A thematic review and a policy-analysis agenda of Electronic Health Records in the Greek National Health System

ABSTRACT

The increasing pressure to improve healthcare outcomes and reduce costs is driving the current agenda of governments at worldwide level and calls for a fundamental reform of the status quo of health systems. This is especially the case with the Greek NHS (National Health System), a system in continuous crisis, and with the recent ongoing financial turbulence under intensive scrutiny. Technological innovations and Electronic Health Records (EHR) in particular, are recognised as key enablers in mitigating the existing burdens of healthcare. As a result, EHR is considered a core component in technology-driven reform processes. Nonetheless, the successful implementation and adoption of EHR proves to be a challenging task due to a mixture of technological, organisational and political issues. Drawing upon experiences within the European Union (EU) healthcare setting and the Greek NHS the paper proposes a conceptual framework as a policy-analysis agenda for EHR interventions in Greece. While the context of discussion is Greece, the paper aims to also derive useful insights to healthcare policy-makers around the globe.

Keywords: Electronic Health Records; European Union; Greece; National Health System; Conceptual framework; Policy analysis and planning

1. Introduction

The Greek NHS (National Health System) is a system in continuous crisis that is currently under intensive scrutiny. From its inception until today it is striving to lay healthcare priorities and assign tight resources not always in a cost effective or quality assuring way [1].

There are usually a number and web of causes that explain the poor performance of many public health and health service actions; overestimation of efficacy and effectiveness, failure to address the health system's structural and organisational problems, failure to perform feasibility assessments, tight budgets, poor maintenance, mismanagement, inefficiency and neglect of psychological, managerial or political support [2]. In many cases, including the Greek NHS, a fundamental system reform is absolutely essential. Such a reform can act as a driving force for accelerating innovation in all aspects of healthcare. In the innovative reform of healthcare systems the role of information technology (IT) and information systems (IS) is recognised as a catalyst. In particular, integrated information systems within the secondary healthcare domain are expected to upgrade the services provided to patients, support the rational allocation and use of resources by either saving resources or improving productivity and create innovative products and services [3].

2. The semantic role of EHR in the contemporary healthcare context

In 2004, the European Union (EU) submitted to its Member States the eHealth Action Plan that defined a challenging list of implementation actions [4] with Electronic Health Records (EHR) identified as a major objective [5]. EHR, the 'holy grail' [6] of healthcare information technology (HIT), which refers to the systematic collection of health information about individual patients or populations in an electronic/digital format [7] is promoted as a panacea to healthcare information management problems. The application of EHR can provide substantial benefits, such as improved patient care and outcomes, increased efficiency, lower costs, improved billing processes, reduction of the frequency of lost (paper) records, data and medication errors and better access to patient histories [8],[9].

Despite the long history of EHR, with the first electronic record dated back to the 1960s [10], the progress on EHR employment remains below expectations. This paradox can be

attributed to the increased complexity surrounding the implementation of EHR systems and emphasises that the healthcare sector compared to other industries is still a laggard in IS adoption [11]. EHR is a costly intervention that alone cannot lead to improved health outcomes but rather additional measures are required [2]. These involve managing the change imposed by the transition from paper to electronic records, redesigning healthcare circuits, organising and standardising the information health services yielded, improving information systems (especially data quality) and providing special assistance to support decision-making for example though electronic reminders, medication alerts, profile-based requests for complementary tests and outcome feedback [2].

Øvretveit et al. [12] identify the individual and organisational "change capability" as a key factor for the success of EHR implementation. At an individual level employees will have to adjust cognitively, behaviourally and emotionally in using an EHR system on their daily practice [12]. At an organisational level the establishment of change management or learning organisation systems along with a "change readiness" climate that is characterised by optimism about the future, trust in leadership, good inter-professional, inter-departmental and professional-management relations, shared experience of successfully managed changes and a learning organisational culture and structures are of paramount importance [12]. It is thus apparent that the change process associated with EHR in the context of healthcare involves a complex web of different parameters and relationships.

3. EHR: The European and Greek perspectives

At a EU Member State level, a wide diversity in the implementation of HIT and particularly EHR that is considered a focal component of an integrated HIT is evident [13 cited in 14]. This diversity renders any cross-country comparison on EHR policy practices rather difficult. Moreover, although all countries surveyed in the ERA study in 2006 reported activities on

EHR systems, widespread adoption appears to be a challenge even for technologically advanced countries since so far EHR solutions deployed at a national level are limited to few countries [5]. Consequently, EHR implementation efforts are expected to be a variable and an ongoing process for EU Member States.

3.1 The status of EHR at a European level

The variation in EHR implementation efforts is indicative in example cases from different levels of health services, primary, secondary and tertiary healthcare, across Europe. In Denmark the use of EHR is well established with general practitioners (GP) and specialists have access to patient data irrespective of the location it was created; in Scotland a central Emergency Care Record (ECR) is available since 2007 for all 5 million citizens and updated automatically twice daily from the respective GP systems; in Czech Republic a nation-wide web-based EHR system (IZIP) that contains lab results, radiology reports and emergency care data where information is recorded for more than 20% of the population is available to connected care providers upon patient's consent; in Sweden a National Patient Summary (NPÖ) has been piloted since April 2008 containing care contacts, personal information, chronic disease diagnoses and medical alert information such as allergies, current examination results and a list of dispensed drugs; in Bulgaria a Personal Health Record (eLAK) system has been integrated in the national health portal where an emergency care data set and copies of for example prescriptions, immunisations, physician's letters, X-rays, electrocardiograms (ECGs) can be uploaded; in Turkey a basic EHR service has been implemented as part of the national family medicine application and its data is synchronised with the health records stored in the central servers of the Ministry of Health [5].

The complexity surrounding EHR systems is illustrative in the cases of United Kingdom (UK) and Germany. In the former case the Ministry of Health in September 2010 announced the end of the National Program for IT (NPfIT) stating that a centralised, national approach

was no longer appropriate leaving responsibility for the implementation of EHR to individual NHS trusts [15]. In the latter case the overall progress of the EHR project has been delayed several times due to technical complexity and strong resistance from health professional organisations [16]. It is therefore not surprising that despite the long-term endeavours on EHR implementation fully-fledged regional systems exist or are at advanced implementation stages only in few regions such as Finland, Sweden (Kronoberg and Norrbotten), Italy (Lombardy) and Spain with DIRAYA, the Andalusia system, representing a global benchmark as the first regional EHR system that integrates all patient information from primary to tertiary care including emergency and in-patient care and connecting all pharmacies, their logistics and billing [5].

3.2 The status of EHR in Greece

The development of EHR is identified as a central strategic target for the Greek NHS upon which all related applications will be based and will accommodate administrative/demographic information, electronic medication record, medical history, laboratory results, radiology reports and emergency care data [17]. However, the relatively immature healthcare technological infrastructure compared to other developed European countries, the absence of a computer-literate population [18] and the legislative flexibility to maintain health records in either paper-based or electronic format [5] have impeded the rapid development of EHR systems at a national level. Therefore, the availability of EHR systems in the majority of public hospitals and healthcare centres is limited with a recent study in 132 hospitals and health centres revealing that 52.7% of the participating institutions had a fully developed healthcare information system including EHR [19]. Overall, the implementation of EHR in the Greek context has been widely fragmented, developed by different providers, leading to complex issues in terms of information exchange, interoperability and integration

between the existent systems since there is no widely accepted standard or protocol for the communication of healthcare systems [19].

Within the primary healthcare sector a secure network named ‘SYZEFXIS’ is under development that aims to interconnect all units providing health and welfare services, in all healthcare regions [20]. Another major project involves the development of an Integrated Hospital Information System (IHIS) that aims to interlink all the existing applications for managing medical information in all Regional Health Administrations (RHA) [20]. For this purpose, under the IV Community Support Framework that expands from 2007-2013, a pilot project titled ‘IASYS’ with the participation initially of a subset of large and medium-sized hospitals has been rolled out [20]. The aim of this project is to implement an integrated and unified solution for health units, ensure interoperability between systems and reduce costs [20].

The current financial turbulence and still pending legislation though pose significant obstacles to sustainable eHealth financing [5, 17]. Whilst there are no technical issues regarding the implementation of EHR the remaining challenge involves the lingering harmonisation of legislation with the relevant European directives that will boost the required process reengineering activities [17].

4 A review of EHR studies in the Greek NHS context

A systematic search to identify journal and conference papers on EHR case studies in the context of the Greek healthcare milieu reveals that the number of pertinent studies is limited to two. The search criteria were a combination of the keywords Electronic Health Records (EHR) and Greece/healthcare information infrastructure/health network within principle scholar databases (Emerald, Google scholar, Science Direct and Scopus).

The two indicative studies build on the notion of integrated healthcare at a regional level and exemplify holistic attempts in the field of EHR across all levels of health services within the Greek NHS. While both studies focus mainly on system architecture, design, and infrastructure including work in progress and future system characteristics, for the purposes of this paper a top-level discussion is carried out. A graphical representation of the two main aforementioned studies and their geographical coverage is depicted in Figure 1.

Figure 1 - A graphical representation of integrated EHR studies in the Greek NHS

4.1 The case of Epirus-Net

EPIRUS-Net is a noteworthy effort in the rather isolated and underdeveloped region of Epirus to establish an integrated environment for healthcare delivery via a regional health telematics network [21]. The region of Epirus presents strong morphological particularities,

such as mountains and isolated areas making transportation and hence provision of healthcare very difficult especially in emergency cases [21]. EPIRUS-Net is a fixed wireless network that connects regional hospitals and healthcare centres including the University hospital in Larisa [21] providing a trans-geographical link between the geographic regions of Epirus and Thessaly as also portrayed in Figure 1. The network provides access to integrated Electronic Health Record services (distributed Computerised Patient Record (CPR) system), resource services (directory of healthcare providers), educational services (distance learning courses on medicine sectors) and specialised medical tele-conference and tele-consultation services [21]. The reasons for the specific network infrastructure were the inadequacy at that time of the telecommunication infrastructure in rural areas and its prohibitive implementation and maintenance cost, the need for high bandwidth, independency and centralised management (without depending on third-parties) and the flexibility of network expansion [21].

The integrated EHR, one of the system's core components, was serving the specific needs of the cardiology and orthopaedic clinics and was extended to cover the needs of other medical sectors, for example gynecology [21]. The authors conclude by emphasising the need for regional planning and political commitment for the viability of the network's infrastructure and services and that the issue of user acceptability should be addressed in order to resolve potential legal issues and reduce capital and operational costs so that quality healthcare services will be available to all citizens [21].

4.2 The case of HYGEIAnet

HYGEIAnet, the regional health information network of the island of Crete, was a substantial endeavour and became a cornerstone model for national and transnational integrated eHealth services and an eEurope/eHealth award winner in 2003 [http://www.eipa.eu/eEurope_Awards/index.htm]. The network serves the local population, including numerous stakeholders, such as patients, healthcare professionals, researchers and

managers at various levels of the healthcare hierarchy namely primary care, pre-hospital health emergency management and hospital care supporting continuity of care across organisational boundaries [22].

The deployment of HYGEIAnet has demonstrated significant benefits in terms of both finance and quality of care [23]. Among the documented benefits are the avoidance of duplication of unnecessary examinations and the reduction of patient referrals to specialists as expert opinion has been available via the regional health information network's supported services leading to a reduction of hospitalisation days [23]. At the pre-hospital health emergency services, quality of care has been enhanced because of the protocol based classification of emergency cases that allowed the dispatch of the most appropriate resources and the increase of personnel's training [23]. Similar benefits have been observed for the remote management of chronic diseases. Results from the tele-management of patients with paediatric asthma demonstrated a relatively high rate of health improvement [23]. Tele-consultation for the Cardiology eHealth services has also reported benefits occurring from instantaneous diagnosis that has resulted in fewer patient hospital referrals [23]. In those cases where transfer to the hospital was required cardiologists had access to relevant clinical information prior to the patient's arrival and could provide immediate directions for the patient's management [23]. A case is also recorded where a GP received detailed instructions on treating an acute episode of myocardial infrastructure during the transfer of the patient to the nearest cardiology care unit [23].

Despite the successful integration of healthcare provision in the case of HYGEIAnet, the actual adoption of the system was not holistically successful. A study conducted over an 8-year period (1998-2006) during the various implementation stages of the system applying the FITT (Fit between Individuals, Task and Technology) model aimed to explain the implementation successes and failures and identify the factors influencing the adoption and

diffusion of innovative ICT in a distributed health network [24]. A number of factors emerged that determined the three dimensions of the FITT framework namely quality, compatibility and customisability of the system as well as training and technical support, managerial commitment and strategies of organisational change with training and organisational support identified as the two most influential [24]. In particular the amount and type of training and the level of leadership and management were indicated as direct and/or indirect predictors of the eHealth network's success [24]. In those healthcare organisations that the implementation was successful, a local champion could be spotted whose role was to act as a change agent by actively promoting innovation, adoption and diffusion of information systems and had an influential role in the organisation's strategy and decision-making [24].

5 A conceptual framework for the EHR policy-analysis agenda in the context of the Greek NHS

Greece is a country in transition and any eHealth policy action plans are also in a transition stage. The limited utilisation of HIT, the lack of a computer-literate population and the absence of a legal framework for ICT application within the healthcare context have so far restrained the rapid development of EHR suggesting that a considerable endeavour is required before EHR systems are well established at a national level [17, 18, 20]. The country's strong morphological peculiarities with almost 80% of its land being mountainous or hilly and more than 3,000 islands, out of which 169 are inhabited [25] emphasise the importance of integrated regional EHR solutions similar to the cases of EPIRUS-Net and HYGEIAnet discussed in section 4. Such solutions can significantly enhance the provision of healthcare especially in rural areas including islands where resources are limited and access to qualitative healthcare is virtually nonexistent while at the same time eliminate health-

related costs. Before the roll-out of region-wide integrated EHR systems throughout the country and drawing upon the experiences from the previous cases this is a timely opportunity to reflect on the supporting mechanisms required in order to realise the full potential of IT-driven reforms. The paper introduces a conceptual model that aims to link the different pieces that constitute critical items for the EHR policy-analysis agenda in the context of the Greek NHS. A schematic representation of this model is illustrated in Figure 2.

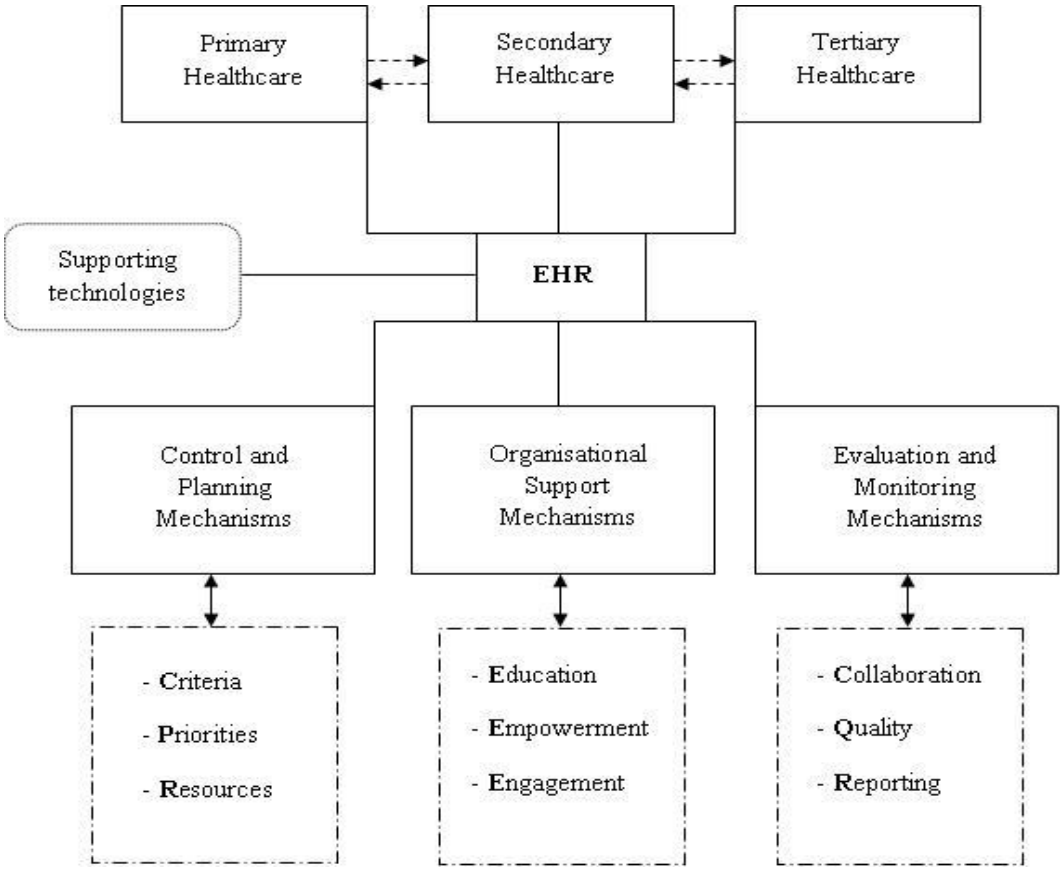

Figure 2 - Conceptual framework for the EHR policy-analysis agenda in the Greek NHS

In the conceptual framework EHR is the central technology. However, it is not a stand-alone technology but is integrated with other supporting technologies, such as telemedicine applications. Primary, secondary and tertiary represent the main healthcare services that form part of the Greek NHS setting. The dotted arrows between these three services denote the continuity of care that a patient receives when entering the national health system. For

example, a practitioner (primary healthcare) may refer a patient to a hospital service (secondary healthcare) which in turn may refer the patient to a university hospital (tertiary healthcare) for further specialist treatment.

Three different supporting mechanisms for integrated EHR-driven policy actions are identified as fundamental. The first, control and planning, includes setting criteria for technological, organisational and legal standards. This element necessitates a close working relationship between technologists responsible for the implementation of eHealth systems and healthcare professionals who will be utilising these systems in their daily practice. Additionally, pending legislation such as doctor's reimbursement by public insurance schemes for tele-medical care and a legislative framework in accordance with the EU [17] should be standardised to accelerate nationwide progress. Another element which falls under this mechanism is specifying priorities at a regional level which entails a detailed assessment of the status quo of the healthcare institutions in interest. This is a rather important theme since lack of planning is identified as one of ESY's daemons [26 cited in 27]. The final point, resources, requires the design of efficient and effective pathways regarding resource allocation whether these are financial, human, technical, physical, and so on.

The second mechanism, organisational support, craves for education, empowerment and engagement. Education is deemed as critical, as the implementation of eHealth services repositions existing medical practices. To effectively support this change process, training is not adequate. Instead, a more forceful intervention is essential that will provide healthcare professionals with the opportunity to study and employ IT innovations in a healthcare context since their medical studies. Empowerment, relates to leading figures within the Greek NHS ambience, particularly chairmen who are responsible for the management of public hospitals. The current criticism is that chairmen are political appointees and largely inexperienced managers [28], without any pragmatic sense of the healthcare context. In this case appropriate

appointees with relevant experience and subject knowledge are needed for the leading empowering role. Engagement involves the constant and active participation and involvement of healthcare personnel including IT departments within hospitals in the planning of organisational initiatives related to IT innovations. This approach will create a sense of place among employees, as to where the healthcare organisation and themselves as professionals, are moving towards. The three E's can act as influential change enablers and are of particular relevance to hospital personnel who are often accustomed to a public servant mentality and lack the incentives to increase productivity, quality and efficiency [29].

The third mechanism, evaluation and monitoring, signifies collaboration, quality and reporting as important sub-elements. Collaboration is suited for both intra- and inter- levels of evaluation. Intra- corresponds to the internal environment of a healthcare institution and inter- to the overall environment that a healthcare institution is part of, in the case of the Greek NHS, this will be at a regional administrative level. This two-tier assessment can act as a productive feedback loop for the interested parties and assist them in the re-definition of standards and actions. For this purpose, a clear and unambiguous set of quality assurance specifications is needed that will emerge from the collaboration between technologists and healthcare professionals. A formal reporting mechanism is finally required both at regional and national level that will aid in identifying gaps and emerging themes for consideration and careful planning as well as in sharing experiences at a wider context.

Whilst the primary purpose of clinical systems such as EHR is to support healthcare quality and in most cases necessitate recurring financial investment, important sustainable socio-economic benefits can be obtained [30]. This is why integrated EHR solutions should be considered as a strategic long-term investment that will provide long-term benefits [30]. A recent study remarks that financial gains from such solutions can be up to 60% of the total returns with an average of 13% [30]. Although there is usually a negative bottom line

regarding the generation of extra cash when there are opportunities to redeploy resources liberated by efficiency gains the financial gains can increase to about 60% of total benefits and exceed the extra cash invested [30]. In general, when the value of benefits starts to cover costs, the net benefit expands and becomes substantial with the case of DIRAYA that serves a population of more than 8 million reaching an annual net benefit for 2010 of over €170 million [30]. Greece is a country of comparable population size to that of the Andalusia region with approximately a population of 11 million and the implementation of integrated regional EHR systems can eventually accelerate similar long-term financial benefits for the country.

Nevertheless, interoperable EHR efforts can be efficacious and deliver the expected socio-economic benefits when they are planned and realised in an open, non-bureaucratic environment, free from political incentives with tight control, legal, organisational support, planning, evaluation and monitoring mechanisms. The current Greek NHS ambience is a highly-politicised context and has proved to be ineffective in setting healthcare standards and re-arranging activities through thorough outcome assessments. It is thus, vital for the Greek NHS to be reconfigured from its foundation and the role of integrated EHR systems can be pivotal in this reconfiguration process.

6 Concluding remarks

The Greek NHS has been since its creation a system in crisis and the ongoing financial turbulence has placed it under intensive scrutiny necessitating a fundamental reform to mitigate most if not all its existing pitfalls. The employment of integrated EHR systems is a timely topic for Greece before the roll-out of region-wide systems but remains a complex, multi-point agenda item. The paper has put forward a conceptual framework as a policy-analysis agenda for EHR interventions in the Greek NHS. While EHR is the focal IT

innovation, it was emphasised that within the context of regional eHealth endeavours the co-existence of other supporting technological innovations, such as telemedicine, are also vital. This is also apparent in the two exemplary case studies, EPIRUS-net and HYGEIAnet that were presented in the paper. The proposed framework is based on the premises of continuity of care as a patient moves across the different levels of healthcare services (primary, secondary and tertiary) and suggests a three-stage policy-analysis framework. The first, control and planning involves setting technological, organisational and legal standards, priorities at regional level and specifying efficient and rational resource allocation. The second, organisational support includes three E's (Education, Empowerment and Engagement) with education and engagement being of paramount importance for healthcare personnel and empowerment referring to the assignment of appropriate leading figures that can foster innovation and facilitate the change process. The third, evaluation and monitoring indicates the significance of collaboration for a two-tier evaluation process, at an intra- and an inter- level. This entails the definition of unambiguous quality assurance measures and as a final step a regional and national reporting procedure to identify unfulfilled themes for consideration and communicate experiences at a wider level. Even though the focus of the paper is the Greek NHS, the proposed framework can provide useful perceptions to policy-makers across the globe and can be theoretically extended and assessed in different countries' national health systems.

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