# Analysis and Typology of Global eHealth Platforms – A Survey on Five Continents

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**Abstract.** Driven by the diverse needs for exchanging patient, other healthcare and health system data with the aim to improve the overall quality and efficiency of healthcare provision, regions and countries globally have been developing electronic platforms to gather and exchange such data. Based on an initial sample of more than 50 potential cases, eight such platforms were analysed in detail. This covered issues like core public health policy goals pursued, and major patient and other healthcare data access and exchange characteristics driving the platforms surveyed. This allows for arriving at an initial, pragmatic typology of such platforms. It provides for a better understanding of the main objective(s) and the major thrust of the underlying national (or district-related) health policy to develop and implement such infrastructures.

**Keywords:** eHealth, platform, interoperability, global good practice, strategy

## 1. Analysing Platforms in a Global Context

### 1.1 Context

The research upon which this paper is based was performed as part of the ISAES – Interoperable eSystems for Africa Enhanced by Satellites – Study [1]. The study gathered global empirical evidence, described, and analysed interoperability opportunities and challenges towards designing a generic eHealth platform. The final goal is to initiate and support the implementation and sustained operation of national or district eHealth platforms facilitating the access and exchange of patient and other health data towards delivering improved healthcare [2, p. 6].

### 1.2 Analysing Global Good Practice

In an attempt to obtain a better grasp of global initiatives and ventures to provide for district or national level eHealth platforms, a global scan of good practice of such eHealth platform development and implementation was undertaken [3-5], including exchanges with global experts and web searches. From a list of more than 50 candidate

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examples, the following eight were selected for a detailed description and analysis, covering the wide variety of such platforms observable globally:

1. The Australian Nation-wide eHealth Platform and its Personally Controlled eHealth Record (PCEHR)
2. The Belize Health Information System (BHIS)
3. SIGA Saúde - The City Health Information System of São Paulo, Brazil
4. The Canadian Nation-wide eHealth Platform and its interoperable Electronic Health Record (iEHR)
5. The pan-European eHealth framework and ICT infrastructure for Smart Open Services for European Patients – epSOS
6. Estonia's national eHealth platform and nationwide EHR system
7. District telehealthcare services platform in Gilgit-Baltistan, Pakistan
8. South Africa Western Cape primary Health Care Information System

The comprehensive case descriptions [1] focused on policy & strategic issues, governance & regulation, and interoperability approaches and implementations. Each case applied an accordingly structured information gathering instrument for descriptions of national or district efforts. These relied on detailed reviews of public eHealth/eGovernment or Information Society programmes, eHealth strategies, and other published results as well as contributions by local experts involved in such endeavours.

## 2. Typology of eHealth Platforms

When reflecting on the dynamic nature and fluidity of any of the platforms described, it becomes obvious that such a momentary classification can only attempt to classify them in a pragmatic, rough manner where a closer analysis would reveal that there are different grades and shades of meeting a certain dimension or not, or that with respect to different criteria it is not a yes-no situation, but rather one of a certain degree of meeting the criterion or not.

### 2.1 Patient Workflow Support System

When considering the overall complexity of the vision and objectives for some national eHealth platform strategies and plans, and the high-flying political goals policy makers and other stakeholders purport to support and justify such visions, the pragmatic character of some cases may come as a surprise.

The two cases of:

- South Africa Western Cape Primary Health Care Information System,

and

- District Telehealthcare Services Platform in Gilgit-Baltistan, Pakistan

can be regarded as excellent examples of setting up very basic, yet fully functional eHealth platforms meeting certain fundamental needs of the health system they service.

With respect to the Western Cape government's overriding goal to establish a rudimentary (when compared to the strategies of some other countries) eHealth infrastructure, it was the need to cope with the fundamental issue of better organising

and managing the flow of patients into and across healthcare services, thereby benefitting both patients who receive quicker services at considerably reduced waiting times [6], and healthcare professionals who are enabled to much better cope with the daily tribulations of looking after hundreds and thousands of patients. The technology employed was built upon a proven, small but successful application, which was further developed with own ICT personnel rather than buying of the shelf software.

In Gilgit-Baltistan, it was the need to deliver most urgently needed care services to outlying areas, like for maternal health, which led to the analysis of how eHealth applications could improve the situation [7]. Based on a thorough needs assessment, priorities were established and dedicated eHealth applications were introduced to support diagnosis and treatment from a distance, enhance human resource capacity of health providers, and provide better support for the health service facilities. The main objective of the initial project was to develop and maintain an eHealth link between different levels of health centres for patient management, triage, and referral of patients.

Both cases are situated in less well resourced or even, in the case of Gilgit, very resource poor settings – and geographic regions which in themselves already pose sometimes dramatic barriers to delivering adequate quality of services – if at all, where meeting basic healthcare needs have highest priority.

An interesting observation is that in both cases the pragmatic approach taken seems to have led to a relatively fast, efficient implementation of the basic platform, leading to a comparatively early start of indeed delivering the type of services promised.

## 2.2   Basic EHR-like System

A similar type of system as the one developed in Western Cape Province is the national

- Belize Health Information System (BHIS).

However, it is somewhat more complex and comprehensive, particularly with respect to recording basic clinical information for each patient and certain infrastructure components like a national ID master index.

Planned since 2003, it was deployed already in 2007 as a country-wide fully integrated patient centred health information system with eight embedded disease management algorithms and simple analytics. It provides every citizen with a basic health record which facilitates also the tracking and monitoring of infectious diseases.

The BHIS was initially developed based on a proprietary system, but was then built on open source components, given the low and middle income country context. A remarkable feature is its replication technology that allows individual sites to operate temporarily without network connectivity, a critical component for infrastructure-challenged environments.

Again, it can be observed that the pragmatic approach, supported by dedicated national and foreign individuals has led to a fast, efficient and successful implementation which can already boost some remarkable impacts: maternal-child transmission of HIV has dropped from around 40% to about 5%, hospitalizations for people over 65 with hypertension have decreased by 25%, adverse drug reactions were reduced by >90%, and even the national health budget costs could be reduced by 3% [8].

## 2.3 Comprehensive, Complex Systems and Platforms

The following two systems are located at the next level of complexity and integration:

- SIGA Saúde - The City Health Information System of São Paulo, Brazil,

and

- Estonia's national health information exchange platform and nationwide EHR system.

When assessing the development success of the SIGA Saúde system, two aspects are of particular relevance:

a) Healthcare services are provided by a central agency, the São Paulo City Dept. of Health (SPCDH); i.e. a top-down approach could be applied.

b) The system started on a very pragmatic, three-step approach, where the first step involved introducing "only" a basic patient workflow support system. The initial goal was to organize:

- patient flow and

- data capture for billing, then

- medication dispensation, and

- referral and counter referral to specialized levels.

Only after the primary care layer was completed, the medium complexity layer with specialized clinics received the software and, after that, the third layer with hospitals entered in the system. A remarkable feature of this system was that this approach allowed for a very fast implementation and continuous improvement of the system [9].

Similarly to SIGA Saúde, an important facilitating factor of the Estonian national platform is that the Estonian National Health Service is almost a sole provider of healthcare, whereas many other countries have mixed healthcare service economies. All of this has led to relatively fast, large scale utilisation of eHealth services across the country. Another remarkable aspect is that the eHealth infrastructure has not been developed in isolation, but rather was impacted by and makes use of overall nationwide policy planning for the development of the co-called Information Society, including a national eGovernment plan [10].

## 2.4 National Framework Systems with Common Components

A quite different type of national eHealth platforms are those which may be called national framework systems with common components. They do not provide one, integrated healthcare patient record for every person, but rather establish framework conditions to improve the overall quality of electronic medical and patient records, to instigate local or district connectivity, and to allow for certain clinical elements, like a patient summary, and/or administrative components, like patient or healthcare professional IDs, to inter-operate at the national level across a great variety of healthcare providers, insurance companies, and other health system organisations.

They are typical for larger and large countries, where healthcare services are provided by a large number of independent actors like GP and specialist offices, medical centres, hospitals, and other independent services like pharmacies, physiotherapists etc. All of these systems suffer from their inherent complexity. Many, if not most of the more developed countries have such eHealth systems on their drawing boards, which are usually quite ambitious, far reaching and multi-purpose, often without being dedicated to a specific public health policy priority, but rather aiming at a generic blueprint which is supposed to cover any and (almost) all health system needs where eHealth applications may be expected to be useful.

Here we classify these two platforms:

- The Australian Nation-wide eHealth Platform and its Personally Controlled eHealth Record (PCEHR), and

- The Canadian Nation-wide eHealth Platform and its interoperable Electronic Health Record (iEHR).

Australia is an almost prototypical global example with quite some history. Already in 1999 the first steps towards implementation of a National eHealth policy were taken with the establishment of a National Health Information Management Advisory Council (NHIMAC). A 'grand plan' for e-Health – Health Online – was conceived. Launched in November 1999, the main focus of the plan was a series of wide-ranging national action strategies. Based on funding of $128.3m over four years a secure national health information network was to be established. Australia published an eHealth strategy and attempted to implement a national summary health record (HealthConnect) and national ePrescription management system and medication record (MediConnect). Neither project progressed past pilot implementations due to lack of federal and state political commitment; they were virtually abandoned by the mid 2000s.

Further studies followed, and another organisation, The National E-Health Transition Authority Limited (NEHTA), was established in 2005 as a collaborative enterprise by the Australian Federal, State and Territory governments, to identify and develop once more the necessary foundations for eHealth. It was to develop the critical standards, infrastructure, software and systems required to support the connectivity and the ability of electronic health information systems to safely and securely communicate with each other across Australia.

And again, success was minimal, and yet another project was devised, the implementation of a Personally Controlled eHealth Record (PCEHR), endowed with a huge budget of $467 million [11]. It is a secure online summary of an individual's health information, which does not replace the records that GPs and other health providers hold or the way they communicate with their patients. Rather it provides a summary of key medical information that may be very useful for other clinicians. The eHealth platform facilitates "only" the secure sharing of that information. However, in spite of the huge investment, by August 2013 only around 700,000 people signed up for such a record, and the large majority of these PCEHR records were still empty. And yet another review was scheduled to assess and judge the system's "fit for purpose and cost effective[ness]".

Canada is another example of how complex, difficult and problematic the establishment of such national systems is: The national eHealth programme in Canada is the responsibility of the not-for-profit agency Canada Health Infoway Inc. It is to

accelerate the implementation of inter-operable solutions through directed investment programs for different functional aspects of inter-operable EHR systems, including the infrastructure needed for this. Since 2001 Infoway has received CA\$ 2.1 billion in funds from the federal government and has allocated those funds across 12 structured investment programs. It has used these funds to co-invest with the provinces, territories and other partners in more than 380 projects focusing on such areas as electronic health records (EHRs), electronic medical records (EMRs), telehealth, public health surveillance, innovation and consumer health, as well as pan-Canadian projects for architecture and standards [12].

Work was started towards furthering the integration of electronic medical record (EMR) GP data, hospital, ambulatory care, and pharmacy systems data into a single national iEHR type of patient summary.

There have been public reviews of the work undertaken or initiated by Infoway, but other than in many countries Canada followed a relatively continuous, albeit slow development path towards integration.

## 2.5   International core patient data exchange service

A globally unique, cross-border eHealth system to make basic patient data available to healthcare providers in another country and in another language (and, if necessary, another alphabet) is:

- The pan-European eHealth framework and ICT infrastructure for Smart Open Services for European Patients – epSOS.

Its overarching goal has been to develop a practical eHealth framework and ICT infrastructure that will enable secure access to patient health information, particularly with respect to basic Patient Summary and ePrescription data, between European healthcare systems and their respective health services providers, particularly hospitals, GPs and pharmacies. It started in 2008, was partially funded by the European Commission, and preliminarily ended in 2014; it is expected that the Member States of the European Union will continue to further develop and expand these services. By now, 25 European countries are involved in this endeavour, and further countries are expected to join [13].

## Conclusions: The Role of eHealth Platforms for Better Healthcare

National or regional eHealth strategies are, at least in principle, driven by diverse policy needs for exchanging and integrating/aggregating patient, other healthcare and health system data with the aim to improve overall quality and efficiency of healthcare provision. Given the page constraints of this paper, it is beyond its scope to analyse these strategies in any detail. Rather, its focus is on concrete instantiations of such strategies as evidenced by regional or national electronic platforms and infrastructures to gather and exchange such data. Nevertheless, it is surprising that hardly any national eHealth strategy document – and consequently also the case studies on how they were implemented - conceptualizes and discusses at any (greater) detail core issues of interoperability, like what it really means, why it may be desirable for which policy field and for which stakeholders, what degree of interoperability in which health

system domain should be accomplished, and what benefits to expect from the sometimes very substantial investment expenditures and sustainability costs.

Although the cases briefly sketched stretch from sometimes relatively small – both in scope and with respect to the number of citizens covered – systems to large, highly complex national systems, a few generic conclusions can be immediately derived. Perhaps the most evident conclusion of these global case analyses is that at any level successful, early results delivering eHealth interoperability platform initiatives are clearly demand driven. As was noted earlier, particularly in more resource restricted environments like those in Belize, Gilgit-Baltistan or Western Cape Province the focus of the initial applications was by necessity on well circumstribed health system needs and priorities, where relatively straightforward solutions could deliver early benefits to both professionals and patients.

A corollary of this conclusion is that rather than focusing during the planning stage on the overall broadness of potential modules and eHealth applications to be supported by such an eHealth platform, it is more important to focus on a scope that is commensurate to given situation. All good practices show that only a limited set of services is being implemented in a given instance.

The cases also underline that the more successful, faster implemented platforms can be found at the district (or small country) implementation level, but sometimes linked to and taking advantage of cooperation and agreements that are made at the national level. It seems that as the size and/or the scope of an eHealth infrastructure increases beyond a certain level, which may be more than 10 m inhabitants and a variety of disparate domain functionalities, it becomes very difficult to manage its complexity both at the technical and the organisational level.

## Acknowledgements

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