Integrated clinical information systems: an essential resource – an opportunity for International cooperation

Angelo Rossi Mori
Istituto Tecnologie Biomediche, CNR, Roma

By computerizing health records, we can avoid dangerous medical mistakes, reduce costs, and improve care. The future of Information and Communication Technology (ICT) in healthcare is citizen-oriented. The transition from the previous facility-centred approach turns into an unprecedented political challenge. In fact, it implies the simultaneous deployment of ICT in large communities and the integration of clinical, organizational and economic information.

The analysis of the ongoing transition processes in the most reactive countries shows that it takes several years to go through the following unavoidable phases: (i) diffuse awareness that innovative ICT solutions can improve quality of care and optimize resources, (ii) debate to reach a common vision across stakeholders and production of a White Book, (iii) definition of a long-term roadmap with short-term milestones, (iv) creation of an eHealth agency to support the coordination of ICT professionals and the dissemination of know-how, (v) launch an acceleration program with significant (federal) financial resources.

The close cooperation among jurisdictions within a country and the international cooperation – throughout all the phases of this process – can produce faster and more robust solutions, at minor cost.

Introduction

The next generation of ICT solutions in healthcare faces an unprecedented challenge, for the amount of resources simultaneously involved, the geographical scale and the need of integration of many heterogeneous information systems. It becomes a key political issue.

The deployment of the next generation of ICT solutions is a key political issue

“By computerizing health records, we can avoid dangerous medical mistakes, reduce costs, and improve care”, said President Bush in his State of the Union Address of January 2004 [1]. A few days later, he affirmed that “moving American medicine into the information age” is a step that Congress can take this year [2].

The English government already took this step. In the last few months it signed contracts for 8 billions euro over ten years, to gradually deploy a lifelong Electronic Health Record (EHR) that will be safely accessible anytime and anywhere [3]. To achieve this goal, the National Program for Information Technology (NPfIT) will double ICT spending in the next three years, from the present 2% of the health budget to about 4%.

In Canada, the central and regional governments in 2001 created Infoway, Inc. to accelerate the introduction of ICT in the health sector and in 2003 they provided an additional budget of 400 million euro. The President of Infoway declared: “Whereas in the U.S. health-care spending on information technology (IT) is around 5.5% of operating budgets, in Canada we invest only 1.8% of health care operating budgets for IT. The gap is even wider when we compare the health-care industry with other information-intensive sectors, such as banking and government, where IT spending ranges from 9–13% of operating budgets” [4].

Other highly reactive countries (in Europe as well in Australia) entered the same process, with strategic plans for the introduction of the EHR solutions and the related infrastructures, mostly deployed at regional level.
An epochal change of perspective, re-focused the citizen’s needs

The approach to ICT in healthcare was driven until now by the economic and managerial needs of each healthcare facility and by the clinical requirements of the individual healthcare professionals.

The focal point of the ongoing epochal shift are instead the needs of the citizen/patient (tab. 1).

Towards a theory on the evolution of ICT and healthcare

The diffusion of international standards specific for ICT applications in the health sector (e.g. DICOM [8], HL7 [9], ISO [10], CEN [11]), with pragmatic approaches for their effective usage (e.g. IHE [12]), is a prerequisite to reach the required levels of integration, at least from a technical point of view.

However, the process of change cannot be managed anymore through separate and independent decisions of individual healthcare facilities.

From “technical awareness” to “political awareness”: agencies and acceleration programs

In fact, according to the experiences observed in various countries, the “technical awareness” is not adequate to face the level of the challenge. It seems however to be a precondition to trigger the “political awareness”, and thus to enter a phase of public interventions to facilitate the close cooperation among all the involved stakeholders (i.e. national and regional authorities, standard developing organizations, hospitals and health trusts, health maintenance organizations, health insurances and third party payers, providers of software, services, telecom, security and hardware, together with the communities of health professionals, health informatics professionals and citizens).

The political awareness progressively brings to strategic plans and then to the creation of permanent collaborative eHealth agencies at regional and national level [e.g. 13, 14, 15, 16, 17, 18].

These eHealth agencies perform a set of structural tasks according to an explicit roadmap:

• to manage the task forces that produce strategic and technical material;

• to organize meetings and portals to build consensus and disseminate know-how;

• to produce surveys and to monitor the deployment of the strategies in regions and pilot sites.

Table 1

ICT as a service for citizens.
The deployment of modern ICT solutions can enable a citizen to:

• reduce waste of time for administrative procedures;

• take advantage of an effective continuity of care, thanks to an information system that facilitates collaboration among all the health professionals caring for him/her;

• access the up-to-date information about healthcare facilities;

• access – through the Internet and in his/her language – authoritative multimedia knowledge (on diseases, drugs and procedures) and the guidelines to express a more appropriate demand for care (see for example NHS Direct on-line [5]);

• manage in a secure way his/her personal clinical information (see for example "My Health Space" in NHS Direct [6]).

This conversion requires the diffusion of clinical information systems [7], and the integration of clinical, organizational and managerial information within each healthcare facility. Moreover it requires the simultaneous deployment of coherent ICT solutions for all the facilities in communities of increasing coverage that, for several functions, will expand beyond the regional and national dimensions.

Data warehouses for top management and for public health – timely fed by reliable information extracted from the care process and interpreted according to reference care pathways – will enable to consider the appropriateness of resources and the quality of care with respect to the specificity of individual patients.
The success of the coordination initiatives is making evident that large benefits will come by increasing the speed of nation-wide infrastructures and from a close synergy among the different jurisdictions, to drive a balanced and accelerated process of change management.

Recently a few countries [e.g. 19, 20, 21] and the largest health maintenance organization in the US [22] entered a further phase: the EHR Acceleration Programs, providing additional resources that can exceed the billion of euro per year.

The eras in the evolution of ICT in healthcare

The combined evolution of organizational models for healthcare provision and of ICT solutions corresponds to a sequence of particular steps in health information systems, within and across organisations, up to a regional, national and international scale.

For explanation purposes, this evolution is schematized here into 3 main eras (the first one is divided into three periods). Each step involves an optimal percentage of spending in ICT with respect to the healthcare budget (see fig.1). The steps in this evolution determine the approaches to ICT standards and the focus of research and development efforts, as well the innovation transfer modalities.

Firstly, information systems in the "proto-taxic era" were mostly provider-centred. This is the era of the preliminary (proto-) organization (-taxon) on ICT solutions, when individual hospitals and local trusts were bringing information technology into the healthcare sector. This era can be divided into three periods:

- In the ancient period of Health Information Technology, the "paleohitic period", a number of hospital wards and services autonomously decided to implement each single application.

- In the intermediate period, the "mesohitic period", communication between applications is pursued, by a first generation of international standards (HL7 [9], CEN [11]). The decisions typically involve several units within a hospital.

- In the new period, the "neohitic period", platforms and common services are developed to integrate subsystems within the hospital or to harmonise views for continuity of care within networks for particular pathologies. The deployment of ICT is managed at the level of the whole hospital or a local community.

During the prototaxic era, the evolution across the periods is left to spontaneous local initiatives, with a myriad of decision makers following different priorities according to their local contexts. For that reason, many local situations at different evolutionary stages (or even in the "pre-hitic period", i.e. paper and pencil) may coexist within the same country.

Several countries and Regional Authorities are realizing that nowadays the evolution should be suitably controlled, as described above. Therefore they are now entering in the "modern era" of eHealth, which implies regional integration and strategic federal initiatives to synchronize and accelerate the local processes. Moreover, there is a need for specific resources and infrastructures deployed at Regional and National level. Information systems should be patient-centred.

Finally, we can expect that in future we will see a "utopian era", to bring the healthcare sector into the Information Society, within a global systemic vision of ICT across all the economic sectors, including in particular social and health sectors and comprehensive e-government actions. The information systems will be fully citizen-centred.

An opportunity for cooperation among jurisdictions

To enter the modern era, each jurisdiction should activate a collaborative process of change management, with a proper blend of regulations, incentives, education and an appropriate amount of human and financial resources.
Each jurisdiction should develop a comprehensive vision on ICT solutions, customized to its actual context. This vision is the framework for a roadmap with long-term objectives, reached through an explicit sequence of partial milestones, and for the decisions of hospitals and local trusts.

The unprecedented challenge requires a cooperation among Regions and countries

In several countries, regions are already cooperating to define their role with respect to hospitals and local trusts, i.e. to promote not only the deployment of a technological infrastructure (e.g. by the e-government actions not specific for healthcare), but also of an information infrastructure (usually termed as "Infrastructure"). The latter area deals with the logistic, methodological and conceptual support to ICT professionals and to decision makers, to exchange know-how and best practices, to develop reference material and to increase the confidence on innovative ICT solutions and on new organizational models supported by ICT [23].

Quoting again the President of Infoway [3]: “Infoway’s value-added is our collaborative approach. By working in partnership with health-care providers and by developing interoperable solutions – usable and reusable by all health jurisdictions in Canada – Infoway ensures that each dollar invested provides maximum return and impact. Our analysis shows that if jurisdictions were to implement EHR in isolation, the estimated one-time costs climb to $3.8 billion. However, with Infoway’s collaborative approach, the cost is estimated at $2.2 billion – a potential saving of $1.6 billion”.

The distribution of tasks and the exchange of know-how across jurisdictions in the same country, and international cooperation, are crucial goals [24–26].

They are effective even in presence of significant differences in the organization of the healthcare systems and in the criteria for financing and reimbursing of care facilities. In fact, medicine is universal and basic functionalities involved in the care process obey to common principles. A demonstration of this axiom is the success of HL7 – the most widespread standard developing organization on ICT for health – that is currently involving about 30 National affiliates in the usage and in the further development of the standard.

How to activate “unaware” countries

Several “reactive” countries already started with their acceleration programs. On the contrary, in many “unaware” countries the enormous potentiality of modern ICT in healthcare is not yet adequately recognized.

In countries like Italy there are many skilled people and optimal experiences, however they are too isolated to express together a proactive “willingness” at the country level, i.e. they are not able to impose in the country the debate with opinion leaders that will bring to eHealth agencies and acceleration programs.
The lesson learned from the reactive countries could be transferred to the unaware countries, to learn how to trigger the passage to the modern era (tab. 2).

For example, in Italy the spending on ICT is around 0.5% of operating budgets. Nevertheless, ICT is nowadays a mandatory component of a modern healthcare enterprise. Decision makers are not yet aware of the heavy costs of not using properly the modern ICT solutions.

Hospitals and local trusts should be guided to overcome the budget limitations and to increase in a few years and in an optimal way the ICT spending towards some 5%.

Decision-makers must be assisted to understand the opportunities coming from advanced ICT solutions, to adapt them to their own context, to develop a precise road-map with limited initial actions to harvest immediately the economical effects and the improvements in quality.

With the current spending, in the Italian local trusts and hospitals there are perhaps 3000 ICT professionals, i.e. a very low amount if compared to the 20000 professionals in the NHS in England (i.e. in a healthcare system similar to the Italian one), presumed to raise by another 7000 in the next three years.

In turn, the market on the whole has difficulty to maintain a decent level of innovation and quality.

It is a delicate issue to divert skilled professionals (in the public sector as well in the industry) from their daily activities, to deal with policies and investment on future. Therefore the most crucial action should be to create the context to optimize the benefits from the involvement of most competent professionals, i.e. to set up the framework for cooperation to transfer know-how and build a common infrastructure.

A Reference Centre with a permanent staff of full-time mediators should be set up in each jurisdiction, to select and transfer know-how to and from eHealth professionals, with appropriate resources to establish an international network among Reference Centres.

Most countries should gain knowledge of the potential approaches how to increase awareness, how to build the community of eHealth professionals, and how to introduce the culture of standards. But the most crucial investment should be in the education.

Within the hospitals, the current role of “technology manager” should evolve into the role of a “Chief Information Officer”, with a proper responsibility near the Chief Executive Officer.

A large number of ICT professionals should be educated into the peculiarities of healthcare, and many new jobs for these eHealth professionals should be created, specially in hospital and local trusts.

On the other side, the healthcare professionals should develop the skills on the innovative management of information with the support of ICT.

---

**Table 2**

Some potential short-term actions to trigger a process of change management in “unaware” countries.

- each hospital or local trust should recognize the crucial role of a Chief Information Officer (CIO) directly linked to the Chief Executive Officer and should make an aggressive plan for the enrolment of a suitable number of ICT professionals;
- each hospital or local trust should require, in the next contracts, the provision of certified applications (e.g. through IHE) and the usage of open standards (e.g. DICOM, HL7), according to National implementation guidelines and profiles;
- the eHealth community should produce a White Book on the opportunities for ICT in healthcare, with an appropriate debate to reach consensus on a common vision across all the potential stakeholders;
- the responsible of each National, Regional, local project should make easily available to the community a structured description of the project, its goals, its expected deliverables, its contribution to the overall vision, together with the collection of promotion and technical material already produced, in order to be able to compare the lessons learned from each project and harmonize their different solutions;
- each jurisdiction should set up a permanent Reference Centre, to transfer know-how to and from ICT professionals, supported by a web-based virtual community and documentation centre [24, 27]. Appropriate resources should be devoted to look for cooperation with Reference Centres of other jurisdictions;
- the community of health professionals should begin to collect and compare the definitions of the structured content of the components of the Electronic Health Records, in relation to specific tasks and contexts (e.g. including diagnostic reports, discharge letters, disease registries, etc), in order to improve their coherence [28].
Conclusions

Information and Communication Technology (ICT) is ready to support the integrated management of clinical, organizational and economic data, with a dramatic improvement in the quality and appropriateness of care provision, as well in the effectiveness of clinical governance and managerial decision making, eventually based on accurate and timely data coming from the actual care processes. The effects on public health surveillance and control can propagate up to Regional and National Authorities.

National and Regional Authorities – each within its own scope – may facilitate harmonization of local subsystems and their integration, by promoting the implementation of a technological infrastructure, of an informative infrastructure (infostructure) and of basic common services. It is an opportunity for cooperation at European level.

We need to create a common vision and a robust context all over Europe, for the healthcare organizations on one side and for the industry on the other, encouraging the National and Regional customizations according to well established criteria and/or guidelines for the implementation of the standards.

Indirectly this infostructure will provide a large benefit to the industry too, as the substrate to support the expansion of the European market. In fact, the international convergence towards a common understanding of the framework and a robust methodology will in turn facilitate the development of new commercial services (indexes, registries, data warehouses, servers) and a proper diffusion of innovative commercial applications.

The challenge is huge. Let’s learn together how to face it.

Acknowledgments

The ideas presented here were developed through discussions with many colleagues linked to the following projects and organizations: CEN, Ehtel, HL7, Mobidis, Osiris, Prorec, Widenet. The documents on e-health strategies are being collected and analysed by the OSIRIS Project, co-financed by the Italian Ministry of Health.

References

6. NHS. Welcome to your NHS HealthSpace. https://www.healthspace.nhs.uk/.
9. Health Level Seven. ANSI-HL7. see www.hl7.org
12. Integrating the Healthcare Enterprise (IHE). www.rsna.org/IHE (International Committee) or www.ihe-europe.org (European Committee)


24 OSIRIS Project to build an e-community on health ICT in Italy. www.e-osiris.it.


26 EUROCER European Institute for the Promotion of the Electronic Health Record. www.eurorec.net/main.htm.
