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Strategic Intelligence Monitor on Personal Health Systems Phase 3 (SIMPHS3)

NEXES (Spain) Case Study Report

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Abstract

The NEXES case, based on a project co-funded by the ICT Policy Support Programme Area (CIP-ICT-PSP-2007.2.2 – ICT for ageing well), aims to deploy "integrated care services for chronic patients based on structured interventions addressing not only prevention, but also healthcare and social support". NEXES is currently in the transitional phase from existing pilot experiences to extended deployment of health/social services for elderly populations. It can supplement existing institutional approaches or offer an alternative to them. The services are grouped in four programmes that represent a broad spectrum of health problems, from those affecting citizens at risk or in the early stages of a disease to those that affect patients with advanced chronic disorders. The programmes comprise the following: (1) Wellness advice and rehabilitation for in clinically stable chronic patients to promote healthy life-styles, enhancing their self- management and improving adherence to prescribed treatments; (2) Enhanced care for frail patients, which aims to assess prevention for frail patients at high risk of hospitalisation; (3) Home hospitalisation (HH) and early discharge, which aims to explore the potential for generalisation of HH and the analysis of the interplay with other Integrated Care Services (ICS) for chronic patients; and (4) Remote support to primary care for diagnosis and therapy (Support), transferring specialised diagnostic and therapeutic interventions to primary care.

Acknowledgments

Preface

The Strategic Intelligence Monitor on Personal Health Systems (SIMPHS) research started in 2009 with the analysis of the market for Remote Patient Monitoring and Treatment (RMT) within Personal Health Systems (PHS). This approach was complemented in a second phase (SIMPHS2) with the analysis of the demand side, focusing on needs, demands and experiences made with PHS by healthcare producing units (e.g. hospitals, primary care centres), healthcare professionals, healthcare authorities and patients amongst others.

Building on the lessons learnt from SIMPHS2 and on the European Innovation Partnership on Active and Healthy Ageing initiative, SIMPHS3 aims to explore the factors that lead to successful deployment of integrated care and independent living, and define best operational practices and guidelines for further deployment in Europe. This case study report is one of a series of case studies developed to achieve these objectives.

The outcomes of SIMPHS2 are presented in a series of public reports discussing the role of governance, innovation and impact assessment in enabling integrated care deployment. In addition, through the qualitative analysis of 27 Telehealth, Telecare and Integrated Care projects implemented across 20 regions in eight European countries investigated in SIMPHS2, eight facilitators have been identified, based on Suter's ten key principles for successful health systems integration.

The eight main facilitators identified among these as necessary for successful deployment and adoption of telehealth, telecare and integrated care in European regions are:

- Reorganisation of services
- Patient focus
- Governance mechanisms
- Interoperable information systems
- Policy commitment,
- Engaged professionals
- National investments and funding programmes, and
- Incentives and financing.

These eight facilitators have guided the analysis of the cases studied in SIMPHS3 and a graphical representation with arrows whose length represents the relative importance of each facilitator is presented in each case study.

In addition to the above facilitators analysed in each case report, a specific section is dedicated to the analysis of care integration. It should be noted that the definition of vertical and horizontal integration used in this research is taken from the scientific literature in the field of integrated care[1] and differs from the one mentioned in the European Innovation Partnership on Active and Healthy Ageing Strategic Implementation Plan[2]. We define horizontal integration as the situation where similar organisations/units at the same level join together (e.g. two hospitals) and vertical integration as the combination of different organizations/units at different level (e.g. hospital, primary care and social care).

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[1]   Kodner, D. (2009). All together now A conceptual Exploration of Integrated Care.

[2]   http://ec.europa.eu/research/innovation-union/pdf/active-healthy-ageing/steering-group/operational_plan.pdf (page 27)

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Case outlook

The NEXES case, based on a project co-funded by the ICT Policy Support Programme Area (CIP-ICT-PSP-2007.2.2 – ICT for ageing well), aims to deploy "integrated care services for chronic patients based on structured interventions addressing not only prevention, but also healthcare and social support". NEXES is currently in the transitional phase between ongoing pilot experiences and extended deployment of health/social services for elderly populations. It can supplement existing institutional approaches or offer an alternative to them. The services are grouped in four programmes that deal with a broad spectrum of health problems, from those affecting citizens at risk of contracting a disease or in the early stages to those affecting patients with advanced chronic disorders. The programmes comprise the following:

(1) Wellness advice and rehabilitation for clinically stable chronic patients which aims to promote healthy life-styles, enhancing their self-management and improving adherence to prescribed treatments;
(2) Enhanced care for frail patients which aims to assess prevention of hospitalisation for frail patients at high risk;
(3) Home hospitalisation and early discharge to explore the potential for generalisation of HH and the analysis of the interplay with other Integrated Care Services (ICS) for chronic patients; and
(4) Remote support to primary care for diagnosis and therapy aimed at transferring specialised diagnostic and therapeutic interventions to primary care.

The focus is set on highly prevalent chronic conditions (COPD, chronic heart failure and diabetes). The study was carried out in Barcelona-Esquerra (540.000 inhabitants) with the idea that it would be extended to the rest of the region. Barcelona-Esquerra comprises a Hospital Clinic, a tertiary public hospital, two general hospitals, 18 primary care centres run by different providers, one mental health centre, one convalescence centre and health transportation systems/organisations. NEXES combines eHealth methods with integrated care models to facilitate more effective delivery of integrated care services through a Health Information Sharing platform, which facilitates communication and information flows across the continuum of care. It also allows inter-professional health teams to develop care pathways. The following figure shows the main facilitators. Interoperable information systems and reorganisation of services were the main drivers of the NEXES case, followed by engaged professionals and governance mechanisms. These were set in place to foster integrated care, taking into account the focus on patients and policy commitments at a hospital and regional level. Lastly, incentives, financing, national investments and funding programmes all play a minor role in this case.

Interoperable information systems

Reorganisation of services

Engaged professionals

Governance mechanisms

Patient focus

Policy commitment

Incentives and financing

National investments and funding programmes

Integrated care
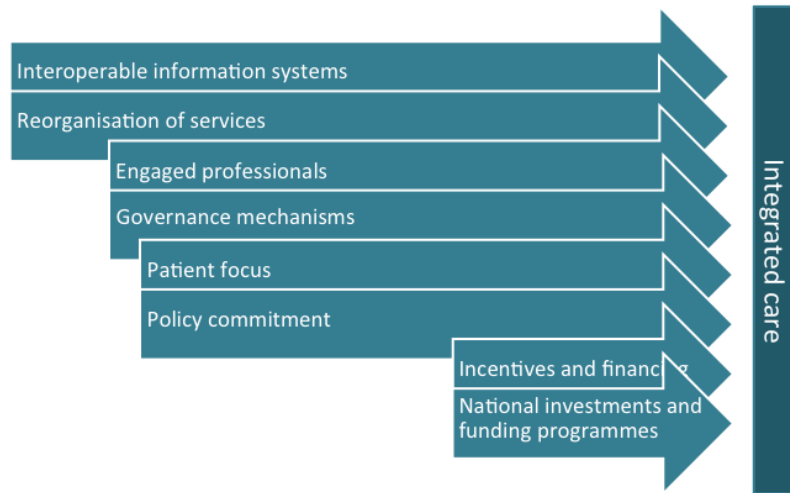
1. Background

## 1.1 Spanish social welfare and health care services

The Spanish Constitution of 1978 established the right to health protection and healthcare for all citizens. According to the Ministry of Health, Social Services and Equality (2012), the main principles and criteria that enable citizens to exercise this right are as follows:

- Public funding, universal coverage and free healthcare services at the time of use.
- Defined rights and duties for citizens and public authorities.
- Political decentralisation of healthcare devolved to the autonomous regions.
- Provision of comprehensive healthcare which strives to attain high levels of quality, and is duly evaluated and controlled.
- Integration of different public structures and health services under the National Health System.

Spain has a statutory national health system (SNS), which is characterised by universal coverage and funded by taxes. Services are largely provided free of charge at delivery, whereas most pharmaceuticals prescribed to people aged under 65 require a co-payment of around 40% of the price. Private voluntary insurance (OVI) plays only a minor role in the Spanish health system. The services provided are mainly complementary to the services provided under the statutory health system, and usually imply reduced waiting times for specialised care or access to services that are limited within the benefits package of the SNS. The political control of the Spanish health system rests with the regional governments (Comunidades Autónomas). There are 17 regional health ministries across Spain, each having primary jurisdiction over the organisation and delivery of health services within their respective regions. In its most typical form, a regional health system of an autonomous community is composed of a regional ministry (Consejería de Salud) that is charged with the general definition of health policies, the regulation of health care and its planning, and a regional health service that engages in the provision of services. The regional ministry organises and structures the health service within the region. Usually, it takes the form of two executive organisations that provide primary care or specialist care.

However, regional health systems frequently integrate primary and specialist care under a single management structure. A single primary care team (PCT), allocated to a patient and not freely chosen, takes the role of gatekeeper for access to services. Access to specialist care largely depends on prior referral from the GP. As a means of shortening the waiting lists, some specialised care delivery is contracted out to private hospitals, but around 40% of all hospitals in Spain belong to the SNS. Most of the public health expenditure in Spain is financed through general taxation (>94%). This is supplemented by contributions from payroll tax and employers contributions, and the health insurance for civil servants.

Figure 1: Spanish National Health System characterisation
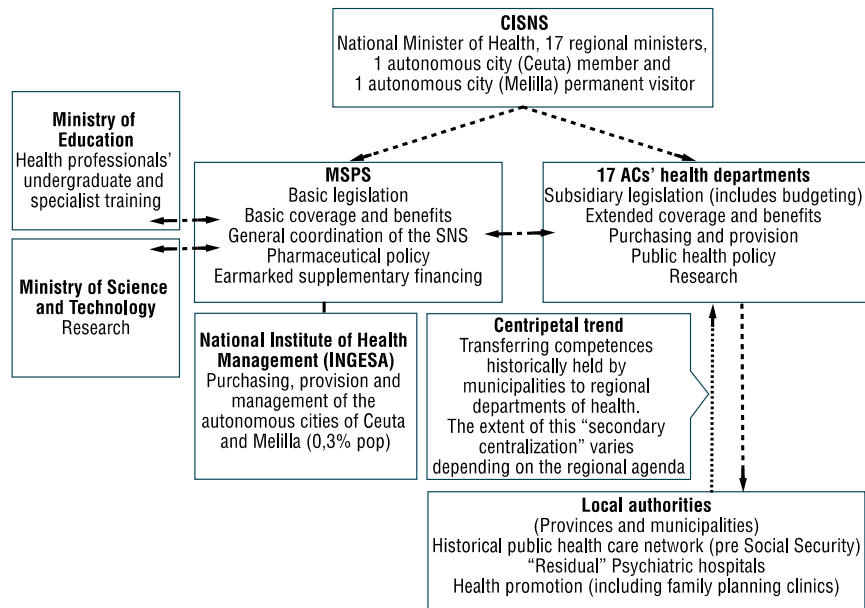
Source: García-Armesto et al (2010)

Public health expenditure relates mainly to both in- and outpatient specialist care (54%), primary health care (16%), pharmaceuticals (19.8%), and prevention measures and general public health (1.4%). The regional government administers the largest share of the public health resources, while the central government and the municipalities have a resource allocation of only about 3% and 1.25%, respectively. The primary care network is completely public, with care professionals working in multidisciplinary teams comprising GPs, nurses, social workers, or paediatricians who are linked to laboratories or diagnostic centres.

Figure 2 shows the financial flows across the Spanish NHS. The allocation formula is based on a per capita criterion, weighted by population structure, dispersion, extension and insularity of the territory.

Figure 2: Financial flows across the Spanish NHS
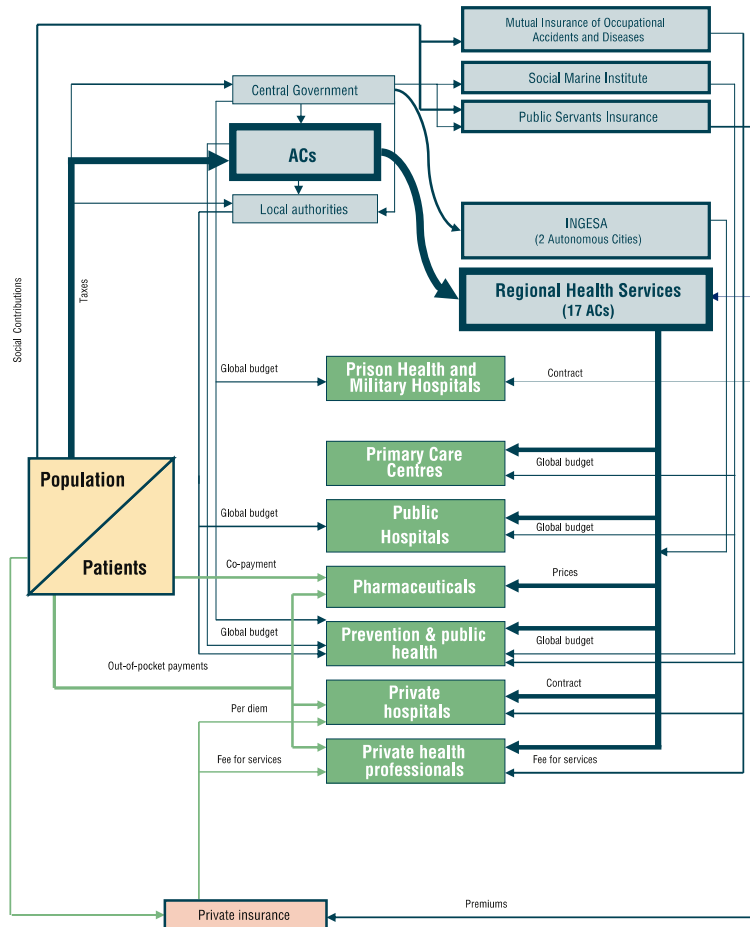
Source: García-Armesto et al (2010)

1.2 Catalonia region

Catalonia is one of the 17 Autonomous Communities, with a population of roughly 7 million inhabitants. This region has full competences in health services, as part of the decentralised Spanish health system. The Catalan government (Generalitat de Catalunya) has developed its own organisational model based on the historical evolution of the Catalan health system. The Department of Health (DSGC) is the maximum official authority for the definition, planning and development of healthcare services in Catalonia. The Servei Català de la Salut (CATSALUT) acts as a purchaser of services and guarantees quality control, while a network of public and private organisations provides the healthcare services.

The Catalan Health system, as defined by the Health Plan for Catalonia 2011-2015, comprises 451 primary care centres, 831 local healthcare centres, 96 acute care hospitals, 96 social health centres, 158 mental health centres (for adults and children/teenagers), and 42 centres for inpatient mental health care. The system is organised within 7 health regions divided into 56 health sectors and 369 basic health areas.

Figure 3: Regional health system characteristics
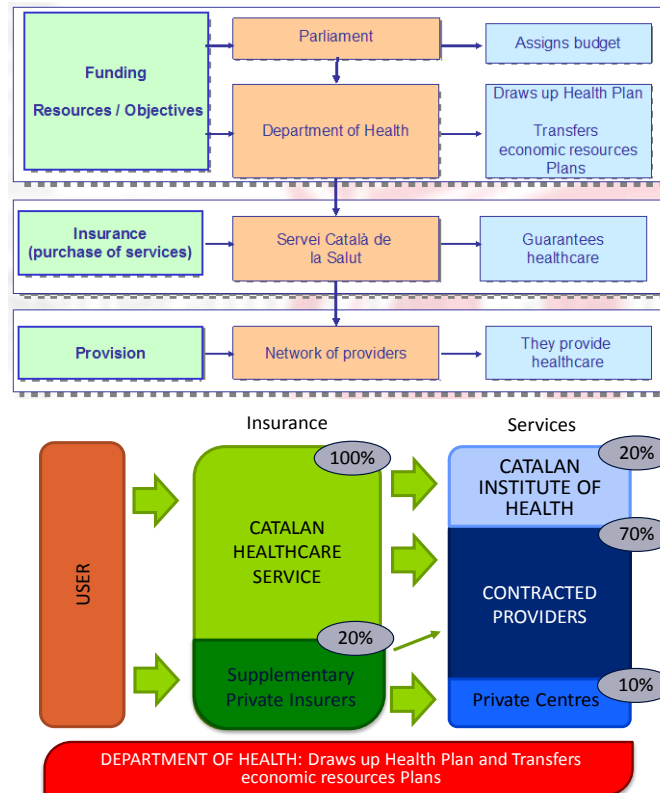
Source: Martinez (2013) and Contel (2014)

The Health Plan for Catalonia 2011-2015 mentions that 30% of these resources are directly owned by the government (through the ICS, National Health Institute, the biggest provider in Catalonia), while foundations, insurance companies and other private non-profit authorities own the remaining 70%. This situation has facilitated the separation of functions (purchasing-providing) in the Catalan Health care model, where CATSALUT acts as a purchaser of health care services, based on harmonised agreements and tenders, from private and public providers.

The Department of Health of Catalonia launched the "Health Plan for Catalonia 2011-2015." It is structured into 3 transformation pillars, 9 lines of action, and 32 strategic projects, and makes up the roadmap for the health system up until 2015 (see **Figure 4** below). This Health Plan envisages three very significant challenges:

(1) the continuously ageing population (the number of people over 65 years of age will increase by over 200,000 during the next 10 years);
(2) worsening habits and lifestyles (one in every two Catalans is overweight); and
(3) the increasing incidence of chronic diseases (in 2010, 34% of Catalans stated that they suffered from at least one chronic disorder).

Figure 4: Health Plan for Catalonia 2011–2015
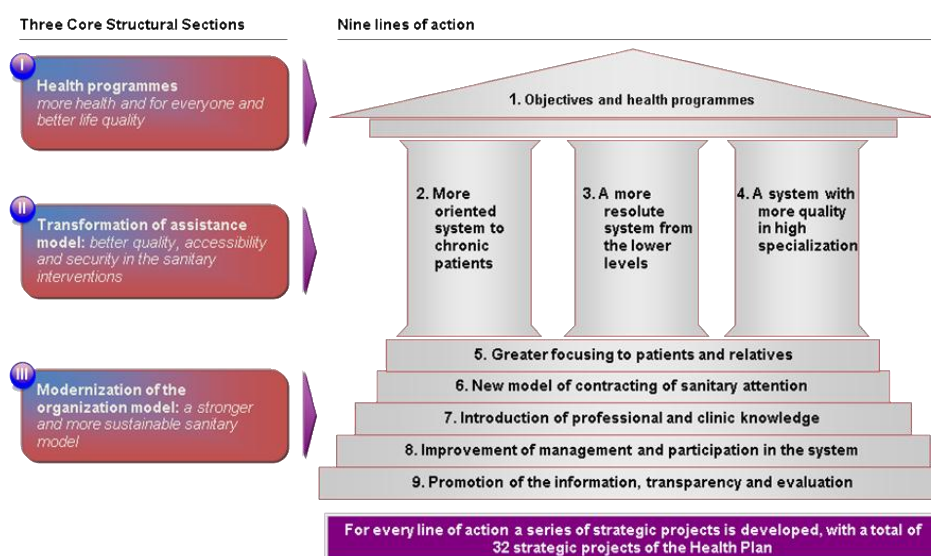
Source: Department de Salut. Generalitat de Catalunya (2012).

Transformation pillar II "Transformation of the healthcare model: better quality, accessibility and safety of healthcare interventions" puts the emphasis on pushing integrated care within the Catalan Health system using line 2 "systems more oriented to chronic patients" that contains six major principles: (1) A population–based approach focused on all – from the healthy patients with or without risk factors, to those who have a disease in any stage of progression; (2) Citizens being responsible for their own health; (3) The strengthening of professional initiative; (4) A comprehensive healthcare model; (5) The use of new technologies and (6) Inter–ministerial collaboration. This strategy is carried out in six major projects, which:

- Implement integrated clinical processes for 10 diseases.
- Foster health protection and promotion and disease prevention.
- Encourage patients and caregivers to be responsible for their own health and promote self–healing.
- Develop healthcare alternatives within the framework of a comprehensive system.
- Deploy regional programmes for complex chronic patient care.
- Implement for the rational use of medicines.

All these major projects reflect the need to define interventions and organise the services based on population stratification (see Figure 5) and a proactive, integrated approach (see

Figure 6). The Catalan Ministry of Health and the Ministry of Social Welfare and Family have created the Chronicity Prevention and Care Programme (PPAC), which should enable health and social sectors to work together in managing chronicity. Chronicity is an evolutionary process linked to the natural course of diseases, with certain initial stages that may be asymptomatic and a progression that can bring about acute care episodes, complications, and co-morbidity until the end of the person's life.

Figure 5: The continuum of chronicity in Catalonia

| Healthy 33% | Chronic non complex 62% | Complex 3,5% | Advanced 1,5% | End of life | Bereavement |

● PREVENTIVE APPROACH   ● PALLIATIVE APPROACH   ● SELFCARE
○ CURATIVE APPROACH   ● COLLABORATIVE CARE
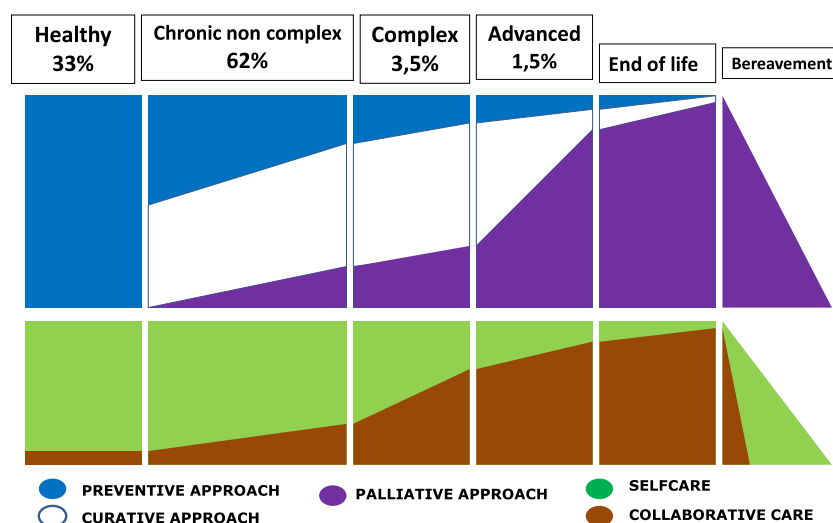
Source: Contel (2014)

The different stages of illness progression, from the point of view of population, create different groups within the population with different needs and risks. Therefore, different objectives and approaches are necessary.

Figure 6: Health care solutions for different strata population

	Characteristics	Objectives	
Complex Chronic Patients	• Patients with multiple chronic diseases or a severe main chronic disease and co-morbidity, usually with disability, and with frequent flare-ups and imbalances with loss of functional capacity	• Symptom control • Unbalance prevention • Decrease of use of hospital and emergency resources • Autonomy maintenance • Delay in institutionalization • Improvement of welfare and life quality, and patient and caregiver satisfaction	**Case Management**
People with chronic diseases in risk or fragile situations	• People with an advanced chronic disease in risk situation for complications but maintaining the capacity of self-healing. In advanced stages they can move towards an upper level own situation (complex chronic patient)	• Optimal control of the disease to encourage the progression and control of related symptoms, reducing flare-ups, hospitalizations and visits to emergency services. Maintenance of the autonomy.	**Disease management**
People with risk factors or low complexity chronic diseases	• People with risk factors for chronic diseases or little evolved chronic diseases	• Maintenance of health, clinical stability of underlying pathologies and prevention of the appearance or progression of severe diseases and/or disabilities	**Support for self-healing**
General population	• Population without risk factors nor underlying chronic pathology.	• Risk management of health, promotion of healthy life styles and preventive primary care activities	**Protection and promotion of health and disease prevention**

Source: Contel (2014)

The following table summarises the main figures about the Catalan health system.

Table 1: General information about Catalan Health System

Geographical coverage km²	**32,106**
Inhabitants per km²	235
Number of inhabitants	7,568,988
Life expectancy at birth years	77.3 males – 83.8 females
Regional GDP (2012) billion €	215
Regional GDP per inhabitant (2012) €/inhabitants	28,289
General Practitioners /1.000 inhabitants (2010)	0.72
Specialists /1.000 inhabitants (2010)	2.17
Regional Budget for Health services management (2013) billion €	17.8
Health care professionals / 100.000 inhabitants	317
Regional health care budget € per inhabitants (2013)	2,345
Hospital beds (2012)	23,600
Hospital beds/1.000 habitants (2012)	3.1
Chronic diseases information: The mortality rate due to chronic disease is as follows: 48% cancer; 48% cardiovascular diseases; 4% COPD	

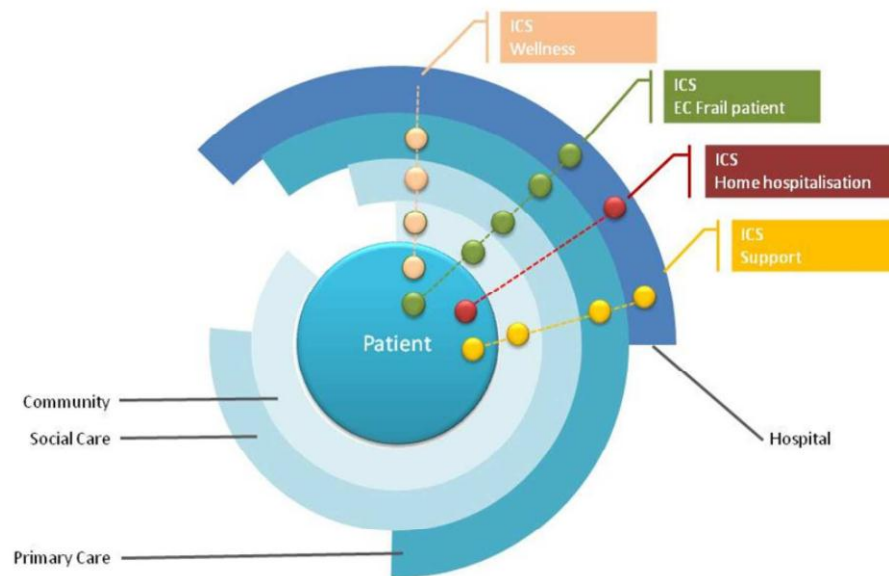Source: Department de Salut. Generalitat de Catalunya (2013)

1.3   NEXES: Hospital Clinic

The specific aim of NEXES, implemented under the ICT Policy Support Programme Area (CIP-ICT-PSP-2007.2.2 – ICT for ageing well) is to "deploy integrated care services for chronic patients based on structured interventions addressing not only prevention, but also healthcare and social support" .This fits into the project's general aim of strengthening the quality of care and reducing costs through improved collaboration between different levels of healthcare services. The project was launched by Hospital Clinic, a university hospital with about 900 beds serving an area with about 540,000 people. Hospital Clinic is a leading experimental institution, not only in Catalonia, but also internationally, especially with regard to eHealth and integrated care. Within these research areas, it is involved in a dozen European projects. It has further developed semi-autonomous services and its own software.

NEXES combines eHealth methods with integrated care models. It facilitates a more effective delivery of integrated care services, based on structured interventions, for chronic patients through a platform. Although it includes ICT-enabled remote monitoring (Tele-hospitalisation) and Telecare tools, NEXES is mainly used as a resource and knowledge management system within the context of integrated care service delivery (Roca et al, 2012).

The data model underlying NEXES could be scaled up to include predictive medicine and data analytics. NEXES' vision, thus, is to holistically support Integrated Care Services (ICS) enabled by innovative ICT and not merely deliver remote monitoring. NEXES' goal is to validate four ICT-enabled integrated care services (ICS) in large scale trials, targeting highly prevalent chronic conditions, mainly Chronic Obstructive Pulmonary Disease (COPD), Chronic Heart Failure (CHF) and diabetes.

NEXES is currently in transition between ongoing pilot experiences and extended deployment of health/social services to elderly populations. It can supplement existing institutional approaches be used as an alternative. The services are grouped into four programmes that represent a broad spectrum of health problems, from those affecting citizens at risk or in the early stages of a disease to those affecting patients with advanced chronic disorders. As described in the NEXES final report, the programmes comprise the following:

- Wellness training and rehabilitation (W&R) – This ICS for stable chronic patients aims to promote healthy life-styles in clinically stable chronic patients, enhancing their self-management and improving their adherence to prescribed treatments. The main objectives in W&R are to assess the deployment, effectiveness and long-term sustainability of a low-cost community-based rehabilitation programme supported by wireless ICT for clinically stable chronic patients. It focuses on the effects of the intervention on the sustainability of training over time and on the impact of the training programme on patient's daily physical activity and health-related quality of life.

- Enhanced Care for frail patients (ECFP) – One of the main aims of the ECFP programme was to assess prevention of hospitalisation in frail patients at high risk, but also to identify a set of ICS addressing management of frailty and complexity in a comprehensive manner.

- Home Hospitalisation and early discharge (HH) – The main objective of this ICS is to explore the potential for generalisation of HH and to analyse the interplay with other ICS for chronic patients.

- Remote Support to primary care for diagnosis and therapy – These groups of ICS have in common the transfer of specialised diagnostic and therapeutic interventions to primary care.

The NEXES project conducted large scale trials of the above four ICT-enabled integrated care services and identified strategies for extensive regional deployment. The focus was set

on highly prevalent chronic conditions (COPD, chronic heart failure and diabetes). The study was conducted in Barcelona-Esquerra (540.000 inhabitants) and aimed to extend the services in the future to the rest of the region. Barcelona-Esquerra has Hospital Clinic, a tertiary public hospital, two general hospitals, 18 primary care centres run by different providers, one mental health centre, one convalescence centre and health transportation systems/organisations (Roca et al, 2012).

Figure 8: Barcelona Esquerra characteristics
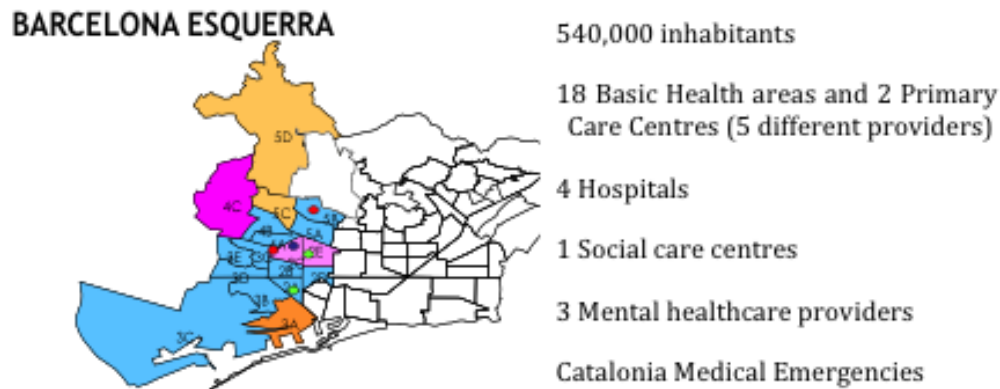
Source: Roca (2013)

2. Integrated care analysis

2.1 Dimensions

The NEXES project was conceived to develop the practicalities of the Innovative Care for Chronic Conditions (ICCC), a framework developed by the WHO in 2002. This acknowledged Integrated Care Services (ICS) and Information and Communication Technologies as enabling tools that are two core components in the new scenario. Well-articulated innovative ICS were proposed by the WHO as more cost-effective solutions on the grounds that they could improve care experiences and outcomes for patients by coordinating their care better. They also simultaneously promote cost-effectiveness through preventing the unnecessary use of complex care services.

The main objective of NEXES was to identify proper strategies for future extensive regional deployment and adoption of ICS supported by ICT (ICS-ICT). It aimed to transfer complexity from hospitals to primary care and to patients' homes with a proper integration with community services. The technology developed (see Section 0) allows a multi-disciplinary team of health care professionals to create, exchange and adopt care programmes, as a set of possible pathways to be applied to each patient based on his/her health and social status (referred as inclusion and exclusion criteria). It is important to emphasise that each patient can be assigned to one or more protocols depending on his/her needs and could be discharged once the assigned protocol is completed. Alternatively, new needs may be identified meaning that the patient would be included in a different protocol of the same programme. Each pathway includes a predefined number of tasks so as to facilitate a case management approach (see Section 0 for a full description of the integration process).

All four ICS included in NEXES (namely Wellness and Rehabilitation, Enhanced Care for frail patients, Home Hospitalisation and early discharge and Remote Support to primary care for diagnosis and therapy) are considered over a wide spectrum of care coordination with a strong focus on prevention and modulation of the progress of the disease based on the care pathways, events and notifications.

The ICS target vulnerable subgroups (e.g., the frail elderly and persons with disabilities) and patients with complex illnesses (e.g., chronic conditions, some cancers). They offer life style advice and disease prevention, and support for patients with chronic diseases (e.g., COPD, cardiovascular disease), frailty and comorbidities. Thus, the main focus of NEXES is preventive care management, chronic disease management, health and social services integration and homecare management.

As emphasised by the stakeholders consulted, the provision of ICS is achieved through back-office and support functions coordination across all units involved (functional integration), including relations among different organisations (organisational integration) and professionals within organisations (professional integration) so as to foster services coordination in a single/seamless process across time, place, and discipline (service/clinical integration).

Therefore, this type of integration could be considered mainly as service delivery and clinical integration, supported by horizontal and vertical interrelationships. Communication, information-sharing and collaboration are facilitated by coordination based on structured, inter-organisational mechanisms. Service responsibilities and funding remain separate (medium degree of integration).

2.2 Impact

The four programmes developed in NEXES have been assessed. The Wellness and Training programme evaluation followed 104 patients over more than one year. The study covered the following dimensions: (1) factors modulating dropouts and adherence (n=84)[3], (2) use of ICT by elderly COPD patients compared to the general population (n=96)[4] and, (3) effects of the intervention on long-term sustainability of physiological training-induced effects, health-related quality of life and on daily physical activity (modified by Baecke questionnaire) throughout the follow-up period. The ICT intervention consisted of a mix of different technological approaches: periodic SMS, use of wireless mobile technology to assess intensity of home-based training and use of the patients' portal.
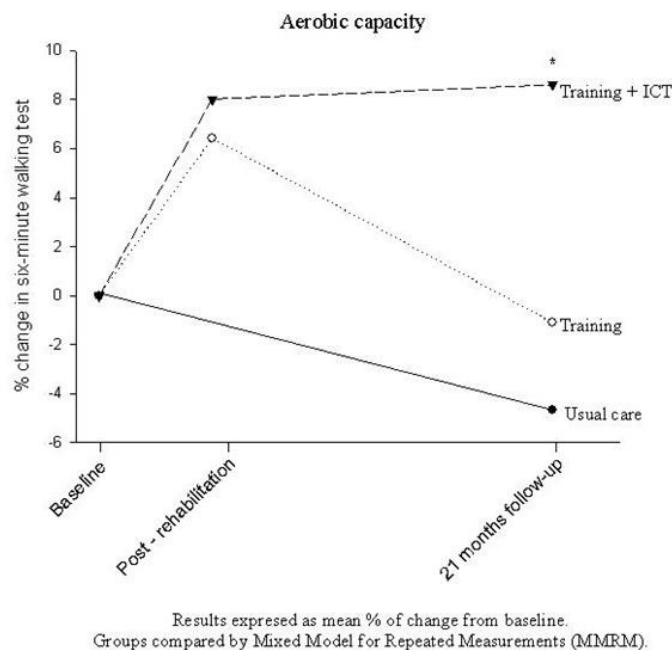
Figure 9 displays a summary of the positive effects of the intervention, as reported in the NEXES project. Statistically significant differences were found compared with two control groups in: i) sustainability of aerobic capacity over time (assessed by six-minute walking test, 6MWT), ii) some key dimensions of health-related quality of life (SGRQ, Saint George's Respiratory Questionnaire), and, importantly iii) enhanced physical activities within daily life activities. Each arm of the study includes about 30 patients. The y-axis indicates the percent change in aerobic capacity from baseline (pre-training) assessed with the 6-minute walking test. The Usual Care group showed the expected decline over time. The training group increased aerobic capacity after 8-week supervised high-intensity endurance training

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[3] Rodríguez DA, Gimeno E, Torralba Y, Blanco I, Barberan-Garcia A, Arbillaga A, Barberà JA and Roca J. 2010. Drop-out in supervised pulmonary rehabilitation programs. *Eur Respir J* 36 (Suppl 54)

[4] Barberán-Garcia A, Arbillaga A, Vilaró J, Rodriguez DA, Torralba Y, Blanco I, Fonollosa D, Bajet M, Solanell L, Alonso A, Barberà JA and Roca J. 2011. Access and use of Communication Technologies in patients with Chronic Obstructive Pulmonary Disease. Eur Respir J 47:618S

programme followed by a similar rate of decline of aerobic capacity. In contrast, the intervention group (training plus ICT intervention) showed long-term sustainability of training-induced effects. Moreover, this last group of patients presented enhanced health-related quality of life assessed by SGRQ (Saint George Respiratory Questionnaire) and improved their daily physical activity assessed using the modified Baecke questionnaire. In other words, the ICS generated cost-effective long-term sustainability of training-induced effects plus induced changes in life style.

Figure 9: ICS Wellness and Training main effects

Results expresed as mean % of change from baseline.
Groups compared by Mixed Model for Repeated Measurements (MMRM).

Source: Roca (2013)

The study in Barcelona showed the clinical efficacy of the intervention on main outcome variables very clearly, namely: sustainability of training effects over time, enhanced health-related quality of life and improved physical activity levels within daily-life activities. The lack of impact on the use of health care resources during the follow-up period could be explained by the small sample size. The enhanced care for frail patients programme (ECFP) was evaluated through a Randomised Control Trial. As reported in the NEXES project, this assessment aimed to explore the effectiveness of prevention of hospitalisations by an ICS across levels of care and, secondly, to examine the feasibility of the use of mobile technology for patient self-monitoring. Up to 155 frail COPD patients randomly selected from the community were allocated either to ICS-ICT or usual care and followed over 12 months. ECFP improved clinical outcomes such as survival, and significantly reduced unplanned admissions, but not the overall admission rate. The mobile system could be highly applicable to clinically stable elderly patients with various co- morbid conditions. The study facilitated the identification of key components for the successful adoption of ICS: i.e. appropriate patient stratification and preparation of work force in primary care.[5] The effectiveness of the ECFP programme in Barcelona run by specialised personnel cannot be doubted. Over the last few years, it has completely changed the ecosystem of the

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[5]   Hernandez C, Jansa M, Vidal M, Nunez M, Bertran MJ, Garcia-Aymerich J, Roca J. 2009. The burden of chronic disorders on hospital admissions prompts the need for new modalities of care: a cross-sectional analysis in a tertiary hospital. QJM 102:193-202.

Pulmonary Medicine Department in terms of admissions of the subset of frail chronic respiratory patients with previous history of repeated hospitalisations. Moreover, the rate of early readmissions after discharge (30 days) is significantly lower (10%) than those observed in the whole region (15%) and in the recent COPD audits done in Spain (30-35%) and at EU level (30-35%).

Since early 2006, the home hospitalisation programme has been successfully deployed in Barcelona by the Integrated Care Unit of the Hospital Clinic. The final NEXES report stated that up to 2,314 patients have been included in the analysis. Early in the programme, the majority of subjects were patients with chronic respiratory disease, but progressively both diversity and complexity have increased. Nowadays, respiratory patients represent approximately 15% of the whole study group. The programme has shown itself to be safe, acceptable and satisfactory for patients and professionals. It delivers slightly better outcomes than conventional hospitalisation with significant lower costs than conventional care (Roca, 2012). The NEXES final report shows that on average 8-10 hospital beds a day have been saved and that patients treated in this way show similar/better clinical outcomes than those receiving conventional care but they have fewer emergency room visits during the 30 day-period after discharge (6% vs. 13%, for HH and controls respectively) and lower mortality during the episode of exacerbation (0.3 vs. 7%).

Remote Support to primary care was successfully explored using a web-based application to enhance the quality of forced spirometry in primary care done by non-specialised professionals. The study,[6] done in 5 different areas of Spain, showed that the rate of high quality spirometries in primary care can be markedly enhanced, during a 12 months follow-up period from 60 to 72% in control and intervention centres, which is comparable to the one obtained in specialised settings.

2.3   Drivers and barriers

The NEXES project was designed to explore the five factors classically recognised as barriers for deployment of ICS-ICT, namely: (1) lack of evidence of clinical benefits; (2) technological issues; (3) organisational issues; (4) regulatory and ethical aspects and (5) service reimbursement. The project consolidated the evidence on the clinical benefits of home hospitalisation and enhanced care when the services were provided as mainstream integrated care services. It documented the potential cost-effectiveness of ICS-ICT for the management of chronic patients with a wide spectrum of severity and co-morbidities. For the other two services investigated, wellness and rehabilitation and support, the project generated new evidence at the pilot level. The project succeeded in filling the gap in clinical evidence, the first barrier above, which to some extent contributed to overcoming the other four barriers.

In NEXES, the ICT platform was central to the delivery of care and extensive deployment at regional/country level. Adopting an open source Health Information Sharing approach was preferred to Health Information Exchange as it seemed to bring more benefits. However, a degree of coexistence between these two options could be a practical compromise in sites that are less mature from an organisational and legal perspective. Thus, the Health Information Sharing approach has acted as a key driver to enhance communication and information flows across the continuum of care. The implementation of such a platform, using simple and robust technologies with particular emphasis on interoperability at health

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[6]   F. Burgos, C. Disdier, E, Lopez de Santamaria, B. Galdiz, N. Roger, ML. Rivera, R. Hervas, E. Durán, J. Garcia-Aymerich, J. Roca. 2012. Telemedicine enhances Quality of Forced Spirometry in Primary Care. Eur Respir J 39: 1313–1318.

system level, did not require replacing the existing proprietary Electronic Health Record system, but allowed the IT systems in place at each health care provider involved in the project to be interoperable. This technological innovation played a pivotal role as an enabling tool for the change but it was not considered as the main driving force, rather a trigger for change. In this regard, resistance to technology was acknowledged as an initial barrier by health and social care professionals and managers. The fact that none of the existing EHR in each organisation was changed but instead complemented by the newly developed technology helped to overcome this resistance. The NEXES project focused on efficiencies of novel integrated healthcare services rather than on implementation of ICT in traditional approaches.

The ICT approach adopted in the project established the basis for the organisational change including the establishment of inter-professionals teams across the continuum of care with a strong, focused, diverse governance represented by all stakeholders. These teams developed the care pathways promoting coordination across settings and levels of care, pushing cooperation between tiers of care and facilitating patients' access to the care continuum with multiple points of access. The health professionals engaged in this process played a leading role. Two exogenous but aligned factors reinforced this organisational innovation fostered by the project: the Catalonia Health System and the Hospital strategy pushing integrated care into the policy agenda. These two separate actions facilitated a strong policy support and commitment fostering both a cohesive culture enabling the care continuum and innovation within the health system to overcome both regulatory and legal aspects.

The NEXES project was co-funded by the European Commission within the ICT Policy Support Programme. Nevertheless, the deployment potential and the impact of the initiative were limited by insufficient national investments and funding programmes to ensure adequate resources for sustainable change and up-front costs. The other main barrier identified during the NEXES deployment was the lack of innovation in reimbursement models and the difficulties to align incentives for health professionals. In this regard, NEXES results show that the formulation of a business case including novel reimbursement policies, based on bundle payments, and incentives with shared risks arrangements among actors must be in place to ensure sustainability, with no increase of overall health costs.

2.4 Organisation, health professionals and patients

The main characteristics of the NEXES intervention were: (1) the model of care addressed chronic patients who fulfil the eligibility criteria for one of the ICS groups, (2) management of the patients is done through programmes, a programme being a specific formulation of one ICS, (3) each of the programmes has well standardised interventions, (4) patient-centred care is adopted including management of co-morbid conditions, and, (5) patients are encouraged, through the patient's portal and through the call centre, including different modalities of tele-monitoring, to take an active part in their own care. The delivery model assumes that integrated care provides a more efficient approach for four reasons:[7]

- It normalizes the interventions through the application of care pathways, which facilitates a new organisational frame. The set of interventions are geared towards specific health and/or social goals, generally more specific than those adopted in

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[7] NEXES case study description http://www.epractice.eu/en/cases/nexes

traditional care (i.e. improving patient self-management of the disease versus improved clinical outcomes).

- It redefines the roles of professionals: given the precise definition of patient trajectories, checkpoints can be incorporated and, accordingly, delegated to nurses or other professionals, for regular follow-up activities.
- It generates opportunities for a more proactive allocation of scarce resources. It is possible to anticipate the resources in line with defined care pathways so as to better monitor patients, while avoiding duplication of test or emergency visits, which would be needed to attend the majority of the patients (80%). As a result, it would also be possible to foresee the free time needed for those requiring traditional approaches.
- The model also demands more coordination and information sharing among professionals, not only among the specialists, but also across different teams and providers. This is where the ICT solutions play a key role. Their value lies in their capabilities to allow for these interactions to take place.

The following figure sketches the NEXES stakeholders map and how health care providers and health professionals interact in the new integrated care services delivery model:

Figure 10: NEXES stakeholders
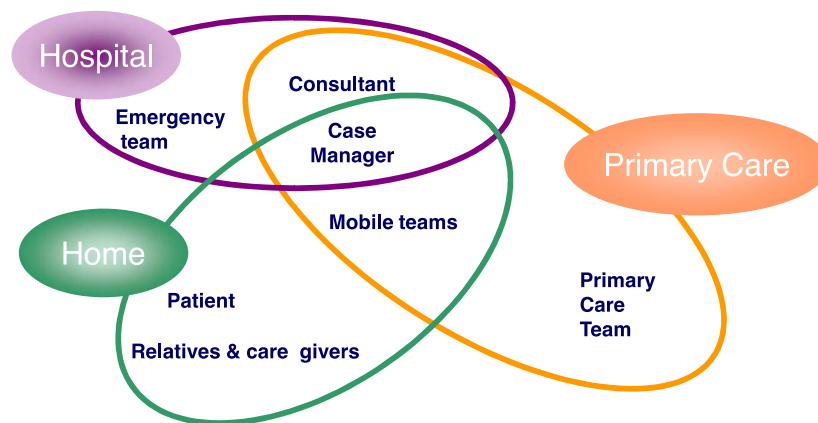
Source: Roca, 2013

Within this ecosystem, all the stakeholders consulted emphasised the importance of re-organisation of the services to ensure cooperation between tiers of care and health and social care as well multiple points of access. This re-organisation redefined the role of health professionals including general practitioners and gave nurses a pivotal role. It is worth mentioning that the stakeholders consulted did not consider IT adoption by health professionals or patients as the main barrier. On the contrary, they all noted the importance of having a patient-centred philosophy. This should focus on patients' needs, the provision of self-management support methods for patients as a part of integrated care and different channels, including the Internet, to give understandable and patient-centred information, facilitating patient engagement and supporting informal carers.

The NEXES intervention emphasises the need to focus on efficiencies of novel integrated healthcare services rather than on implementation of ICT in traditional approaches. Therefore, the focus is on organisational and cultural aspects of change, taking into account the fact that healthcare is a complex system in which promoting novel and flexible organisations could be more effective than IT in furthering change and fostering deployment of ICS.

2.5 Information and Communication Technologies

The NEXES intervention developed a state-of-the-art information system to collect, track and report activities, along with interoperable information systems to enhance communication and information flow across the continuum of care. Electronic Health Records are shared across the continuum of care and the Telehealth system to support health professionals and patients, including specialists-general practitioners' support systems.

The NEXES core node (centre), Linkcare, includes the functionalities underpinning the management of the programmes. Interoperability with the five different nodes is ensured through web services. Those nodes cover different functionalities: i) Accessibility to the support centre (see Figure 3); ii) User-profiled portals; iii) Interoperability with Electronic Health Records (EHR) from different providers and research databases; iv) Remote monitoring using wireless mobile technology; and, v) Clinical Decision Support Systems (CDSS).

Figure 11: Architecture of the Health Information Sharing (HI-Sharing) platform
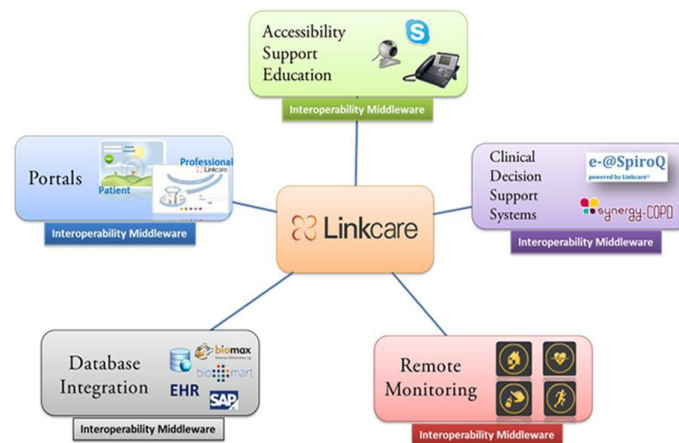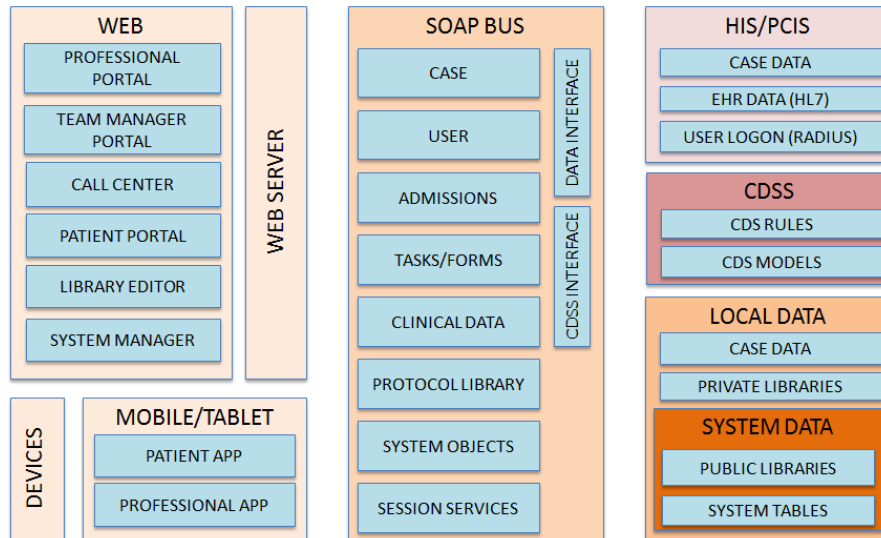

Source: Linkcare

The Linkcare platform is organised in three layers. The general architecture layout is shown in Figure 12. The user interface layer is composed of two types of access:

(1) A set of web portals that use a standard web browser, and includes separate portals for professionals (admission, protocol association, tasks programming and form programming); for team management (creation of care practice units and user management); for call centre operators (automatic call identification and call event processing); for patients (self-care, educational information and event posting); for protocol library edition (creation of new forms, tasks and protocols) and ultimately a system manager portal for system maintenance; and

(2) Downloadable apps for mobile and tablets allowing self-care and medical device measures.

Figure 12: Linkcare diagram


Source: Linkcare

The interface has been developed in such a way that it can be easily extended to work with other interfaces. All web service requests are properly recorded for data access tracking purposes. Two special gateways allow communication with existing Hospital Information Systems (HIS) and Electronic Health Records (EHR). Lastly, all anonymised data from Linkcare's clinical patients recorded as part of the task execution is recorded in a local or cloud database private repository. Protocol libraries can be kept private (for the exclusive use of the Health Care service) or can be shared with other service providers. A public library provided by Linkcare can also be used. Such libraries can be "synchronised" on an ad-hoc basis from a "master repository" for clinical information and software updating.

It is worth pointing out that Linkcare is an open source modular platform developed and maintained by Linkcare Health Services, a spin-off from the Hospital Clinic de Barcelona (HCPB) and Fundació Clínic per la Recerca Biomèdica (FCRB).

2.6 Governance

The NEXES governance model included a territorial health care commission represented by a permanent commission formed by all the institutions involved in the intervention (see Figure 8). This permanent commission was responsible for redesigning the four clinical processes and for its implementation and follow-up with the support of a technical management team. The intervention involved an emergency department; specialised care; social care; health transport; home care; pharmacy; mental health; paediatric care and an IT department. The following figure sketches the governance model.

Figure 13: NEXES governance model
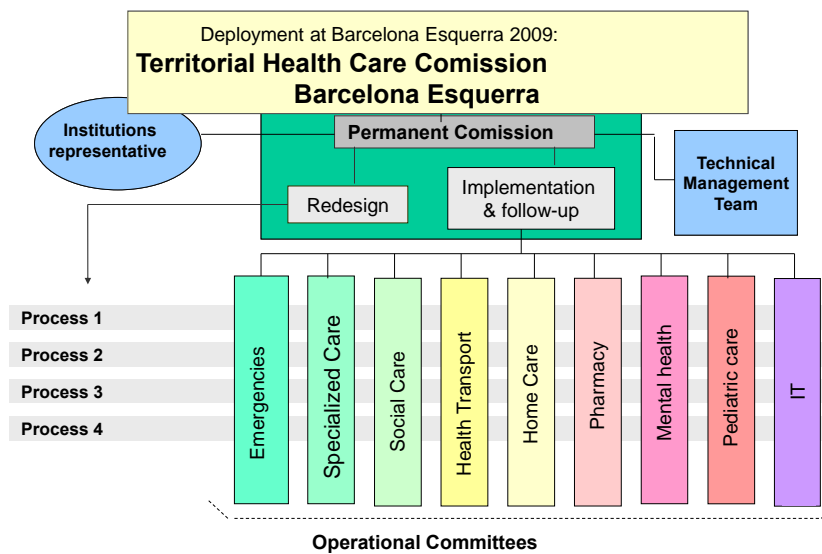
Source: Roca (2013)

Furthermore, TICSalut, the governmental institution in charge of the deployment of technologies in the health domain in Catalonia, was a partner in the NEXES consortium. This reinforced the political support originally given by the Catalan Department of Health. It was further strengthened by support from the Catalan Agency for Health Information, Assessment and Quality (AIAQS) of part of the analytical and evaluation work. Finally, the fact that the investigation was deployed in the Eixample Esquerra area was also of relevance from the perspective of the Catalan Health Administration, because this area has traditionally been chosen for experimenting with innovative health practices, which may be later deployed on a larger scale.

2.7 Organisational processes

The organisational processes were designed and supported using Linkcare, an open source modular platform developed and maintained by Linkcare Health Services, a spin-off from the Hospital Clinic de Barcelona (HCPB) and Fundació Clínic per la Recerca Biomèdica (FCRB). Linkcare allows health care professionals to create, exchange and adopt care programmes. A care programme is a set of possible protocols to be applied to each patient on the basis of his predefined health condition and social circumstances (referred to as inclusion and exclusion criteria). One patient can be assigned to one or more protocols as far as they are part of different programmes. The enrolment of a patient in a programme is followed by a protocol assignment (called an admission). The patient can be discharged (i.e. in an early discharge program) once the assigned protocol is completed, or re-evaluated and included in a different protocol of the same programme. Patients can also voluntarily withdraw from the programme or their health conditions may change, making them ineligible. Each protocol includes a predefined number of tasks, which facilitates a case management approach: i.e., patient-centred care with management of comorbidities. Each task may fall into any of the following six categories:

- Patient self-administered (or patient's caregiver/assistant administered) activities such as health conditions and life style reports, medical device measurements and educational activities.
- Care centre meetings between the patient and health care service providers.

- Home care visits from health care professionals.
- Remote meetings such as telephone calls or video conferences.
- Internal health care professional clinical history review tasks.
- Group sessions including several patients and one or more health educators.

Tasks can be pre-scheduled into a protocol to be performed under a defined interval or frequency. Protocols can be changed or tailored for each patient. Selected tasks can be assigned to a care-team or a specific professional. In case a task has been scheduled to a team, the team manager would eventually assign it to a professional. A team may be any health care supplier which has agreed to be part of the Linkcare system for each specific geographical or health care district. In addition to the professional or care team responsible for the patient protocol management, any individual task can be assigned to another team or professional according to the pre-established terms of collaboration between different teams or professionals.

In addition to the protocol-defined tasks, Linkcare supports a number of events. Events are notifications generated by the patient or by professionals to request a service or advice from another professional or team. Events can also be generated as a result of the findings reported in a task (warning events). Typical events include management of patient calls, enrolment, re-evaluation, discharge or advice requests, emergency and warning conditions. Once an event is posted, the designated professional or team may respond by including recommendations on predefined report forms; or by adding to or modifying the care plan. Furthermore, any professional or team may define some different settings to be reported on task assignment, task completion or event posting. Typical reporting methods are SMS messages, mail notifications or call centre call requests.

A key component of the Linkcare platform is the support centre (see Figure 14), which plays a central role for three specific functions: (1) patient's triage, (2) promoting patient self-management, and (3) management of remote monitoring. The tele-operator in the Support Centre receives different types of requests (health issues, administrative problems and social support requests) from target patients that she/he solves or refers promptly to the most efficient resource from the network of providers (i.e. by transferring the call to a nurse, or setting up a home visit or day hospital visit, etc.). The system is operational only for target patients with chronic conditions that are managed by programmes (ICS) following well-standardised interventions and providing a patient-centred care.

Figure 14 Conceptual integrated care model of NEXES
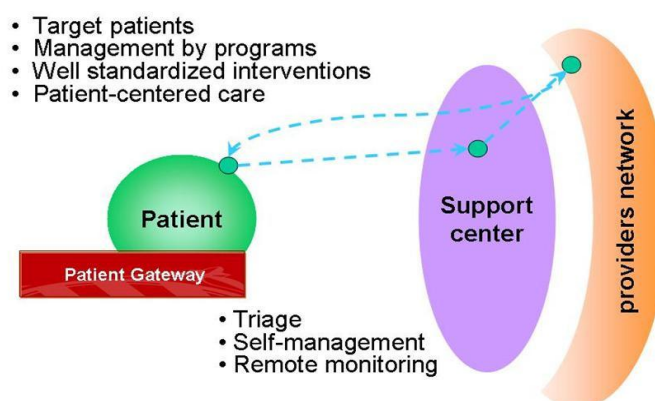
Source: Roca (2013)

2.8 Reimbursement model and economic flow

Beyond the EC funding, the reimbursement for the provision of integrated care services provided by the NEXES intervention used the same scheme as the one used by other providers in Catalonia. The payment method of CatSalut (see section 1) is defined by two principles:

- The "global budget principle", meaning that resources allocated to hospital care should be treated as a whole, to guarantee services. The global budget is used to give priority to certain healthcare actions over others, always in line with previously established healthcare policy parameters and the population's healthcare needs. Hospitals and public contractors sign a contract defining these goals.

- The "prospective purchasing of services principle", meaning that hospital care should meet objectives and respond to identified needs. It was essential to maintain the prospective aspect of purchasing of services as the main contracting driver. Budgets are hence related to indicators, such as the Relative Structure Index (RSI) to reflect different costs due to geographic location, area of influence, decision-making capacity, teaching possibilities and the complexity of research studies carried out in the hospital. Discharges and case-mix (measured in terms of Diagnosis-related group) are also taken into account.

The payment model offers the possibility of specifically financing certain services or facilities such as:

- Projects that ensure the viability of special facilities for a recognised need, and that would otherwise be totally unfeasible or would represent an unsustainable cost to the provider company of whom the service is demanded.

- Selected activities that have to be incentivised or regulated, in line with health policy criteria.

- The set-up of different facilities to reach the scale required (e.g. establishing new hospitals).

- Recognition of the university teaching role at undergraduate and graduate level: the payment model recognises the direct and indirect costs that are generated at hospitals with graduate teaching programmes (MIR, FIR, etc.) and includes a specific budget line for these costs.

The Hospital budget payment system is a kind of a bundled system, as shown by the way services are aggregated for reimbursement purposes: professionals, drug prescription, all inpatient and outpatient services within a hospital setting are taken into account under a global budget. However, it is an incomplete system if we consider all health care needs and especially those pathologies where the care needs go beyond the capacity of a hospital setting. For instance, it does not include the payment of other healthcare services, like rehabilitation, oxygen therapy and the treatment of kidney failure, which are reimbursed outside the hospital budget. Home-based respiratory therapy is, as an example, paid on a per-day-of-treatment basis to home care providers. Finally, there are no specific incentives in this budget system to increase the coordination among providers.

Figure 15: Reimbursement flowchart
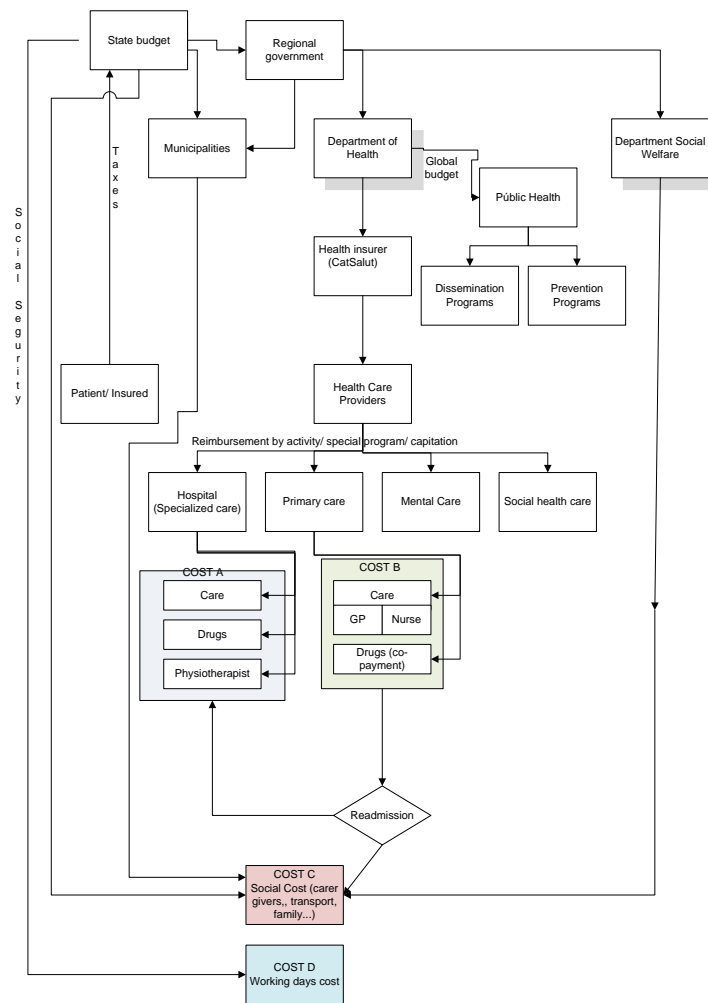
Source: Roca (2012)

3. Transferability

NEXES is an ICT–PSP project which has been conducted in Spain, Norway and Greece. Therefore, many components of the initiative have been developed in these three different countries. The stakeholders consulted strongly believe that the degree of transferability of NEXES is high with a medium level cost of customisation. However, it was also underlined that organisational and cultural dimensions in each region should be considered in order to overcome some barriers.

Lessons learned from NEXES include the importance of professional role redesign such as having care managers as leaders of the different programmes and also the importance of training participants to acquire adequate skills. Sustained leadership is also considered crucial, especially from the scientific/clinical perspective and from a managerial perspective. From a technological point of view, NEXES showed a flexible pace of adoption with an open ICT platform supporting organisational interoperability and collaborative work, which helped avoid having to replace existing IT systems.

The platform supporting the NEXES business model works as an Enterprise Application Integration (EAI) framework to support integrated care service provision through collaboration among professionals and healthcare organisations. In this context, the

platform is composed of a set of technologies and services to provide the functionalities required for the execution of integrated care programmes:

- Definition and management of integrated care programmes both by professionals and patients,
- Integration of information between the platform and external Hospital Information Systems (HIS),
- Call-centre capabilities,
- Remote monitoring.

Integration with external HIS and other legacy systems is achieved by implementing web services for interoperable machine-to-machine interaction. Organisational interoperability between professionals participating in integrated care programmes is enabled by means of a common frontend. This is made possible by the modularity of the system which ensures vendor independence so that different vendors can provide specific functionalities.

To sum up, NEXES' transferability is supported by its capabilities to mediate between external applications and its core module, and act as the common frontend showing only the relevant information and interfaces to the relevant end-user. NEXES could be potentially transferred to many other European countries, provided that the incentive and reimbursement system breaks the barriers preventing the deployment of integrated care.

4. Conclusions

The NEXES project conducted large scale trials of four ICT-enabled integrated care services – well-being and rehabilitation, enhanced care for frail patients, home hospitalisation and early discharge, remote support for diagnostic and/or therapeutic procedures– with emphasis on highly prevalent chronic conditions (COPD, chronic heart failure and diabetes). This initiative could be considered as a hospital-driven transfer of complexity to territorial care, including all the health care providers in Barcelona Esquerra (540,000 inhabitants). Information and Communication Technologies (ICT) play a pivotal role as an enabling tool for change but it is not the main driving force. Novel integrated healthcare services rather than the implementation of ICT in traditional approaches could be considered as the trigger to fully integrated care deployment. The deployment of care pathways by motivated and engaged inter-professional teams facilitated the re-organisation of the services to ensure cooperation between tiers of care and between health and social care, facilitating patients' access to a care continuum with multiple points of access. This organisational innovation was deployed, even though it increased the workload for professionals, who had no clear incentives beyond the motivation to do research.

The technological platform is flexible, built around a federated model and as such has embedded potential for scalability from the initial health area of Barcelona up to all of Catalonia or other EU regions. There are, however, some challenges for scalability, most of which are related to issues of interoperability. First, the open source block-components need to be coupled with different proprietary devices and applications, which will require some substantial system integration work. Second, compatibility and interoperability for EHR and PHR need to be tackled not only inside the IT system of Hospital Clinic but at regional level. Third, the integration and technical interoperability between the data from social care and health care still needs to be built.

This study has shown us that organisational and cultural aspects have played a key role in the implementation of this initiative, as has support from managers and policy-makers. Nevertheless, the full deployment of NEXES may need innovative approaches with regard to reimbursement models and funding.

To sum up, the following figure shows the main facilitators in the NEXES case. Interoperable information systems and reorganisation of services are the most important ones. These two are followed by professionals' engagement and governance mechanisms set in place to foster integrated care, taking into account the focus on patients and policy commitments at hospital and regional level. Lastly, incentives and financing, and national investments and funding programmes, have played a minor role in this case, but would hamper the full deployment of the initiative at regional level.

Figure 16 NEXES Integrated care facilitators
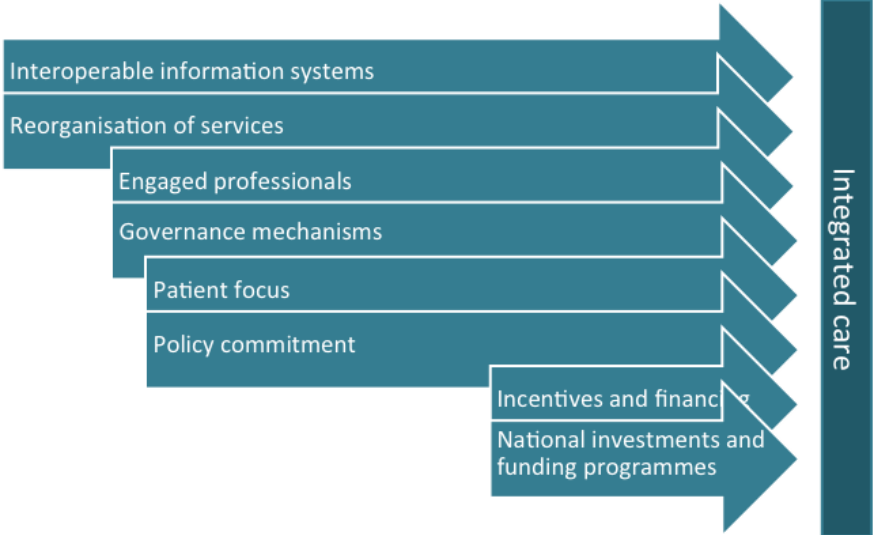
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