eHealth in Slovenia. Deriving from the comparative analysis results, the contribution of the paper tends to be twofold. Firstly, the results of the comparative analysis reveal interesting findings in connection with those issues which directly influence the development level of eHealth projects, offering a clear impression of the critical success factors and contributing to theory building in the eHealth domain. And secondly, the paper has even higher value for the practitioners, by facilitating an explicit set of recommendations and guidelines which may eventually provide the groundwork for more effective allocation of project management resources and encourage practitioners to exceed the identified deficiencies by boosting the mobilization of all stakeholders and experts in the field, defining clear and measurable objectives, and taking appropriate measures in the course of eHealth conceptualization, development and implementation.