An integrated approach to telemonitoring noncommunicable diseases: Best practice from the European Innovation Partnership on Active and Healthy Ageing

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ABSTRACT: The European Innovation Partnership on Active and Healthy Ageing (EIP on AHA) has prioritized noncommunicable diseases (NCDs). An innovative integrated health system built around medical systems and strategic partnerships is proposed to combat NCDs. Information and communication technology (ICT) is needed for the implementation of integrated care in a medical systems approach. The Teaching Hospital of Montpellier has set up the clinic and uses IP-Soins® as an ICT tool. Patients with NCDs will be referred to the chronic disease clinic of the hospital by a primary care physician. This paper reviews the complexity of NCDs intertwined with ageing. It gives an overview of the problem. It presents an innovative approach in the implementation of a clinical information system in a “SaaS” (Software as a Service) mode.

Chronic diseases are diseases of long duration and slow progression. Major noncommunicable diseases (NCDs: cardiovascular diseases, cancer, chronic respiratory diseases, diabetes and mental health) represent the predominant health problem of the century. NCD prevention and control are the priority of the World Health Organization, the United Nations and the European Union 2010 Council. The new trend for the management of NCDs is evolving towards integrative, holistic approaches (Bousquet 2011). To tackle them in their totality and reduce their burden and societal impact, NCDs could be considered as a single expression of disease with different risk factors and entities. NCDs require an integrated care model using multidisciplinary and teamwork approaches to provide optimal care on a basis of adequate public health strategies (Harris 2010, Chan 2010).

European Innovation Partnership on Active and Healthy Ageing (EIP on AHA)
NCDs particularly affect elderly patients. Functioning and physical health declines with advancing age and/or NCD co-morbidity (Moussavi 2007). As the general population ages, the number of patients with NCDs is growing with gender differences (Ninot 2006).

Active and Healthy Ageing (AHA) is a major societal challenge common to all European countries and to all populations. Ageing, intertwined with socioeconomic inequalities, is an under-appreciated cause of poverty. AHA should be promoted very early in life.

In the EU, several initiatives are responding to this challenge and consider NCD co-morbidities as key factors. The European Innovation Partnership (EIP) aims to enhance EU competitiveness and to tackle societal challenges through research and innovation. It addresses weaknesses in EU research and innovation (e.g., under-investment, fragmentation and duplication), which considerably complicate the discovery or exploitation of knowledge, and may ultimately prevent the entry of innovation to the market place.

The pilot EIP on AHA will pursue a triple win for Europe (EIP):
+ enabling EU citizens to lead healthy, active and independent lives while ageing;
+ improving the sustainability and efficiency of social and health care systems;
+ boosting and improving the competitiveness of the markets for innovative products and services, responding to the ageing challenge at both EU and global levels, thus creating new opportunities for businesses.

The overarching target of this partnership will be to increase the average healthy lifespan by two years by 2020 (measured by Healthy Life Years (HLY)) (Jagger 2008). Other indicators include unavoidable hospitalizations for NCDs.

MACVIA-LR (contre les Maladies Chroniques pour un Vieillissement Actif en Languedoc Roussillon) is an integrated programme led by the President of the Région Languedoc Roussillon in order to fight chronic diseases for AHA. It includes all pillars of the EIP on AHA centred around NCDs (Bousquet 2012).

Integrated care model for the control of NCDs
A worldwide debate on the efficiency of primary health care attempts to re-orientate health systems in all countries, optimizing costs (WHO 2008). Primary health care provides the means of organizing a complete range of care, from home to hospital,
investing resources rationally in the different levels of health. NCDs require an integrated care model using multidisciplinary and teamwork approaches, in which primary care is on the front line, in order to provide optimal care on a basis of adequate public health strategies (Harris 2010, Chan 2010).

**Information and communication technology (ICT)**

ICT is needed for the implementation of integrated care in a medical systems approach. Although home telemonitoring appears to be a promising approach to patient management, designers of ICT could consider ways of making this technology more effective as well as controlling possible mediating variables, and considering diseases in their totality. Continuous and precise monitoring makes the clinical history of each patient a valuable source of comprehensive information. More user-friendly and efficient ICT platforms are needed to understand and tackle NCDs in their totality over several years using precise constructs which need to be validated (Valderas 2009). The effectiveness of interventions to promote ICT adoption in health care settings remains uncertain (Cagnon 2009), probably since co-morbidities are not included in most plans.

**Shared decision-making (SDM)**

SDM, the process by which a health care choice is made jointly by the practitioner and the patient, is an essential objective for patient-centred care in an integrated ICT system (Legare 2010). An innovative patient management programme combines ICT and SDM in a multidisciplinary approach. Patients’ values and preferences should dominate decision making (Collins 2010).

An innovative patient management programme could combine ICT, SDM, personalized patient education and an interaction between primary, secondary and tertiary care levels when available and appropriate.

**Integrated care, CDSS and ICT**

“Integrated care is a concept bringing together inputs, delivery, management and organization of services related to diagnosis, treatment, care, rehabilitation and health promotion. Integration is a means to improve services in relation to access, quality, user satisfaction and efficiency” (Crone 2001). Integrated care is of importance in service provision to the elderly, as elderly patients are often chronically ill and present several co-morbidities.

Clinical Decision Support Systems (CDSS), an interactive decision support system (DSS) computer software specific to the co-morbidity clinic, will assist physicians and other health professionals with decisions in the diagnosis and management of patients. When possible, it will also be linked with the *Dossier Pharmaceutique* and, for the Teaching Hospital of Montpellier, IP-Soins (Figure 1). The *Dossier Pharmaceutique* (pharmaceutical dossier, article L.1111-23 Code de la santé publique) aims at the electronic monitoring of patients’ prescriptions by pharmacists. In France, 15,000 – 22,000 pharmacists use the system which makes it possible to track the prescription of medications (article L. 4211-1).

This integrated system will enable continuity of care which is often subdivided into three components:

- continuity of information (though shared records);
- continuity across the secondary–primary care interface (discharge planning from specialist to primary care);
- provider continuity (seeing the same professional each time with value added if there is a therapeutic, trusting relationship).

**Hospital-based clinics and links with primary care**

The Teaching Hospital of Montpellier has set up a clinic and uses IP-Soins as an ICT tool. Patients with NCDs will be referred to the chronic disease clinic of the hospital by a primary care physician. After co-morbidity evaluation, the patient will be followed up in primary care.

A mobile chronic disease clinic has been set up using the same examinations in order to screen co-morbidities in remote areas of rural counties in the region.

An asset in the follow-up of chronic diseases, this innovative clinical information system (IPSoins), is operational in SaaS (Software as a Service) mode (Figure 3).

IPSoins is an innovative clinical information system that has been designed by the Teaching Hospital of Montpellier, France.

The IPSoins (the clinical information system) complies with the computerised management of general health care. This system functions in collaboration with the administrative management of the patient.

IPSoins has been designed around the computerized health file DXCARE from the French company MeDaSys, selected in November 2011 after a call for tenders.

In a very complex multifactorial context, the Teaching Hospital of Montpellier deployed its clinical information system in 2012 to 9,000 users in a record time of nine months.

IPSoins can be accessed on a network, enabling a secure and personalized sharing of the collected information.

To date, it can be noted that each month:

- almost 50,000 new reports are entered, most by an integrated digital dictation system;
- near to 80,000 appointments are made outside the hospital;
- approximately 200,000

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**Figure 1: Integrated care for major NCDs in the teaching hospital of Montpellier**

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<tr>
<th>Chronic diseases (DG Sanco)</th>
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<td>Chronic disease clinic</td>
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<td>Chronic neurologic diseases</td>
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<td>Musculoskeletal diseases</td>
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<td>Dossier pharmaceutique</td>
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<td>IP-Soins</td>
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<td>Databank</td>
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<td>ICT follow up of patients</td>
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prescriptions are prepared; around six million medical letters are typed.

In order to benefit from the best associated infrastructures and services, The Teaching Hospital of Montpellier has chosen to outsource the data and applications connected to IPSoins to several ultrasecure data centres with spare capacity. The Orange business service, which hosts health care data, has been selected for this purpose. IPSoins is therefore the first clinical information system of this scale in SaaS mode.

Integration of IPSoins® with MACVIA-LR


Deployment beyond France will be carried out by Noemalife (http://www.noemalife.com), a European leader in electronic medical records and a partner of MedaSys. Electronic data interchange (EDI) and enterprise service bus (ESB) are carried out using Antares® (enovacom, http://www.enovacom.fr), a software used by the Région Languedoc Roussillon to link different levels of care, stakeholders and citizens and public organizations.

The CDSS will establish a patient care coordination domain defining patient stratification. It will integrate and deliver interoperability across existing ICT tools dedicated to individual chronic diseases. It will use a cloud computing platform capable of protecting the confidentiality of medical data and providing real-time access and data analysis.

A wide variety of information managed and an exceptional collection of data and record acquisition

IPSoins stands out for the quality and diversity of the information that it manages. IPSoins provides hospital health care professionals with one single tool that can be used for all the information it handles: letters, administrative information, requests for/results of tests and imaging, specialist medical files, vocal recordings and videos, databases, etc.

Within the framework of research on chronic pathologies, innovative algorithms and statistical models are being developed, tested and put on the market. The aim is to explore large amounts of information that are heterogeneous and diverse but combined, in order to search for decision support systems.

Pooling information of different specialities

In its standard catalogue, IPSoins aspires to provide a large number of "career" modules including medical, surgical and psychiatric specialties, obstetrics and follow-up care.

In case of missing elements, uncertainties or specific needs such as the management of a clinical study, an extension module using questionnaires is available. This enables the possibility of qualitative management of chronic diseases.

The computerization of old files are necessary for the follow-up of chronic diseases

This diversity does not only concern recent information: the launch
of IPSoins was accompanied by a big effort to update existing files, whether computerized or still on paper. For certain departments, activity since 1985 is now online: 23 million documents, covering the past 15 years and relating to eight million records and more than 1.6 million patients, have been retrieved from the old systems.

**A system ready for telemedicine**

Constructed by means of Internet technology, IPSoins is secure and readily accessible to the other actors involved in the follow-up of patients suffering from chronic disease.

Through telemedicine, it is possible for private health care professionals to access part of the medical file from a distance when following up on patients with chronic disease. Such is the case for private doctors and for professionals from the medico-social sector. This access is highly secure and already possible from sites outside of the Teaching Hospital of Montpellier. A very finely-tuned, specific and precise management mechanism allows administration of rights satisfying the statutory and legal regulations regarding access to patient data.

**In conclusion**

eHealth is the natural extension of an open and secure clinical information system and an ally for the follow-up of chronic diseases (EIP on AHA).

+ IPSoins is a natural basis for the many functions in e-Health:
  + IPSoins is deployed in SaaS mode and is hosted by a personalized health care data system;
  + IPSoins can be adapted to the user. Each user can adapt the system to his (her) own views;
  + the IPSoins engine has a functional richness allowing it to fulfill many needs;
  + thanks to its adaptative software, IPSoins can be extended: specialty files, enquiries, documents for private practice, etc.

The Teaching Hospital of Montpellier provides the complete IPSoins package to its partners, within its territory and to the region.

e-Health is thus developing a new model for hospitals by transforming the relationship between hospitals and private practices and between doctors and patients. Chronic patient habits seem to be different, i.e. much more inclined towards empowerment. These patients use e-health to follow-up on their disease, as well as for education, training and exchange. A recent study conducted by the Massachusetts Institute of Technology ([http://digital.mit.edu](http://digital.mit.edu)) has shown that no matter what sector an organization belongs to, it will gain between 12% and 26% in efficiency and efficacy when concentrating on the development of digital technology.

Jean Bousquet is a full Professor of Pulmonary Medicine at the University of Montpellier, France. He is the coordinator of MeDALL (Mechanisms of the Development of Allergy, a Framework Programme 7 (EU) Integrated Project (2010-15)), past-Chairman of the WHO Global Alliance against Chronic Respiratory Diseases (GARD), the founder of ARIA (Allergic Rhinitis and its Impact on Asthma, in collaboration with the World Health Organization (WHO)) and co-coordinator of Action Plan B3 of the European Innovation Partnership on Active and Healthy Ageing (Action 5: Care Pathways, Integrated Care for Chronic Diseases).

Professor Bousquet has a public health interest in particular as past-Chairman of the WHO GARD. The main activity of GARD is to help include chronic respiratory diseases in the UN Resolution A/RES/64/265. He is leading the Région Languedoc-Roussillon programme on chronic disease for an active and healthy ageing.

Jean Bousquet has edited and authored over 675 peer-reviewed papers posted on Medline. He was the editor of Allergy, the second ranking journal in the field, 2003-2009. His H factor is 90.

References


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Rodolphe Bourret is a hospital director. He is also a trained engineer and has a PhD in physics. He has held various roles in systems information, finance and management within teaching hospitals, local authorities and national committees. He is currently Deputy Director General of the Teaching Hospital of Montpellier. He is also Director of the hospital’s research and innovation unit and a member of the National Commission on Teaching, Research and Innovation.