

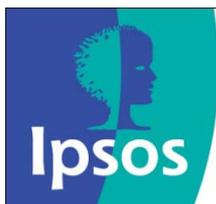
EUROPEAN COMMISSION  
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**eHealth Benchmarking III**

SMART 2009/0022

Final Report  
Deloitte & Ipsos Belgium

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## 0 Executive Summary

**At this early stage of the twenty-first century, Europe's health systems and services are under extreme pressure. It is vital to discover how acute hospitals use eHealth services today. To understand this use may enable hospital systems to handle future challenges. Helping to develop and test a robust survey instrument that can uncover such information is an important step in policy terms and in the development of methodologies.**

**This study provides an overview of how Europe's acute hospitals use eHealth. It offers empirical evidence from hospital's Chief Information Officers and it gives a sense of the attitudes and motivations of Medical Directors.**

### **Background**

Like all technological domains, eHealth is not static. It undergoes both technological and organisational innovations. As the eHealth action plan (COM(2004)356 final, p8) first identified, eHealth systems and services "combined with organisational changes and the development of new skills" can act as key enabling tools. Considerable enhancements in access to care, quality of care, and the efficiency and productivity<sup>1</sup> of the health sector could result. This survey offers some first evidence of the experiences of Europe's acute hospitals with eHealth both within their own walls and in relation to their relationships with external users and service providers.

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<sup>1</sup> "eHealth systems and services can reduce costs and improve productivity in such areas as i) billing and record-keeping, ii) reduction in medical error, iii) alleviation of unnecessary care, and iv) savings achieved by business-to-business e-commerce" (COM(2004)356 final), in relation to Danzon and Furukawa 2001.

## Overview of progress

### **Some sound ICT-related developments have taken place in Europe's acute hospitals.**

Today, practically all hospitals are connected to broadband (92%) – although half of them have a bandwidth of below 50Mbps (52%). Thus, there is still room for improvement when it comes to next generation broadband (>100Mbps). High bandwidth could prove useful in advancing digital imaging and telemonitoring. There is a clear focus on investment in broadband and in next generation networks in the actions of the Digital Agenda for Europe, the European Commission (EC) strategy on Information Society up to 2020. Attention could be paid to the considerable differences among the countries regarding the quality of broadband speed provided. As an example, 100% of hospitals in Denmark have broadband speeds over 50Mbps as compared to only 20% in Greece.

### **Wireless single infrastructures have yet to be widely deployed in many acute hospitals.**

Only 54% of hospitals have wireless infrastructure. One-third of these (18% of the total) have multiple individual wireless infrastructures for discrete applications rather than having a single unified infrastructure. Slightly more than half of the hospitals with broadband have wireless communication systems. Hospitals offer Internet access wirelessly from a number of locations inside their own walls, especially from workstations (75%) and to inpatients (47%). Only 28% provide for wireless monitoring of inpatients<sup>2</sup>.

**Videoconferencing facilities are relatively common.** They are available in nearly 40% of the European hospitals surveyed. The most general use of videoconferencing is for consultation between internal medical staff and external healthcare providers – this is how it is used in 64% of the acute hospitals with videoconferencing.

**A majority of European hospitals (65%) have a common electronic patient record system<sup>3</sup> and a picture archiving and communication system\* (PACS) (61%) in situ.** Electronic exchange of radiology reports occurs in more than two-fifths of hospitals (43%). It is undertaken particularly with specialists (28%) and general practitioners (28%).

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<sup>2</sup> This provision may be prohibited by legislation in certain Member States, for example, by concerns about health and safety.

<sup>3</sup> All terms marked with an asterisk are described in a small glossary at the end of this executive summary.

**Accessing systems inside hospitals is easier than from outside hospitals.** Electronic patient record systems and PACSs can be accessed from a number of locations inside the hospitals. The locations are especially outpatient departments and wards, operating rooms

*“Only 4% of hospitals in the survey grant patients online access to their electronic patient record”*

and emergency rooms. However, both electronic patient record systems and PACSs are less accessible from outside the hospitals by external healthcare providers (24% for electronic patient record systems and 27% for PACS) or by patients.

**Only 4% of hospitals in the survey grant patients online access to their electronic patient record.** Considerably more access provision to records is to be foreseen in the years to come in Europe<sup>4</sup>. Professionals' and patients' access to digital records and how these can be used inside – or in connection to – hospitals is a matter for keen discussion. The relationship between the use of such records in acute hospitals to the relevant actions of the Digital Agenda for Europe on the piloting of Europeans' "secure online access to their medical data by 2015" (Key Action 13, p29/30)<sup>5</sup>, interoperability, and the accomplishment by 2020 of "the widespread deployment of telemedicine services" (Key action 13, p30) is subject to collaborative action between the European Commission, the Member States and associated stakeholders.

A majority of hospitals have **electronic patient record systems in place** (81% have one or more types of these systems). Yet the hospitals do not yet seem to have reached a level of sophistication that will translate into clinical transformation. Many relevant eHealth services and applications are still not being used.

**On the positive side, a number of applications are common** in European hospitals. For example, **eBooking\*** is widely available. It is used by 71% of the European hospitals in this survey. It is a service used by internal medical staff, nurses, and administrative staff. More

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<sup>4</sup> Key Action 14 of the Digital Agenda for Europe (p30) implies that, in 2012, a recommendation will be proposed that defines "a minimum common data set for the interoperability of patient records to be accessed or exchanged across Member States", in accordance with data protection requirements.

<sup>5</sup> The Digital Agenda for Europe (p29) also makes reference to "technologies" which "incorporate the right of individuals to have their personal health information safely stored within a healthcare system accessible online". The argumentation provided implies that the circumstances under which this can be expected are care settings and include especially geographically remote locations.

than half of European hospitals also have a system for electronic transmission of **clinical test results** (70%) and **a system for electronic service order-placing** (55%).

## However, still more needs to be done...

There are still plenty of opportunities for what applications are available for use and by whom.

In terms of eBooking, **only 11% of hospitals offer patients the opportunity to book a hospital appointment online**. Some countries, like Finland, however, do this as a matter of routine.

**ePrescription\*** is among the medical applications that need greater attention. It is currently available in 30% of the hospitals surveyed. It is used mostly to connect to a pharmacy

***“ePrescription\* is among the medical applications that need more attention. It is currently available in 30% of the hospitals surveyed”***

which is inside the hospital (in 87% of cases when it is used), but not with external pharmacies (this takes place in only 29% of cases).

**Telemonitoring of outpatients** remains at low levels: only 8% of European acute hospitals do it. Since 2008, telemonitoring is high on the European eHealth policy agenda. In years to come, this renewed preoccupation

with telemonitoring could raise its profile in terms of choices about commissioning<sup>6</sup> in all healthcare sectors, including in acute hospitals.

**Electronic medical data exchanges outside the hospital with other providers** are still not common in European acute hospitals. Three instances are immediately evident: 54% of acute hospitals do not have electronic exchange of clinical care information, 57% do not exchange laboratory results and 57% do not exchange medication lists.

**Cross-institution electronic medical exchanges**, and exchange across countries, are still extremely rare among those hospitals in this survey. For instance, only 5% of the hospitals in the survey have any kind of electronic exchange of clinical care information with healthcare providers in other countries in the European Union.

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<sup>6</sup> The term 'procurement' is often used in European Commission documentation to describe commissioning.

## Security and safety are generally advancing

With regard to **regulations aimed at guaranteeing the security and privacy of electronic patient medical data**, more than seven in ten CIOs (71%) say that there is a regulation in use at hospital level that relates to security.

Most countries have relevant approaches and mechanisms in place to facilitate data protection and security. Sixty-three per cent of CIO respondents say that there are national regulations in place. There are several different security measures that are taken to protect the patient data stored and transmitted by the hospitals' IT systems. The most commonly used measure is the **use of passwords to access workstations** (this is the case for 93% of acute hospitals). Passwords are used across all the types of hospitals considered. The **more sophisticated systems** (such as encryption of transmitted data and data entry certified by a digital signature) are more likely to be found in large hospitals that belong to groups of hospitals or care institutions. A large majority of hospitals also have an **enterprise archive strategy\*** (83%) in place. They can recover critical infrastructure immediately or in less than 24 hours (67%). **Integrated adverse health events reporting systems** are, however, present in only 39% of the hospitals surveyed.

## Context, countries and players ...

There are notable **geographic, system and organisational differences** among countries in terms of their responses to infrastructure, applications available, data exchanges and the security levels or approaches used in the hospitals. The Nordic countries lead in terms of eHealth deployment in all the organisational and technical areas surveyed.

*“There are notable geographic, system and organisational differences among countries”*

**Large hospitals, public hospitals and university hospitals** are generally more advanced in eHealth terms than smaller, private, and non-university hospitals. These three types of hospitals have proven themselves to be ahead in the implementation of eHealth within and outside the acute hospital site. These can be *intramural* or *extramural* activities (they take place with external healthcare actors or with patients).

This survey provides an eHealth profile for a number of key indicators selected. The report's acute hospital eHealth profiles show which types of hospitals outperform others in

terms of best practice in relation to a number of indicators. Five specific indicators – out of a total number of 13 – indicate a significantly larger level of advance when hospital size is examined. These five are:

- high-speed broadband connectivity,
- ePrescribing,
- availability of an integrated system for eReferral,
- exchange of radiology reports with external providers, and
- having an enterprise archive strategy in place for disaster recovery immediately or in less than 24 hours.

European Union-level breakdowns relating to hospital size, ownership, function, and regional connectivity are shown using spider diagrams.

Part of this survey targeted hospital **Medical Directors**. It outlines the main perceptions

*“electronic patient record systems remain a top priority for investment in those hospitals where there is still not a common central system”*

and attitudes that they hold with regard to eHealth, in particular on electronic patient record systems and telemonitoring.

According to Medical Directors, **electronic patient record systems remain a top priority** for investment in those hospitals where there is still not a common central system to share information. Despite the low deployment of telemonitoring to outpatients (8%), according to Medical Directors **this remains the lowest priority for investment** in the next three years. Only 17% view it as a priority for investment over this timeline.

For Medical Directors, the **benefits** of electronic patient record systems are **concentrated around efficiency**. Having introduced such systems, Medical Directors perceive the number of patient admissions each day to have increased (55% of Medical Directors agree). Waiting lists are judged to have been reduced (49% of Medical Directors agree). **However, Medical Directors show little evidence of perceiving that the quality of the treatment of patients has improved as a result**. Only 25% agree that the quality of diagnosis has improved, 24% agree that the quality of treatment has improved, and 13% agree that medical errors have been reduced due to the introduction of electronic patient record systems.

According to Medical Directors, this situation might be due to prevailing interoperability problems. The Medical Director respondents identified interoperability between different departments' electronic patient record systems as the **largest barrier** to their implementation – 46% agreed that it was a barrier. This was followed by the **lack of financial incentives** for the staff to use these systems, a barrier that is more evident in large hospitals: there, 76% of Medical Directors agree that it is a barrier compared to only 46 % in the smallest hospitals.

*“The quality of the treatment of patients has not yet improved as a result”*

**No clear barriers or impacts were identified concerning the adoption**

**of telemonitoring.** The low rate of implementation of telemonitoring might be explained by the Medical Directors' lack of perception that, in their hospitals, it will lead to improvements in quality of care if implemented. Seventy-eight per cent of Medical Directors state that telemonitoring would have little or no impact on the improvement of the quality of life of patients.

## **Institutional and national results are shown using an eHealth profile**

The study has developed an **acute hospital eHealth profile**. The profile includes 13 advanced indicators. These have been applied to the 30 European countries involved in the survey and to the four types of hospitals identified. These hospital types are: large hospitals, public hospitals, university hospitals and those hospitals that belong to a dedicated national or regional eHealth network.

The survey results have shown that the **level of eHealth in hospitals varies across the countries in the European Union**. For example, Denmark and Belgium show best practices in terms of adoption. Differences occur in such fields as infrastructure, quality of broadband, eHealth applications integrated in the system, the level of medical electronic external data exchanges with healthcare actors outside the hospital system and the levels of access of eHealth services directly to patients. This is of concern to patients who might be travelling around Europe and also to policy-makers concerned to maintain equity and balance throughout the geographic areas of the Union.

## Comparisons with other surveys ...

Two comparisons have been undertaken with other surveys. First, these 2010 results were compared with previous surveys of EU acute hospitals that took place in 2004 and 2006. The results show good progress in the European Union over the past five years in advances in eHealth in hospitals regarding, for instance, broadband penetration and ePrescription.

*“ The results show good progress in the EU over the past five years ”*

Comparisons have also been made with hospitals in the USA. The European hospitals are certainly more advanced in terms of external medical exchanges with hospitals outside the hospital's immediate own system. However, the results show that American hospitals are slightly more advanced in relation to the implementation of certain applications: these include the viewing of laboratory reports, radiology images and discharge summaries.

## ... and insights useful for policy formulation

Several policy-related and methodology-related lessons learned have emerged. These serve as potential key messages. They might act as possible foundations for planned actions over the coming decade. They could be included in any of the next rounds of measurement and benchmarking exercises to be conducted throughout the lifetime of the Digital Agenda for Europe.

First, the potential policy-related messages in relation to technology and health systems or services are laid out. Second, the implications for handling questionnaires and other forms of study in relation to acute hospitals and clinicians, health professionals and other users' use of information and communication technologies (ICT) is described.

<b><u>Policy-related observations</u></b>
<b><u>Potential policy actions</u></b>
Create a fit with various policy documents
Identify, remove, and reduce any gaps inherent in terms of policy directions
<b><u>Hospital ICT infrastructure</u></b>
Investigate whether more ultra-fast broadband (>100MBps) is needed in hospitals
Towards a ubiquitous hospital – more wireless needed
<b><u>Availability and use of electronic medical applications in hospitals</u></b>
Electronic patient record systems are deployed but are not broadly used
Apply appropriate incentives for health professionals to use electronic patient record systems
Focus on patients' access to electronic patient record systems
Concentrate on interoperability – it is still an issue
Pay attention to low telemedicine deployment and intention to invest
<b><u>Electronic patient data exchanges</u></b>
Involve more hospitals in a pan-European approach to combat the low levels of European data exchange
<b><u>A bridge towards a new methodological approach</u></b>
Undertake an overall census of European hospitals – it could prove useful
Involve a wide range of hospitals
Focus on the clinical experience of medical staff in terms of ICT support to increase quality of care
Pay attention to patients' needs in terms of the support that ICT offer
Ask a wide range of questions with regard to the use of legacy systems and use of future systems.

The survey findings offer a **comprehensive picture of the state-of-play in 30 European countries in terms of the digitisation of their acute hospitals**. The focus is on European policy priority issues such as the *adoption and usage* of ICT solutions for healthcare purposes (electronic patient record systems, PACS, and ePrescribing), improved patient clinical data exchange among healthcare actors outside the hospital as well as with patients, and the deployment of telemedicine and telemonitoring services.

***“All the relevant gaps need to be identified, reduced and removed”***

Overall, while good progress has been made since the mid-2000s, there is a need to progress further on eHealth use. All the relevant gaps need to be identified, reduced and removed. Interoperability remains a challenge. Broadband and wireless connection in hospitals is in line with the Digital Agenda for Europe.

Electronic patient records, one of the most important elements of commitment of many European Member States currently, are being

***“ Electronic patient records, one of the most important elements of commitment of many European Member States”***

trialled in the current large-scale eHealth pilot, epSOS<sup>7</sup>. From this survey's findings, they need two major enhancements. On the one hand, more explicit incentives are needed for medical staff to take them on board. On the other hand, involving patients more pro-actively in their use could be an extremely important move. More acute hospitals – together with other hospitals, institutions and all stakeholders, including health professionals and patients, involved in the health system – need to be engaged in the process of organisational transformation and changes to relevant clinical procedures.

***“Broadband and wireless connection in hospitals is in line with the Digital Agenda for Europe”***

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<sup>7</sup> <http://www.epsos.eu/glossary.html/>

## Methodology-related observations

### What and who to survey

Repeat certain indicators

Complement the survey findings with findings from other levels of healthcare

Create a more in-depth and accurate understanding of electronic patient record systems

Focus on advances in telemonitoring and/or the barriers to its use

Consider undertaking a wider range of studies and surveys

### How to survey

Enlarge the span of the survey

Explore divergences across countries/regions

Involve hospitals in the collection of data

Involve different job specialities in the collection of data (examples include cardiologists, radiologists, emergency staff and nurses)

Involve patients in the collection of data

Consider the use of online surveys rather than computer-assisted telephone interview surveys

Improve the survey research by extending the fieldwork time

### What other forms of investigations are possible

Understand barriers and impacts more effectively through qualitative research

Encourage change to happen through using an appropriate learning model

This survey was a pilot exercise. Hence, the methodological lessons learned have been categorised into what and who to survey, how to survey and what other forms of investigation are possible.

*“ In particular, there is still a need to develop a more in-depth understanding of the use of electronic patient records, and clinicians' attitudes towards this.”*

Many questions posed in the survey resulted in good and interesting indicators. They should be subject to further piloting in the years to come. The survey could be enhanced by complementary findings that could emerge from institutions at different levels of healthcare in Europe. In particular, there is still a need to develop a more in-depth understanding of the use of electronic patient records, and clinicians' attitudes towards this. Qualitative data collection should be considered.

Exploring attitudes towards the use of ICT in hospitals by people in a wider range of job specialities and other health-related professions and occupations could be considered. Just one example is nurses. The hospitals themselves – and their staff –

could be involved appropriately in the collection of data. Ultimately, online surveys might ease data collection as could an extension in the duration of any fieldwork. Staff involvement in dynamic data collection might enhance and support organisational learning through development of an appropriate learning model. Patient involvement in data collection should also be considered.

Last but not least, methodologically, reflection needs to be paid to the implications of having small universes of hospitals in small, less populous countries (that is, those where there are fewer than one hundred observations that have been gathered).

## Brief glossary of terms

**eBooking:** This is an electronic booking system which enables appointments to be booked with clinicians and other health professionals. A range of medical personnel may be allowed to do the bookings but so may others (such as patients/citizens). There is a diversity of approaches throughout Europe in the ways in which different users are allowed to take responsibility for making eBookings.

**Electronic patient record systems:** These are electronic health records for patients which are put into a system. The system may be more or less sophisticated. The system may also be accessible to other institutions besides the hospital itself.

**Enterprise archive strategy:** This is a comprehensive information archiving strategy that is aligned with hospital's goals and performance needs. Many other types of organisations, besides hospitals, can also have such a strategy.

**ePrescription:** This is a medical prescription that is issued and transmitted electronically: it is an electronic version of a prescription.

**Picture Archiving and Communication System:** This kind of system enables images such as x-rays and scans to be stored electronically and viewed on screens.

## Notes

This report presents the outcomes of the study on “Benchmarking deployment of eHealth services III”, carried out by Deloitte, in association with Ipsos Belgium and with the support of Diane Whitehouse of The Castlegate Consultancy, on behalf of the Information Society and Media Directorate-General European Commission (EC). This is the first time that the EC has measured eHealth in acute hospitals in 30 countries.

The data used in this report was collected by means of a survey of 906 acute hospitals which targeted Chief Information Officers (CIOs) in all the hospitals and Medical Directors in 280 of the hospitals: CIOs were asked about the availability of eHealth infrastructure and applications in their hospitals whereas Medical Directors were asked about priority areas for investment, impacts and perceived barriers to the further deployment of eHealth. The survey was carried out in 2010 in all 27 Member States of the European Union (EU) and in Croatia, Iceland, and Norway.

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# 1 Introduction to the Study

Over the years, healthcare organisations have had to respond to many different changes – from advances in diagnostic and therapeutic procedures to the emergence of concepts such as managed care and telemedicine. Healthcare is fast becoming one of the most competitive and value-added industries worldwide due to the many technology-driven developments in diagnosis, treatment, care provision, patient monitoring, and healthcare infrastructure.

## 1.1 Context of the study

Throughout the past two decades, enormous progress has been made in information and communication technologies (ICT) support of the health systems and services in Europe. Europe is eager to be at the forefront of these developments as is reflected in the Digital Agenda for Europe (COM(2010)245 final/2). Indeed, for over 20 years, the European Commission (EC) has been steering a number of developments in eHealth through its co-funded research, support to deployment, and policy developments, and actions such as the eHealth action plan (COM(2004)356 final) and the Lead Market Initiative (LMI) (COM(2007)860 final). The main instruments used have been the various Framework Programmes for Research<sup>8,9</sup> and the Competitiveness and Innovation Programme Information and Communication Technologies Policy Support Programme (CIP ICT PSP) pilot actions. Structural Funds and regional funds financing has also potentially been available since 2007 for the deployment of eHealth initiatives: however, apparently, it is considered that the Member States have to date not used these sources of funding to great advantage.

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<sup>8</sup> eHealth (which was previously called either health telematics and ICT for health) has been co-financed by the EC since a set of pilot actions were undertaken prior to the Fourth Framework Programme. The size of the co-funding committed to this field doubled between the Sixth and the Seventh Framework Programmes.

<sup>9</sup> From the earliest forms of research co-financed by the EC in the early 1990s, hospitals have been involved in the initiatives. A number of the early projects focused on regional communications among countries' hospitals (these were, for example, in Denmark, Italy, and Greece). Since the Fifth Framework Programme, in particular, greater efforts have been made to include the professional associations of clinicians and other health professionals.

eHealth, of course, remains a competence of the Member States: each has put forward its own eHealth strategy<sup>10</sup>. The range of activities included in these policies incorporates many actions. They comprise the development of national health information systems, equipping hospitals with ICT, setting up web portals for public access to medical services (such as managing hospital visits online), developing approaches to digital prescriptions and dispensing, using electronic health cards, setting up electronic medical files, and deploying telemedicine services. Certain public health elements that relate to safety and security more generally have a more universal decision-making span and are not limited to single countries. Similarly, the well-being and sustenance of the EU economy (and the role that can be played in this by eHealth infrastructure and instrumentation) have pan-European implications.

At the end of this first decade of the twenty-first century, Europe's health systems and services are now under extreme pressure. As identified by the Organisation for Economic Co-operation and Development (OECD), there is "an absence, in general, of independent, robust monitoring and evaluation of programmes and projects" (OECD 2010). In this context, there is a very real need to benchmark for the first time in a consistent and comparable manner eHealth deployment, take-up, and impact in hospitals across the EU27.

This study therefore plays a vital role in discovering how today's hospitals use eHealth services. Its findings can indicate how the use of eHealth in hospitals may enable these institutions to handle future challenges. Building a robust and repeatable survey instrument to uncover such information is an important step forward for policy-makers and health authorities. It is anticipated that such benchmarking will constitute an important part of a decision-maker's toolkit.

### 1.1.1 A changing landscape

Like all fields of ICT, eHealth does not stand still. It is subject to both technological, and organisational, advances. Indeed, as the eHealth action plan (COM(2004)356 final) first identified, eHealth systems and services "combined with organisational changes and the development of new skills" could act as "key enabling tools" (p8). They are able to deliver

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<sup>10</sup> The latest assessment of progress on this front, co-financed by the EC, is due for publication in spring 2011.

significant improvements in access to care, quality of care, and the efficiency and productivity<sup>11</sup> of the health sector.

This 2004 EC Communication (COM(2004)356 final) can be placed in the context of the i2010 initiative (COM(2005)229 final). Its three sets of aims were based around addressing common challenges, accelerating the benefits of implementation (through pilot actions) and working together and monitoring practice. Many of the actions planned for the mid-2000s related to the establishment of various governance initiatives (such as forums for decision-making) and to regular means of measuring progress.

This was, however, one of the first documents to place an emphasis both on the quality of care, and access to it, but also on notions relating to "productivity gains" and even "substantial productivity gains" (p5, p23). It identified the need for a consideration of the relationship between mobility, infrastructure and technology and how that might be enhanced. It brought together the notions of health authority leadership, the interoperability of health information systems, patient identifiers and the interoperability of electronic health records.

Successor policy enhancements placed even greater emphasis on the need for the interoperability of various eHealth applications – especially electronic patient records (EPR systems) and ePrescribing (COM(2008)3282 final) and on telemedicine (COM(2008)689 final). They created bridges with the industrial and commercial highlights of the LMI (COM(2007)860 final).

In 2011–2012, on the one hand, any successor eHealth-related action plan will need to build at least two sets of bridges. It will need to be integrated in the wider context of the Europe 2020 economic reform package initiative COM(2010)2020 final and its associated pillars of activity (such as the creation of a Digital Agenda for Europe (COM(2010)245 final/2)). As a key objective, the Agenda's topics include the promotion of the use of eHealth technologies. This is undertaken with a view to improving the quality of healthcare, reducing medical costs and fostering independent living that include in remote places. On the other hand, it will need to be associated with the policy setting that relates

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<sup>11</sup> "eHealth systems and services can reduce costs and improve productivity in such areas as i) billing and record-keeping, ii) reduction in medical error, iii) alleviation of unnecessary care, and iv) savings achieved by business-to-business e-commerce" (COM(2004)356 final), in relation to Danzon and Furukawa 2001.

to health in its largest sense both in a cross-border European context and also with wider global horizons.

#### 1.1.1.1 Contextual considerations

The level at which to handle implementation of ICT, but also to encourage its use, is complex. It is hypothesised that the size of a country, and especially its population size, matters when a country is trying to develop certain health-related ICT applications (for example, an EPR – or patient summary – as a national initiative). The challenges it faces may depend on the extent to which a country is attempting to service the health-related needs of five million or fifty million inhabitants. By virtue of a country's size, the extent to which it can deploy an application, the time within which it can do it, and its levels of achievement will differ. How geographically scattered the population of a country is, and the geographic challenges of a country, may also be important attributes.

Many of those countries which are viewed as leaders in the eHealth field are indeed small countries, hence national, institutional, and organisational scale needs to be considered. Similarly, the type of health system that operates, and how healthcare is organised in a country, whether it is a public system, private, or a public-private mix, is important. However, at least two other attributes should be borne in mind: first, the length of time over which any implementation has been taking place<sup>12</sup>; second, the extent to which some countries have longstanding, historical traditions of approaching institutional and organisational change from a socio-technical perspective which has classically involved stakeholders in a participatory approach to design and implementation (Bødker et al 2004; Bjercknes and Bratteteig 1995; Bjercknes and Bratteteig 1987).

#### 1.1.2 International policy developments and expectations

Any European development in the eHealth field currently needs to be coordinated and placed in the context of both the work of the World Health Organisation (WHO) (which uses a survey mechanism) and the OECD (which has used a case study approach).

At the end of 2010 and beginning of 2011, the Global Observatory for eHealth of the WHO published two documents (World Health Organisation 2010; 2011). The 2011 volume is an atlas of eHealth profiles. It presents data gathered from the responses of 114 countries

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<sup>12</sup> Many of today's eHealth leading countries have more than twenty years of experience in deploying electronic health systems' applications.

around the world to the WHO's 2009 global survey on eHealth. The information covered is very general and relates to a number of high-level eHealth issues as well as to telemedicine (it does not relate to specific health sectors or institutions). This association with telemedicine is appropriate since the 2010 volume highlights the way in which the organisation's Member States are moving towards the application of this technology, its current status and relevant facilitating mechanisms, barriers, and information needs.

The OECD (2011) has used a case study approach to explore the various handicaps, incentives, enabling of secure exchanges of information, and the use of benchmarking in relation to eHealth with an aim to determine which practices can improve the adoption and use of ICT. It undertook six case studies, three of which were in Europe (the Netherlands, Spain and Sweden). Internationally, it also explored the situation in Australia, Canada and the United States of America (USA).

In the context of a visit to the Transatlantic Economic Council in late 2010<sup>13</sup>, Commissioner Kroes and United States (US) Secretary of Health and Human Services, Kathleen Sebelius, signed a memorandum of understanding on eHealth (IP/10/1744 and *Memorandum of Understanding*). It covers especially the organisation of shared delegations, expert visits, joint working groups, and mutual conferences, meetings and workshops but also includes a distinct focus on standardisation, safety and on health IT education. Chapter Six of this study already explores the way in which work undertaken by the US Department of Health and Human Services and by the EC can be compared and contrasted.

In Europe, the proposed article 14 of the proposed directive on patients' rights in the context cross-border healthcare, which it is anticipated will be signed into law in 2011, relates to eHealth (European Parliament 2011). It places the Union's emphasis on supporting and facilitating "cooperation and the exchange of information among Member States working within a voluntary network connecting national authorities responsible for eHealth designated by the Member States." Items of prime importance include patient summaries – that is, electronic patient records (EPR systems), medical information for public health and research purposes and appropriate identification and authentication mechanisms. This voluntary network can be understood in terms of the eHealth

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<sup>13</sup> December 17, 2010.

governance initiative which had its kick-off on February 24, 2011 in Brussels, Belgium<sup>14</sup>. It highlights the very same issues as those included in the text of the draft directive, and also draws attention to benchmarking and benchlearning.

These trends all provide indications of ways in which eHealth, whether in hospitals or in other healthcare institutions or wider, more general, settings are geared to enhancing the provision and quality of healthcare in Europe as well as internationally.

## 1.2 Objectives of the study

This study is formally called "Benchmarking deployment of eHealth services III": however, the study team has tended to use the briefer expression of "eHealth Benchmarking III". The survey follows on from a first exercise which measured eHealth use by general practitioners in 2007 and a second benchmarking exercise in 2009 which developed a framework for future eHealth benchmarking.

The main objective of this study has been to undertake a survey in hospitals in the EU27 and three other countries: Croatia, Iceland, and Norway. The approach has been to develop a survey method that can be repeated in the future and which has relevance in its ability to inform policy-makers about eHealth progress made by European hospitals.

The survey's intention is to introduce, for the first time, an understanding of the level of deployment and take-up of ICT and eHealth applications in acute hospitals in Europe. The resulting survey gives a clear picture of the state-of-play in terms of the digitisation of hospitals.

## 1.3 Final report structure

The final report of the eHealth Benchmarking III survey is organised according to the following structure.

In chapter two, background information about the survey methodology, the sample, target respondents, and representativeness is provided. The profiles of the hospitals that participated in the survey are described.

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<sup>14</sup> Described publically on November 16, 2010 at the final open meeting of the CALLIOPE thematic network. Accessed February 16, 2011. See [http://www.calliope-network.eu/Portals/11/4%20CALLIOPE%20event\\_CMA.pdf/](http://www.calliope-network.eu/Portals/11/4%20CALLIOPE%20event_CMA.pdf/).

In chapters three and four, the main results for the survey are laid out. The first of these two sections relates to the results which emerged from the CIO-related questions. A second section presents the results from the questions posed to Medical Directors.

In chapter five, best practices are presented. It includes the results of an assignment to create an acute hospitals eHealth profile. It also incorporates a more detailed analysis of the types of hospitals which perform best on the eHealth front in Europe.

Chapter six contains a comparison of this survey with several other surveys. The data from this survey are examined in an indicative manner with the other surveys' data. Although the previous surveys did not use identical methods or pose identical questions, the comparison provides some indicative trends on the good progress made in Europe in implementing eHealth. A comparison of certain of the current survey's indicators is made with regard to the tentative survey results that are currently emerging in the USA in relation to the American Hospital Association (AHA) annual survey on IT (2010 version).

Finally, chapter seven includes a number of key policy messages, conclusions, and lessons learned for both future policies and possible further editions of the survey.

A set of annexes are attached to this final report. They include a set of abbreviations, a glossary, the two questionnaire modules and other background materials such as sampling and statistical details relating to the survey, an information note, a description of the study's validation workshop, key data from previous surveys and a reference list.

In a separate annex, all the charts and breakdowns from the survey are available.

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## 2 Methodological Approach

This chapter outlines how the survey instrument was developed and describes elements that relate to the statistical reliability of the survey.

As indicated by the OECD, there are considerable challenges in aiming to measure ICT use in healthcare, whether in hospitals or elsewhere (OECD 2010, p15):

methodological difficulties are further exacerbated by data limitations, definitional problems and the lack of appropriate sets of indicators on adoption and use of ICTs which can be compared over time, within and across countries. For many of the hypothesized modes by which ICTs might effect efficiency in health care systems, there is little or no available data which would allow measurement.

### 2.1 The survey

The data on the deployment and use of ICT presented in this report were collected by means of a survey of acute hospitals. The survey was carried out in all 27 Member States of the EU and in Norway, Croatia and Iceland. This total sample is referred to as the EU+.

The fieldwork took place in the third quarter of 2010. It was coordinated by the Ipsos Belgium and was conducted in cooperation with their national partner institutes.

The survey was carried out using Computer–Aided Telephone Interviewing (CATI). The main advantages of this technique are twofold:

- It enables screening and qualifying of the survey respondents<sup>15</sup>.
- It is usually preferred to other techniques when short questionnaires such as the one used in this survey of CIOs and Medical Directors are administered<sup>16</sup>.

The universe represented was the population of hospitals in each of the countries covered by the survey. To guarantee coherence and comparability with e–Business W@tch<sup>17</sup>, the sample was limited to acute hospitals. By acute hospital is meant those public, private or

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<sup>15</sup> Since there were no public lists of CIOs and Medical Directors available to the survey team, to obtain access to the appropriate respondent, interviewers had to pass through the screening process of the hospital's main reception and/or the officers' secretary.

<sup>16</sup> This technique was used with similar surveys such as the e–Business W@tch (2006) survey.

<sup>17</sup> e–BusinessW@tch (2006) was conducted by Ipsos for the EC's Directorate–General Enterprise under the direction of empirica.

university hospitals which treat predominantly patients who are in immediate need of healthcare<sup>18</sup>. The following institutions were excluded: psychiatric hospitals, rehabilitation centres (preventive medical care centres, sanatoriums and rehabilitation clinics), medical nursing homes (including geriatric homes), and other hospitals such as military hospitals, police hospitals or prison hospital facilities.

The unit of enquiry was the establishment (the local unit where healthcare was provided)<sup>19</sup>. In the case of multi-establishment hospitals, information was collected only for the local unit sampled.

From the universe, a random sample of acute hospitals with a quota on hospital size, hospital ownership and region – the Nomenclature of Territorial Units for Statistics (NUTS) – was drawn. The target respondents were selected through a random procedure. The questionnaire involved 1,186 interviews with CIOs and Medical Directors in over 900 acute hospitals in the 30 countries surveyed. More precisely, 906 CIOs and 280 Medical Directors were interviewed. The design of the questionnaire was based on a mix of desk research, focus group input and advice from a steering group composed of representatives from various international socio-economic and health-related organisations.

#### 2.1.1 Questionnaire and indicators used

A first draft of the questionnaire was designed, and revised after commentary was received from the study team and steering group. On March 16, 2010, a focus group was held in the context of the high-level, eHealth week 2010 conference in Barcelona, Spain. Its role was to help the EC and the study team to make decisions with regard to the fine-tuning of the questionnaire structure, its wording, and the types of survey respondent. The desk research and the focus group discussions indicated that CIOs and Medical Directors would be the preferred target populations for this CATI survey in order to collect the levels and types of information needed.

The questionnaire was piloted with both CIOs and Medical Directors in hospitals in five countries (Belgium, Ireland, France, Poland and the United Kingdom (UK)). As a result, a

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<sup>18</sup> See Annex 2 of this final report for a glossary of terms and definitions.

<sup>19</sup> Each establishment was counted as a sampling unit. This is reflected in the size of the universe of the survey.

final versions of the two questionnaire schedules were refined. The original version of the draft questionnaire, on which all other versions were based, was written in the English language.

The piloted questionnaire schedules, and the versions used in the actual survey, were all worded in the respondents' own language. Skilled translators, who work in the health domain, were used to translate the versions. Two levels of checks operated: first, the pilot and, second, the first translation and a back translation. The training given to the interviewers on how to present the questionnaire involved an introduction to the use of a set of definitions and explanations. There appeared to be no major problems of understanding on the part of either the interviewers or the questionnaire respondents. The English version of the questionnaire schedules used for the survey are located in Annex 3: [Questionnaire module used with CIOs](#) and Annex 4: [Questionnaire module used with Medical Directors](#) of this report.

Further details with regard to the sampling procedure and sample sizes, statistical elements and limitations of the survey are included in Annex 5: [Sampling and statistical details relating to the survey](#) of this report.

#### **Cautionary notes on country data**

The study team proposes that the following approach is used when country results are compared.

The survey results portrayed in this final report always indicate in brackets the number of hospitals surveyed out of the total sample. This draws attention to any possibility for margins of error. As a consequence, country results should be interpreted carefully, but they can still be considered as a trend. When country percentages are reported, they should be interpreted in a qualitative, and not in a quantitative, way.

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## 3 Key Results and Conclusions relating to CIOs

This chapter presents the key results of the survey module targeted at hospital CIOs. They were identified as having the most appropriate profile among the acute hospitals' personnel to reply to questions related to the availability and use of eHealth in their hospital. In particular, the CIO questionnaire contained 46 questions<sup>20</sup> which explored the following four eHealth dimensions:

- Hospital ICT infrastructure and connectivity. Covered by questions 7 to 15 in the CIO questionnaire, they are described in section 3.1.
- Availability and use of electronic medical applications in hospitals. Covered by questions 16 to 32 in the CIO questionnaire, they are described in section 3.2.
- Electronic patient data exchanges. Covered by questions 33 to 37 in the CIO questionnaire, they are described in section 3.3.
- Data protection and security strategy aspects. Covered by questions 38 to 46 in the CIO questionnaire, they are described in section 3.4.

The key results for each of these four dimensions are provided in the following sections. When appropriate, indicator data is presented by hospital type or according to country differences. The chapter ends with a number of conclusions on the CIO component of the questionnaire. The results of the Medical Directors' module are reported in Chapter 4.

### 3.1 Hospital ICT infrastructure

The availability of the range of applications in the order in which they were investigated in the survey are described here: ICT availability and connectivity; Internet; and wireless connectivity.

#### 3.1.1 ICT availability and connectivity

eHealth has been considered to be important in Europe for thirty years. It has been introduced increasingly into the primary, secondary, and tertiary levels of the Member States' healthcare systems. Hospitals are no longer considered as "stand-alone" institutions or systems. They are clearly now a part of the value chain in terms of

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<sup>20</sup> The full CIO questionnaire is located in Annex 3.

healthcare provision and maintenance. It is not only important that hospitals have ICT available to them, but also that the systems and the applications used are connected and increasingly integrated. The ways in which this is done, and the geographic areas covered, are subject to the appropriate European legislation<sup>21</sup> (in terms of data protection and privacy, for example)<sup>22,23</sup> and domestic legislation (with regard to the responsibility of Member States for the provision of public health in their own countries).

According to the survey results, almost all acute hospitals in Europe have a computer system. Of the hospitals that have a computer system in place, two-thirds are specific to, or are limited to, the hospital site. Almost one-fifth of the hospitals form a part of a computing network of different hospitals or hospital sites. Only 14% are a part of a regional or national computing network. Regional networks appear to be more established in large Member States or in states which have a more regionally-oriented system, such as Italy, Spain, and the UK.

In around half of the hospitals with a computer system in place, their computer systems are externally connected through an extranet. On the other hand, in almost one in three hospitals, computers are connected through a value-added network or proprietary infrastructure as shown in Figure 1. This percentage is even higher in large hospitals, and reaches 39% in hospitals with more than 750 beds.

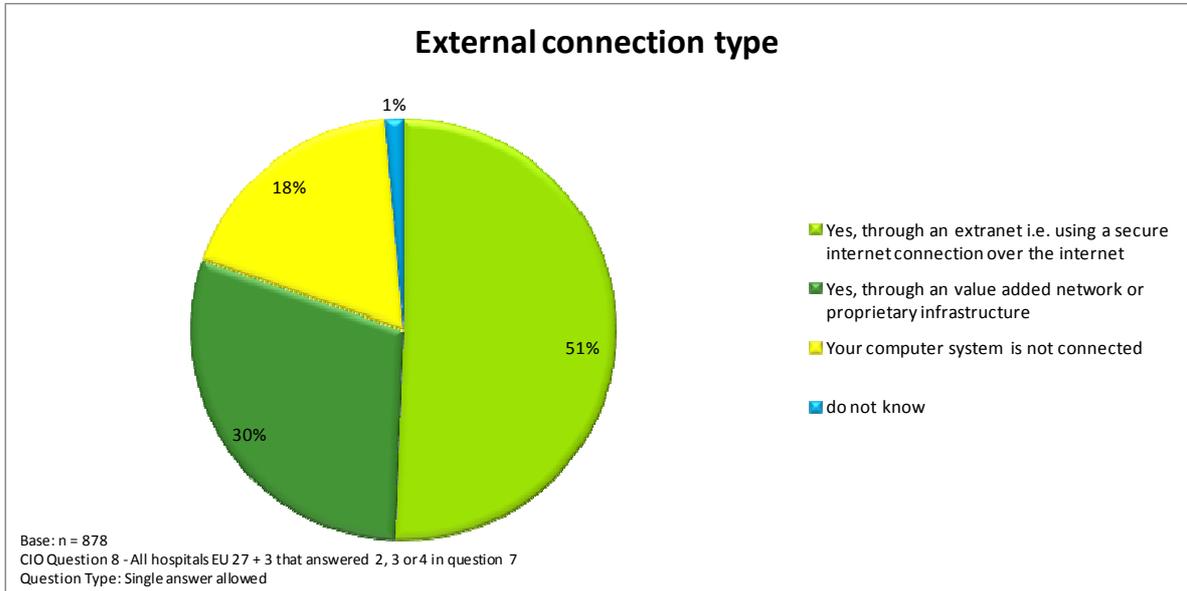
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<sup>21</sup> The cross-border patient care directive of 2011 which has now been formally adopted.

<sup>22</sup> Ongoing discussions with regard to revision of the European Data Protection Directive.

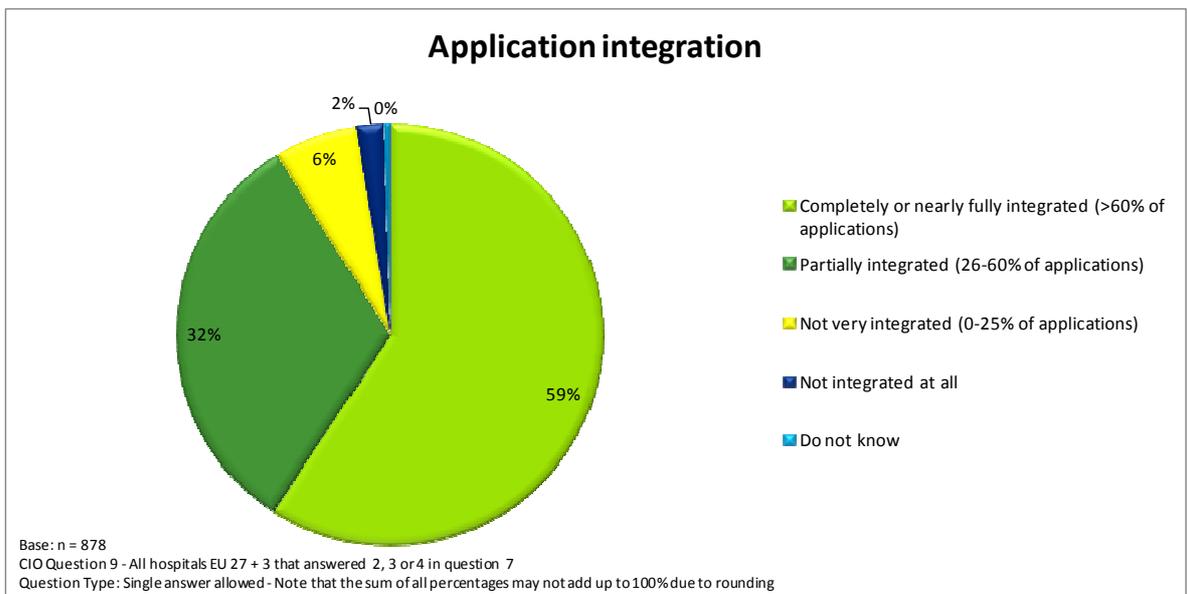
<sup>23</sup> Public health threats (such as epidemics) are covered at a pan-European level (not just at a country-specific level, although of course each Member State handles its national approach to a pandemic, for example, through local vaccination).

Figure 1 – Computer systems that are externally connected



With regard to the application integration in the system, the survey results show that a majority of the hospital applications are either nearly fully, or fully, integrated in their hospital's computer system. In almost one-third of the hospitals, applications are partially integrated as Figure 2 shows. In less than one-tenth of the surveyed hospitals, applications are not very, or not at all, integrated.

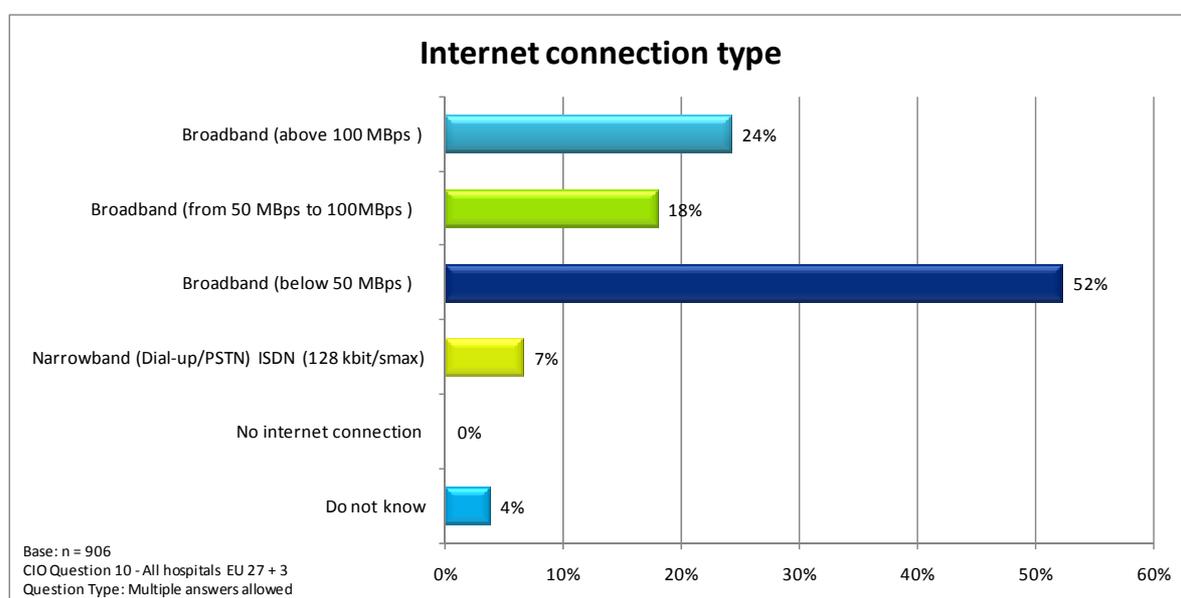
Figure 2 – Integration of applications in the computer system



The degree of integration varies greatly across Member States. For instance, in Belgium, 83% of the hospitals surveyed reported a completely, or nearly fully, integrated system. In the UK, however, only 45% of the hospitals surveyed reported that this was the case.

Broadband Internet is the norm in acute hospitals in the EU+. Among the 92% of hospitals that have broadband, just over half have Internet connections with a bandwidth of below 50 MBps. Almost a quarter of connections have data transfer rates of more than 100MBps. It appears that next generation broadband (more than 100MBps) is more likely to be found in large public hospitals (with more than 750 beds) and in university hospitals than in other hospitals.

Figure 3 – Type of Internet connection



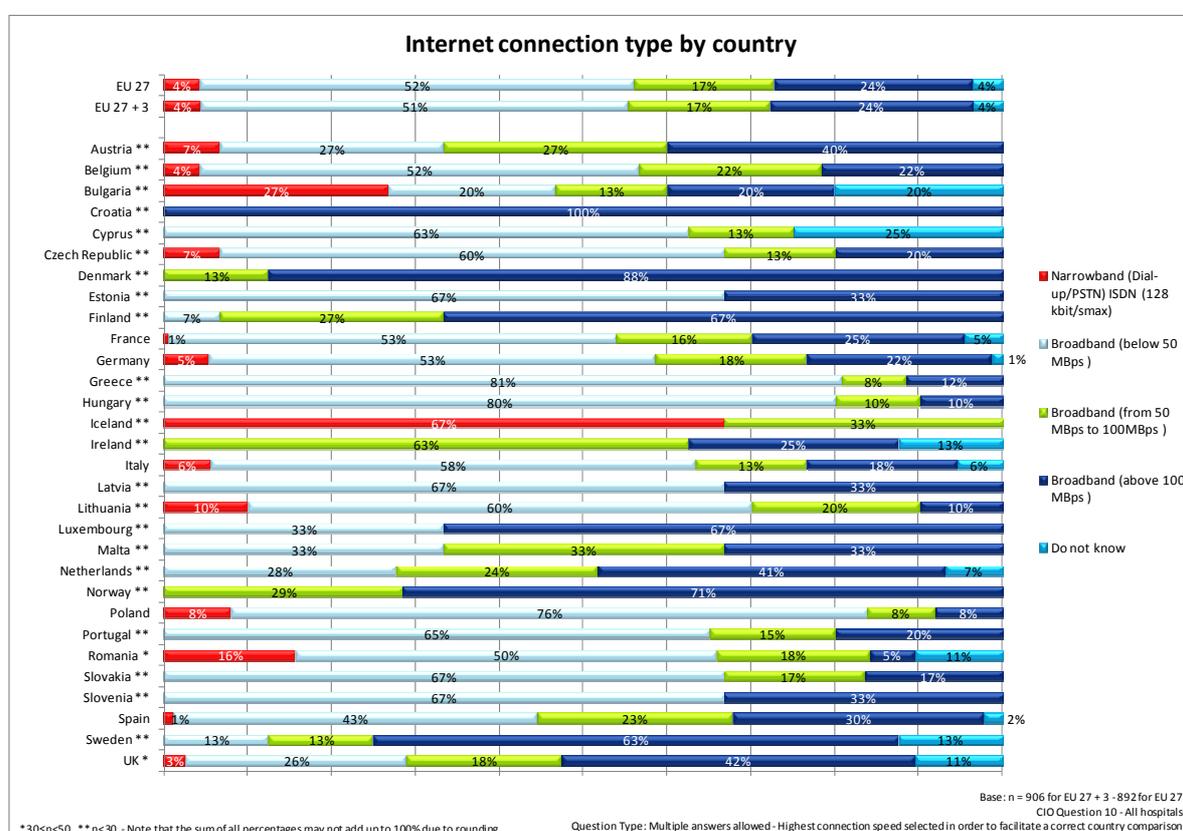
The status of broadband infrastructure and its availability is becoming increasingly important to the European policy agenda (COM(2010)245 final/2). The Digital Agenda for Europe sets out its expectations regarding these actions for the EC in the deployment of, and access to, fast and ultra-fast Internet (Ibid.)<sup>24</sup>. In particular, it is anticipated that access to universal broadband, with appropriate increases in speeds, will be guaranteed. A wide range of instruments and mechanisms are proposed to achieve these developments on the part of both the EC and the Member States.

<sup>24</sup> See section 2.4 of the Agenda, including the specifications of its Key Actions 8 and 9.

It is likely that Member States and their regions have not adequately explored the availability of both structural and rural development funds since 2007. These funds could still be earmarked for connecting and improving access to broadband in the countries' hospitals until 2013 or beyond. The funds could be used to improve national health systems or even home-based care.

Narrowband is still present in hospitals in several European countries as Figure 4 shows. For instance, narrowband is offered in 67% of Icelandic hospitals and in 27% of Bulgarian hospitals.

Figure 4 – Internet connections speed by country



In order to facilitate a correct and accurate country comparison, the multiple choice question 10 in Figure 4, has been reduced to a single answer only question, so that overlap does not affect a clear reading of the chart. For each hospital in the survey, only the highest speed selected by the interviewee has been taken into account for Figure 4<sup>25</sup>.

<sup>25</sup> For a country overview with the full multiple choice answers included in the figure, please view section 1.7 of the Report's Data Annex.

The Digital Agenda for Europe (Ibid, p4) outlines the ambition to:

bring basic broadband to all Europeans by 2013 and [to seek] to ensure that, by 2020, (i) all Europeans have access to much higher Internet speeds of above 30 Mbps and (ii) 50% or more of European households subscribe to Internet connections above 100 Mbps.

reach these ambitious targets it is necessary to develop a comprehensive policy, based on a mix of technologies, focusing on two parallel goals: on the one hand, to guarantee universal broadband coverage (combining fixed **and wireless**<sup>26</sup>) with Internet speeds gradually increasing up to 30 Mbps and above and over time to foster the deployment and take-up of high speed access networks (NGA) in a large part of the EU territory, allowing ultra fast Internet connections above 100 Mbps.

The availability of wireless and mobile computing in hospitals is becoming an important part of a healthcare information technology (IT) toolbox. It connects caregivers to clinical data and applications anywhere and anytime, thereby improving efficiency in acute care where time can often be of critical importance. Certain forms of wireless use may, however, be treated with caution in certain Member States.

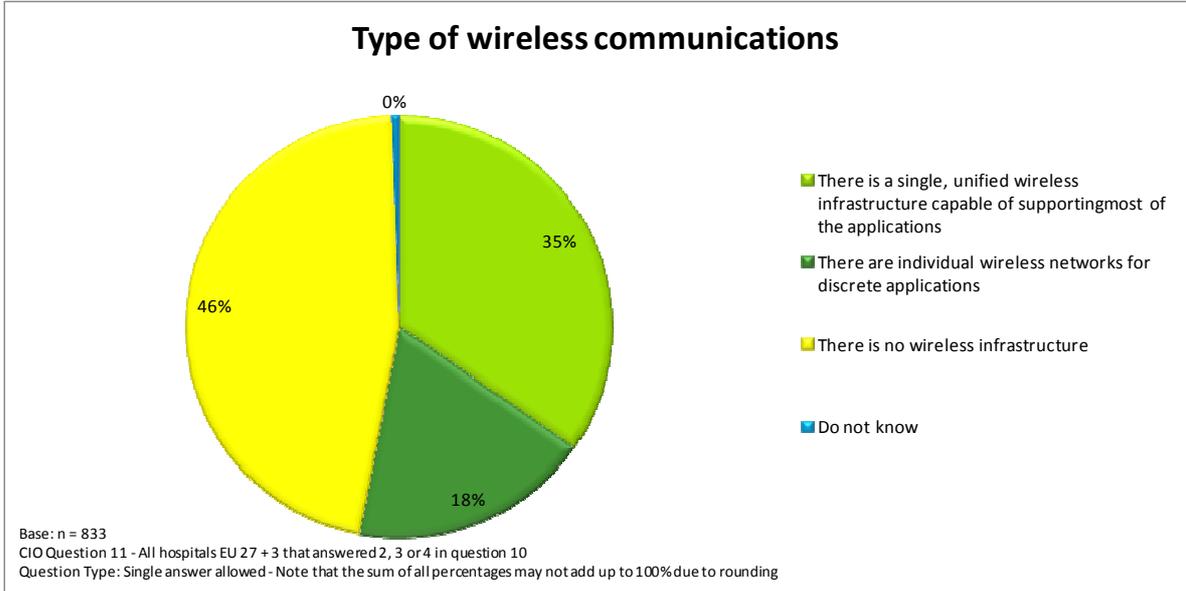
Figure 5 shows that wireless communication is not yet the norm in European acute care hospitals. Nearly half of the acute hospitals with broadband do not have a wireless infrastructure. However, one in five hospitals has individual wireless networks for discrete applications. In over one-third of hospitals with broadband there is a single and unified wireless infrastructure that is capable of supporting most of the applications.

Lack of wireless infrastructure seems to be related to hospital size. Small hospitals are less likely to have any wireless communications system. Over half of small hospitals with broadband are without wireless infrastructure while only one-third of large hospitals with broadband do not have it.

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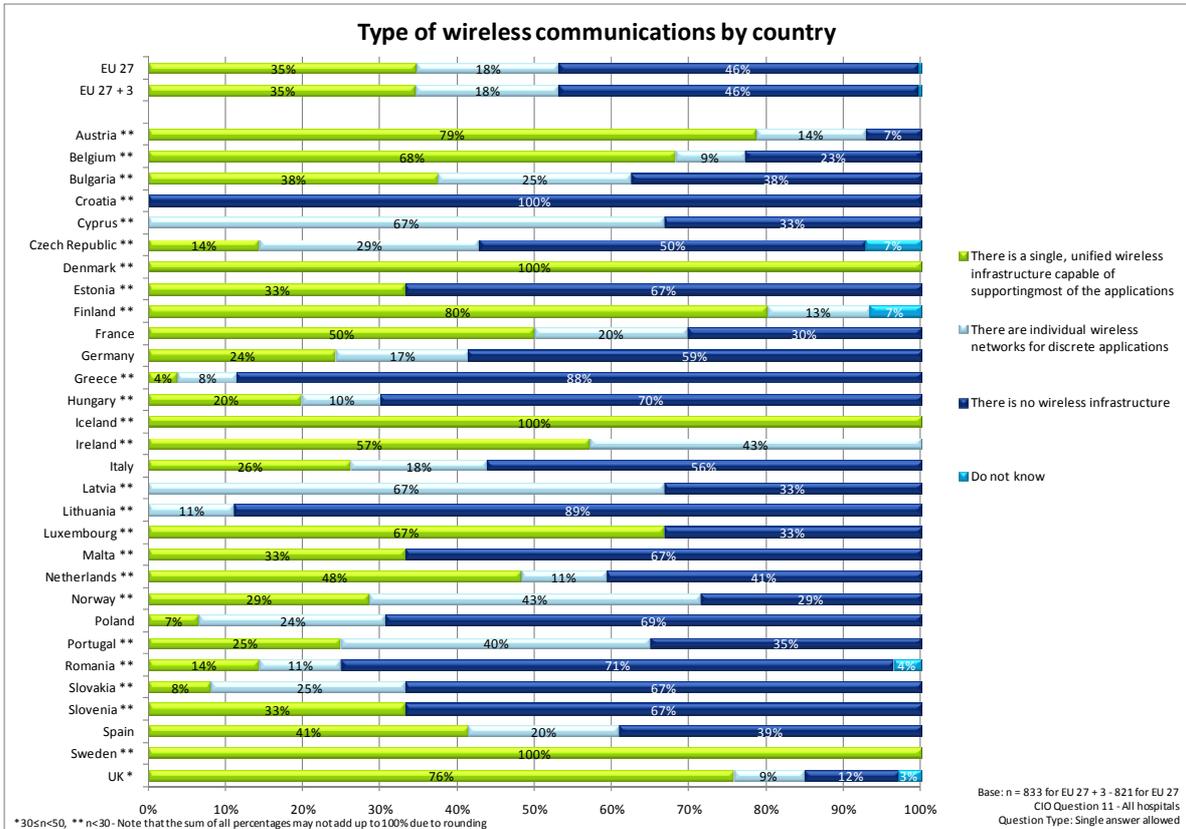
<sup>26</sup> emphasis added.

Figure 5 – Wireless communication systems available



A wireless infrastructure in acute hospitals is not present, to varying extents, in a number of hospitals in different countries, as Figure 6 shows.

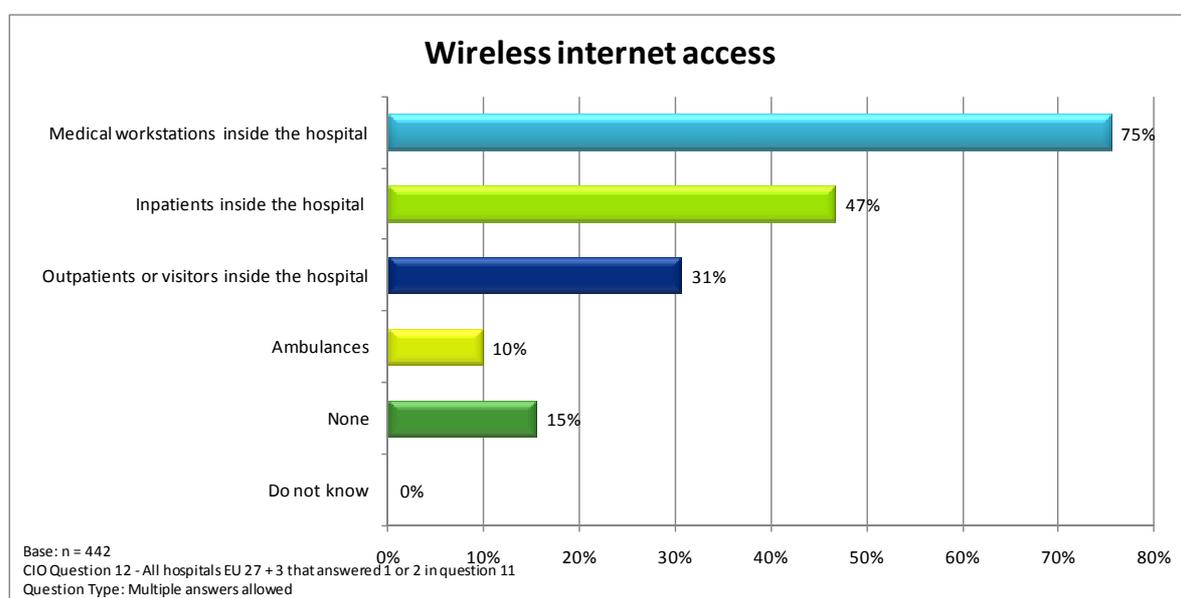
Figure 6 – Wireless connectivity by country



For example, wireless is not present in any Croatian hospital surveyed, 88% of the Greek hospitals with broadband, 71% of the Romanian hospitals with broadband, or 69% of the Polish hospitals with broadband.

The CIO survey question 12 deals with wireless Internet access. Of the hospitals that have a wireless infrastructure, three-quarters have Internet access inside the hospital through medical workstations as Figure 7 shows. Inpatients have access to wireless Internet in nearly half of the hospitals that have a wireless infrastructure, and so do outpatients or visitors in about one-third of the hospitals. There are no significant differences, however, across hospital size or typology.

Figure 7 – Wireless Internet access



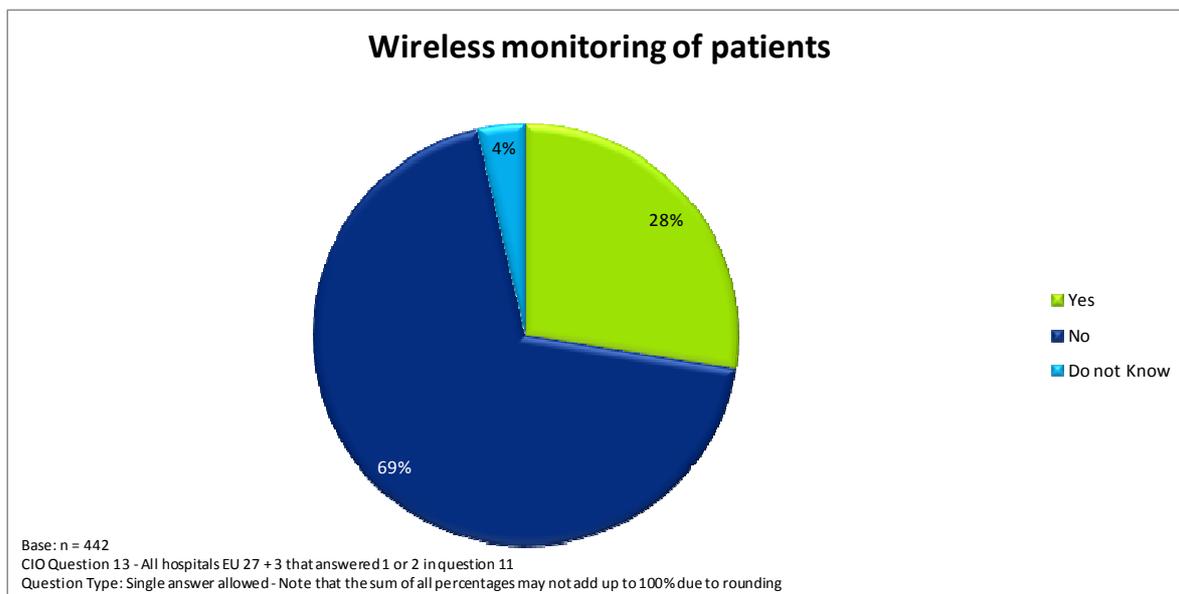
Wireless Internet access to medical workstations inside hospitals is high in some large countries: for instance, 93% of the hospitals in the UK and 87% in France provide wireless Internet access in the workstations inside their hospitals. The lowest percentage of wireless Internet access to medical workstations can be found in Poland – among 39% of the hospitals which replied to this question.

Such use of wireless communications, particularly in connection with patients, is interesting in terms of the current policy directions stipulated in the EU2020 economic reform package initiative (COM(2010)2020 final) and the Digital Agenda for Europe (COM(2010)245 final/2). It shows a level of synergy with initiatives and approaches that are perhaps easier to apply or introduce than are changes in physical infrastructure

(especially if these were to be associated with an expansion of the current Radio Spectrum restrictions). Current wireless use in hospitals indicates that such a communication scheme is now perceived to fit appropriately with the safety and security expectations of Europe's hospitals. Its use might feasibly also gel with the current expectations, and use of telecommunications, of Europe's citizens – whether in an office, domestic, or in-street/mobile setting. Some countries may, however, retain concerns with regard to the safety aspects of the provision of wireless for use by patients or others in their hospitals.

The last question on wireless monitoring (question 13 to the CIO respondents) shows that only just over a quarter of the hospitals with a wireless infrastructure provide wireless monitoring of patients inside the hospital (as Figure 8 shows).

*Figure 8 – Provision of wireless monitoring of patients inside the hospital by hospital size*

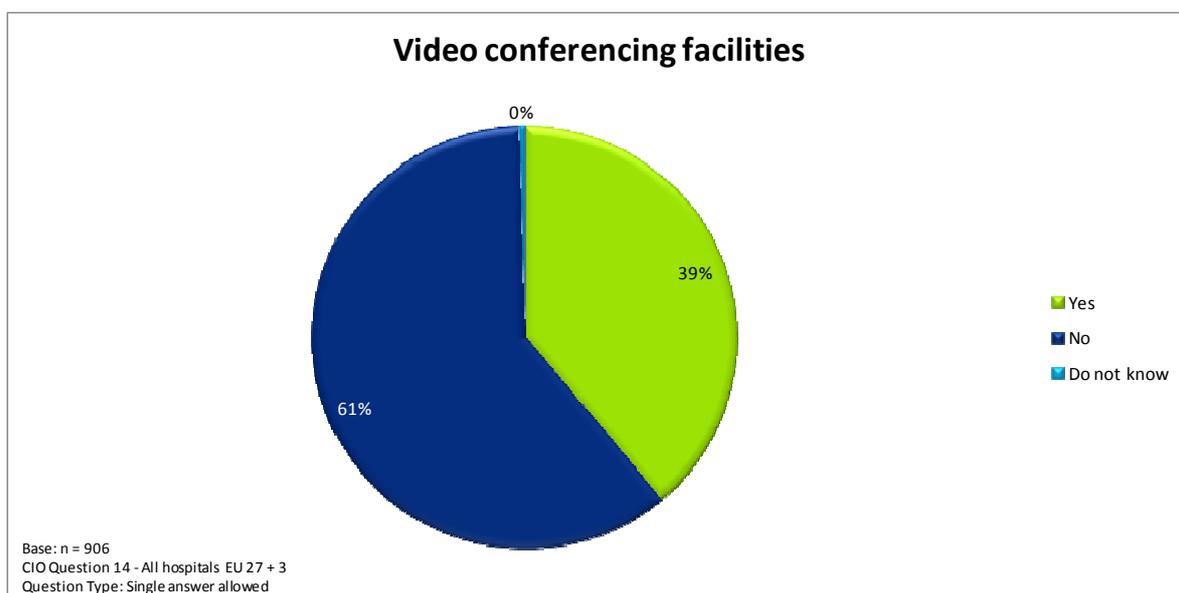


In geographical terms, there are noticeable differences among hospitals wireless availability. More than half of the Swedish and Norwegian hospitals that answered this question responded in the affirmative. The proportions vary from 43% of the Italian hospitals and 39% of those in the UK. Even in those new Member States where the sample of respondents was larger, the percentage of affirmative answers to this question is rather low (11% for Poland, for instance). Finally, in several countries, none of the hospitals surveyed that have wireless systems in place provide wireless monitoring of patients: these include, among others, Croatia, Estonia, Hungary, Lithuania, Malta, Slovakia, and

Slovenia. Indeed, it may be that there are restrictions in a number of Member States with regard to wireless monitoring of patients or use of wireless in proximity to patients<sup>27</sup>.

The next question on ICT infrastructure (question 14 posed to the CIO respondents) deals with the availability of videoconferencing. Videoconferencing can, of course, facilitate telemedicine consultations as well as other remote clinical exchanges within the hospital site and with external healthcare actors and patients. Videoconferencing is quite prevalent already in EU hospitals since around two-fifths of hospitals replied they have video conferencing facilities (as Figure 9 shows).

Figure 9 – Video conferencing system facilities



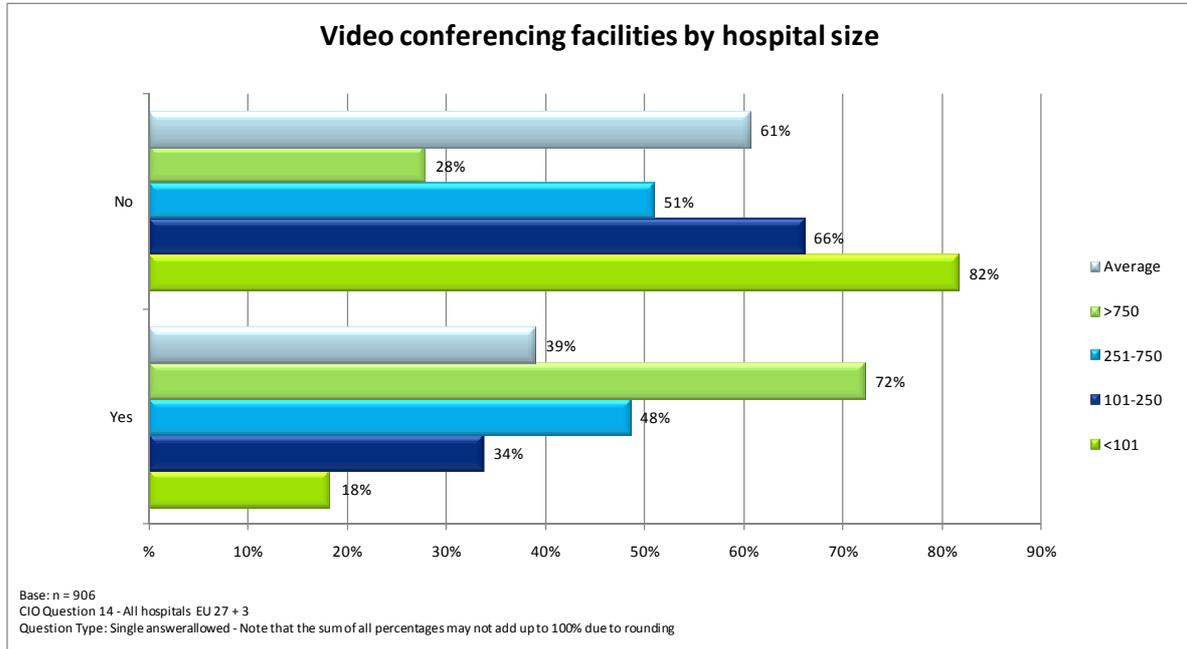
The percentage of available videoconferencing facilities is higher in university hospitals where over three-quarters have video conferencing systems. It is also higher in public hospitals (55% in comparison to 45% of private hospitals).

In terms of size, large hospitals are more likely to have video conferencing systems in place (as Figure 10 shows). Nearly three-quarters of hospitals with a capacity of more than 750 beds have video conferencing facilities compared to less than one-fifth of small hospitals. Independent single-site hospitals are less likely to have video conferencing facilities.

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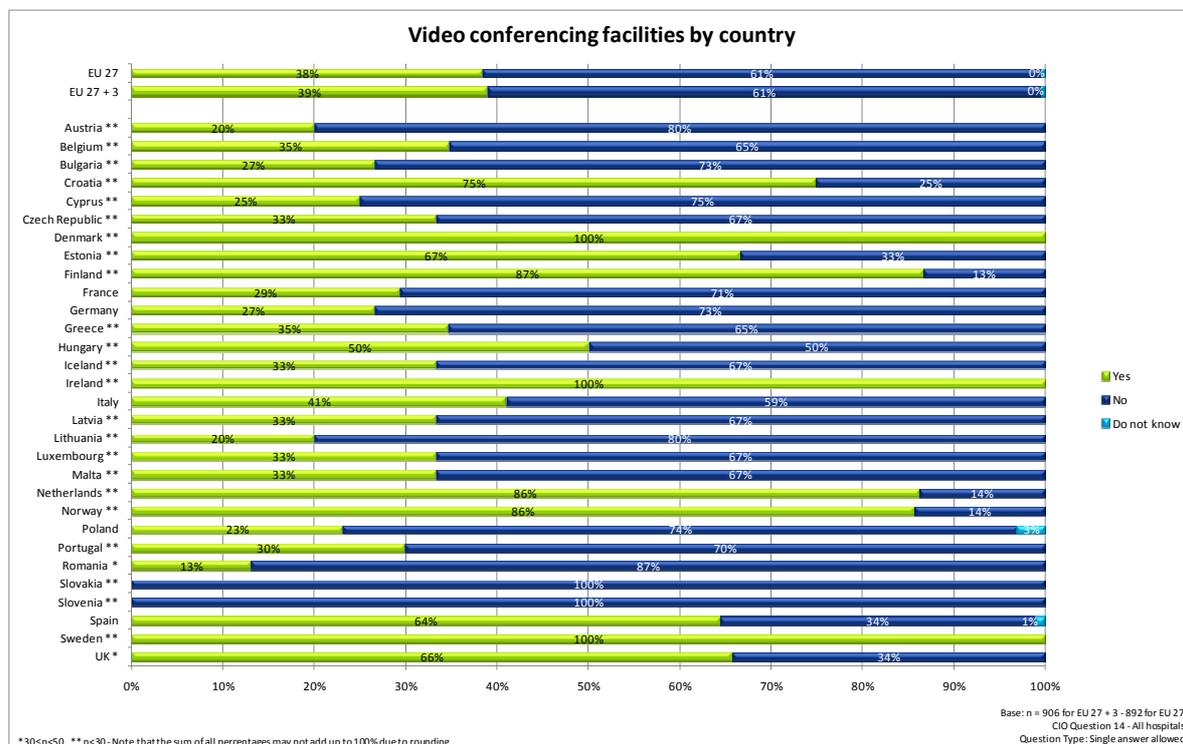
<sup>27</sup> Belgium is an example.

Figure 10 – Video conferencing system facilities by hospital size



In geographic terms, acute hospitals in Nordic countries have the highest availability of videoconferencing facilities: all Danish and Swedish hospitals surveyed have video conferencing facilities, together with six out of seven Norwegian hospitals. Very high availability is also displayed for the Dutch hospitals surveyed (86%) and for those in the UK (66%). On the other hand, as Figure 11 shows, lower availability is to be found in the hospitals surveyed in France (29%), Germany (27%), Poland (23%), and Romania (13%). In Slovakia and Slovenia, none of the surveyed hospitals have such facilities.

Figure 11 – Availability of video conferencing by country

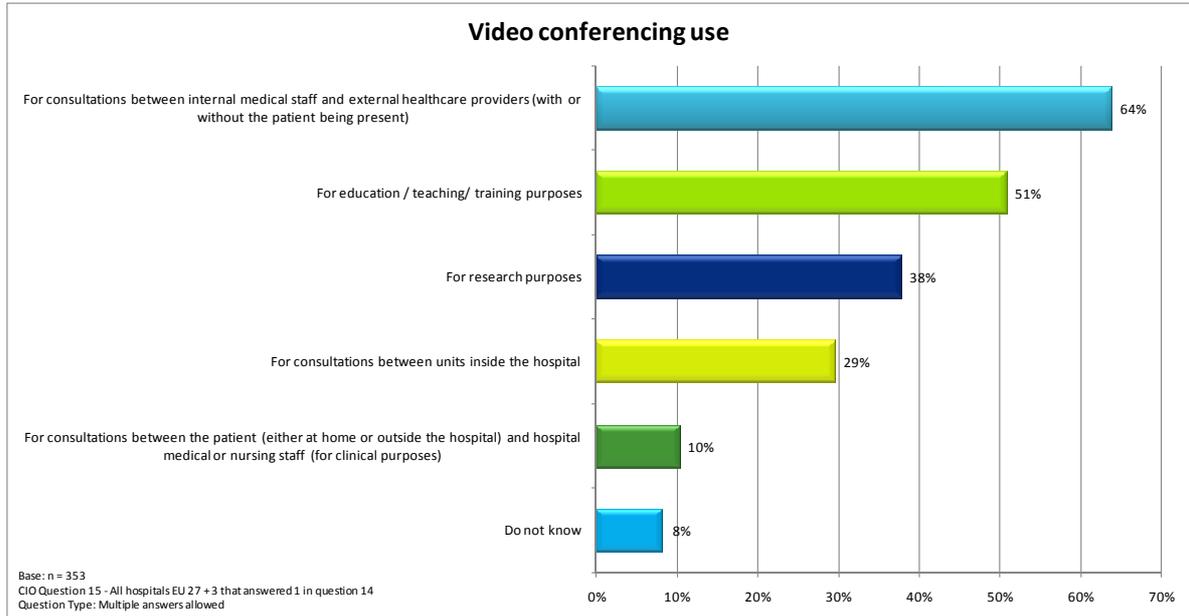


The CIOs in the hospitals that have video conferencing facilities were asked about the medically-oriented purposes of video-conferencing use between medical colleagues.

According to the answers received, two-thirds of video conferencing facilities are used for consultations between internal medical staff and external healthcare providers, half are used for education or teaching or training purposes, and nearly two in five are used for research purposes (as Figure 12 shows).

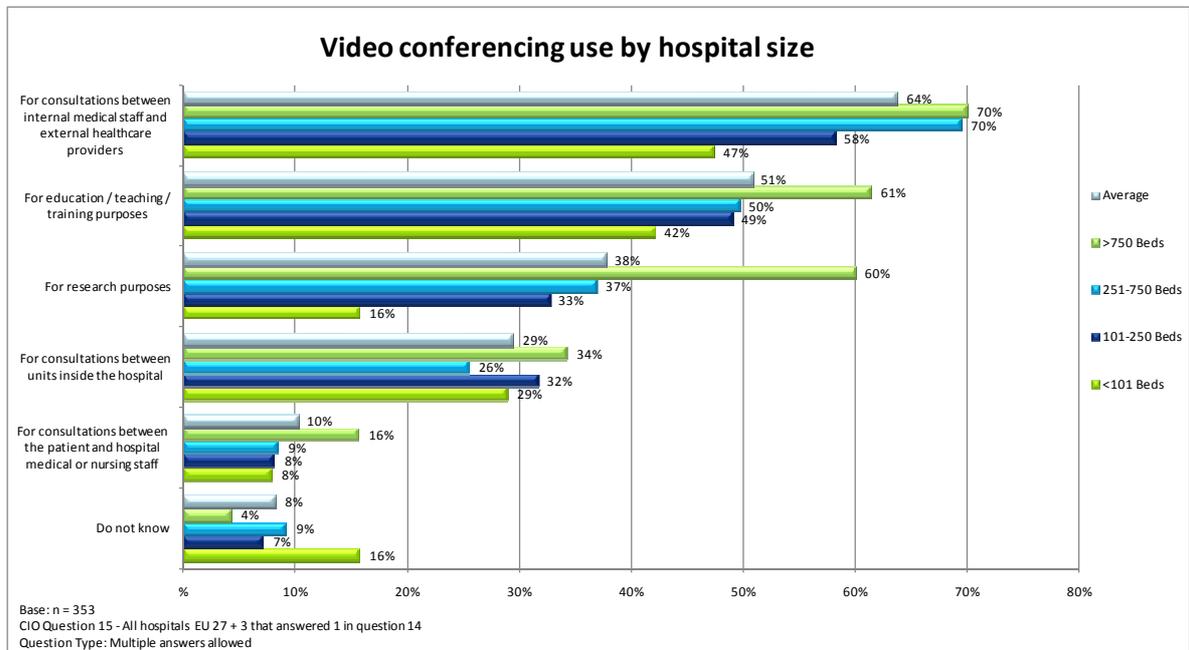
A small proportion (8%) of the CIO respondents was not able to answer this question. This difficulty might be related to the fact that, in some hospitals, CIOs may not know precisely for which purposes the video conferencing facilities are being used by the clinical staff.

Figure 12 – Medically-oriented purposes of videoconferencing



University hospitals' usage is higher than for non-university hospitals for all the purposes mentioned above. Larger hospitals are also more likely to use videoconferencing for these purposes (as Figure 13 shows).

Figure 13 – Medically-oriented purposes for videoconferencing according to hospital size



## 3.2 Availability and use of electronic medical applications in hospitals

This section includes the responses to questions 16–32 of the CIO questionnaire. They concern the availability and use of different types of electronic medical applications and systems. The sub-sections deal systematically with EPR systems, PACS, integrated computerised systems, electronic adverse healthcare reporting systems, electronic transmission of test results, eOrder-placing, eBooking, telemedicine, and online chronic disease management capabilities.

It would, of course, be feasible to categorise these nine different applications in more condensed and smaller groupings, for example, that relate to patient care and safety and/or security.

### 3.2.1 Electronic patient records

An electronic health record (EPR)<sup>28</sup> (also known as an electronic patient record or a computerised patient record) is an evolving concept which is currently defined as a systematic collection of electronic health information about individual patients or a population.

An EPR refers to a comprehensive medical record (or similar documentation) that covers the past and present physical and mental state of health of an individual in an electronic form, and providing for ready availability of these data for medical treatment and other closely related purposes (COM(2008)3282 final, p13)<sup>29</sup>. The Gartner (2009) definition of an electronic medical record can help with the understanding of an EPR. It is a computer-based patient record system which contains patient-centric, electronically-maintained information about an individual's health status and care. Gartner (2009) similarly uses the notion of an EPR system which is "limited to a single care delivery organisation" (for example, to a single hospital).

Currently, in the different Member States and among systems supplied by different suppliers, there is a range of sophistication in terms of systems available and accessible.

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<sup>28</sup> When only an electronic patient record (EPR) is referred to, the abbreviation EPR, or its plural EPRs, is used. When an EPR system is intended, then the abbreviation EPR system (or EPR systems) is used.

<sup>29</sup> The wording used here is a slight adaptation of the text located in COM (2008) 3282 (final).

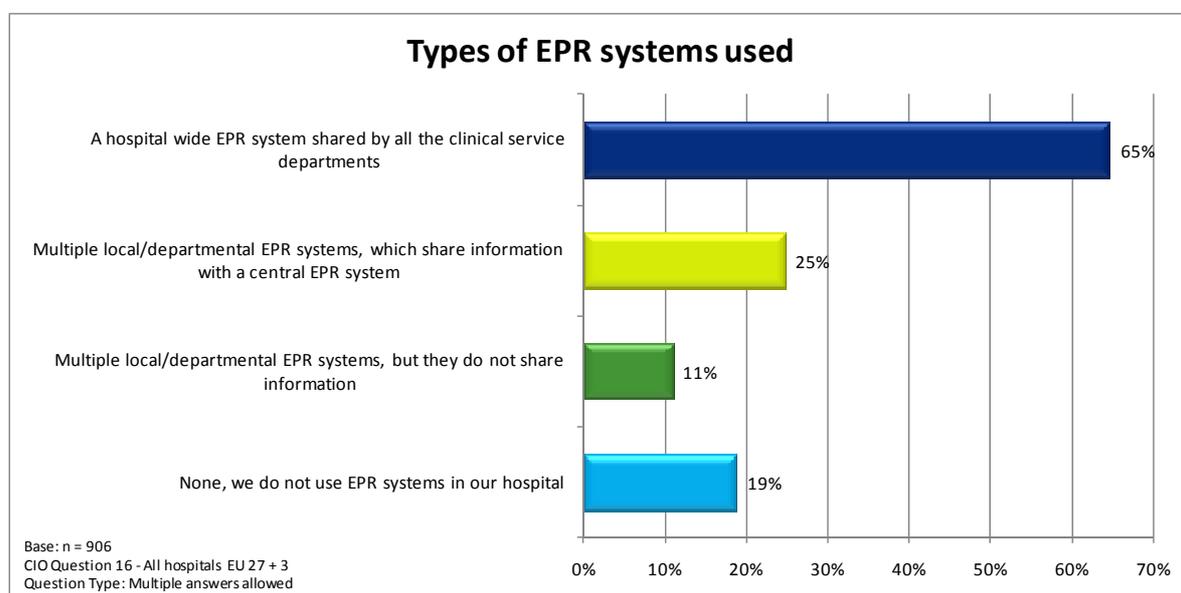
Generally, a simple history of a patient’s access to hospital services is not sufficient to be considered as an EPR system.

An EPR is important for a variety of reasons. These include the associated ease, and speed, of treatment that can be offered to the patient by a particular healthcare or hospital specialist, the associated potential link between the patient's treatment in the primary care and secondary care context, and last – but increasingly not least – the patient's own ability to manage his or her own care as a result of understanding, and having access to, his/her own health or care record(s).

Questions 16 to 19 are related to the use of EPR systems in the hospitals surveyed. In the survey, questions that related to an EPR system were based on a definition of a computer-based patient record system which contains patient-centric, electronically-maintained information about an individual’s health status and care.

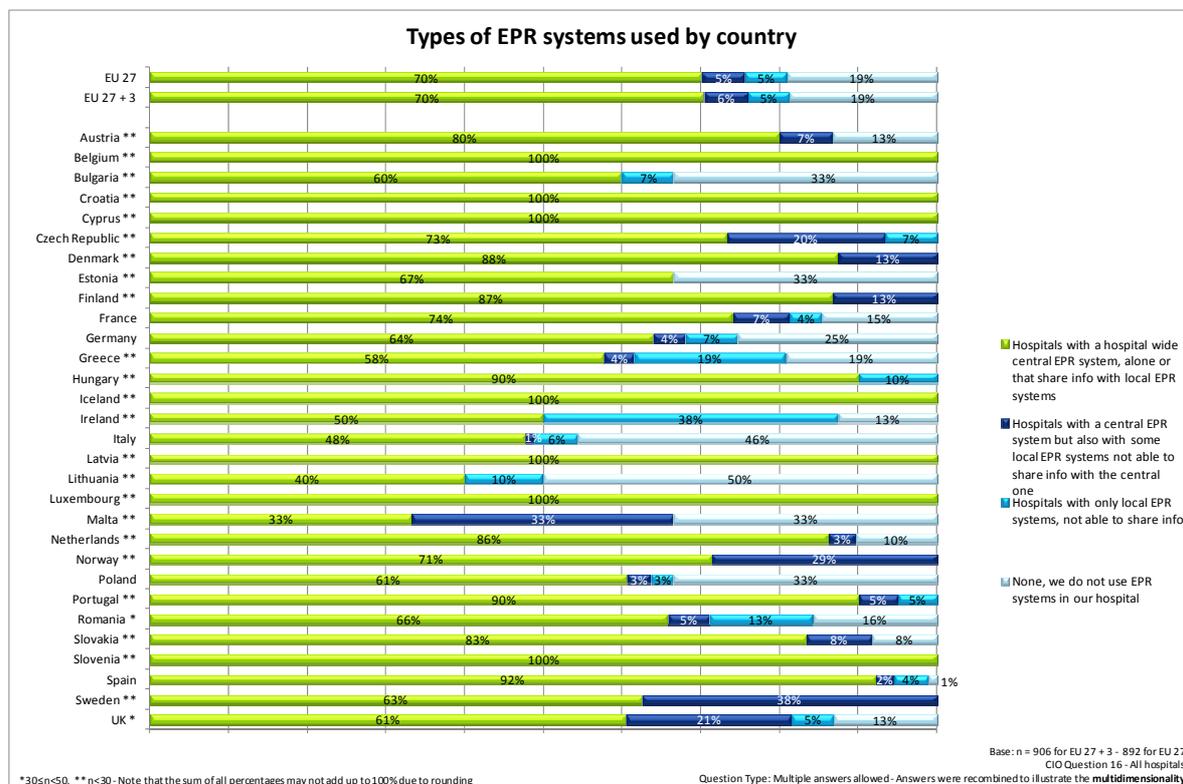
Almost two-thirds of hospitals, whatever the hospital type or sizes, use a hospital-wide EPR system which is shared by all the clinical service departments. A little less than one-fifth (19%) does not use any EPR system (as Figure 14 shows).

Figure 14 – Types of EPR systems used



As shown in Figure 15, hospital wide central EPR systems alone or that share information with local EPR systems are more likely to be found in hospitals in Belgium, Croatia, Cyprus, Iceland, Latvia, Luxembourg, and Slovenia. Lower rates are to be found in Bulgaria, Ireland, Italy, Lithuania and Malta.

Figure 15 – Types of EPR systems used by country



In order to facilitate a country comparison that takes the multidimensionality into account, the data that has been used for Figure 15, was recoded. The recoding was done by combining the various answer combinations into four new categories<sup>30</sup> that are used in Figure 15:

- *Hospitals with a hospital wide central EPR system, alone or that share info with local EPR systems* is a combination of the hospitals where the interviewee answered answer one alone, answer two alone and both answer one and answer two. These have been combined as it shows hospitals that have a more or less complex system able to share information, somewhere in the order of three-quarters of them have a single central system and the rest have multiple systems that share information.
- *Hospitals with a central EPR system but also with some local EPR systems not able to share info with the central one* is a combination of the hospitals where the interviewee answered both answer one and two, both answer two and three as well as the interviewees that answered all of the following answers: one, two and three.

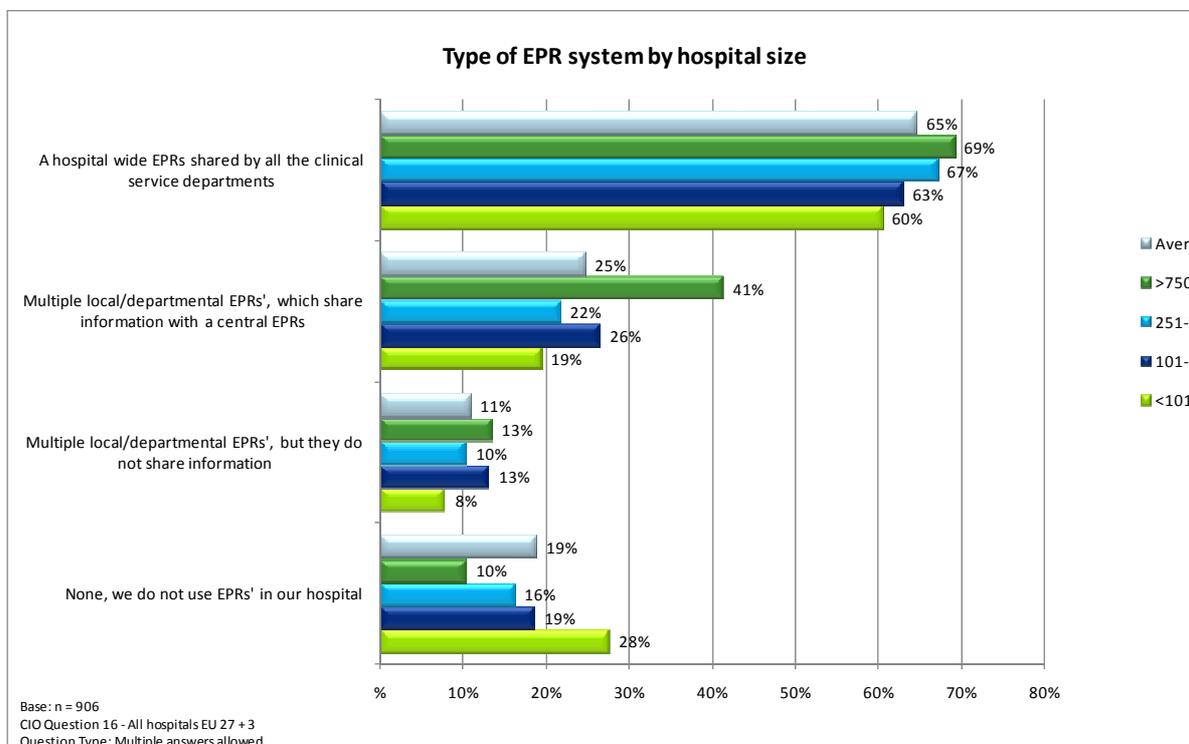
<sup>30</sup> For a country overview with the full multiple choice answers included in the figure, please view section 1.13 of the Report's Data Annex.

This combination only accounts for about one in eighteen hospitals. It may indicate a hospital that is in transition from local systems to a central system or it could indicate complex hospitals where there is a central system and local systems that are specialised.

➤ *Hospitals with only local EPR systems, not able to share info* is the category for the hospitals where the interviewee answered answer three only.

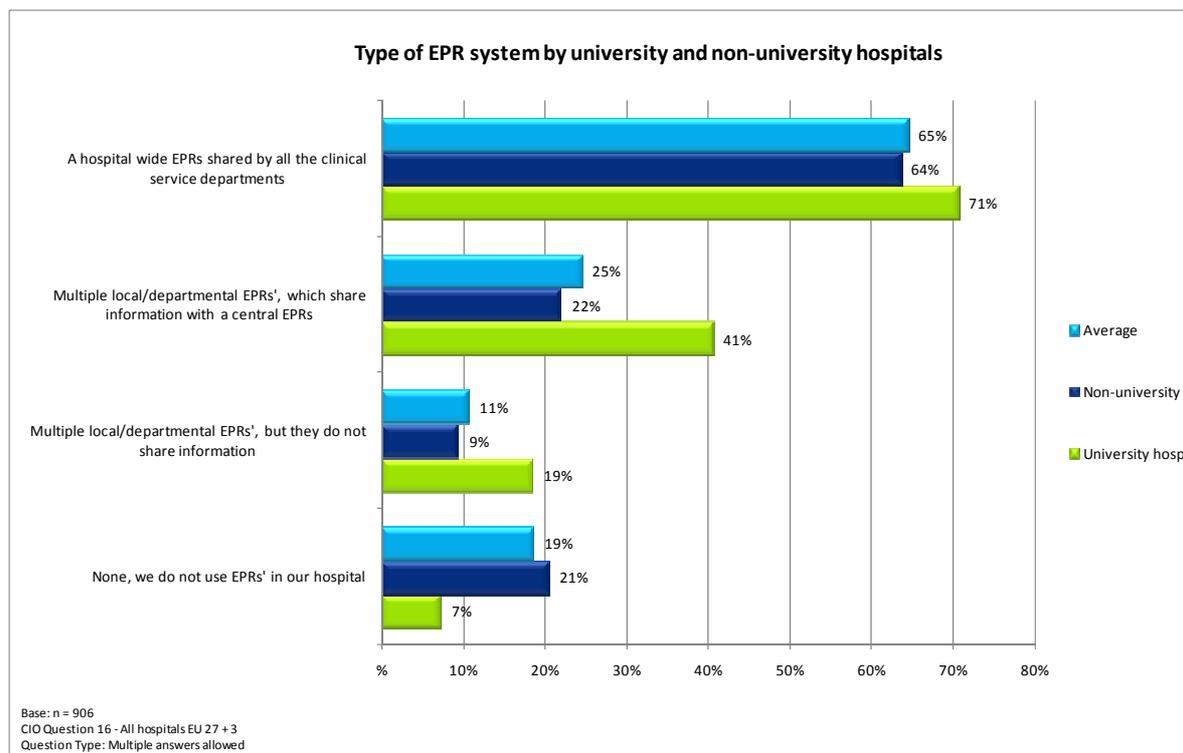
➤ *None, we do not use EPR systems in our hospital* is the category for the hospitals where the interviewee answered answer four only.

Figure 16 – EPR systems by hospital size



In Figure 16, it is evident that smaller hospitals are less likely to have EPR systems, and – when they do have them – less sophisticated EPR systems than larger hospitals. Large hospitals, with over 750 beds, are more likely to have multiple local or departmental EPR systems which share information with a central EPR system than are the other types of hospitals.

Figure 17 – EPR systems by university/non-university Hospital



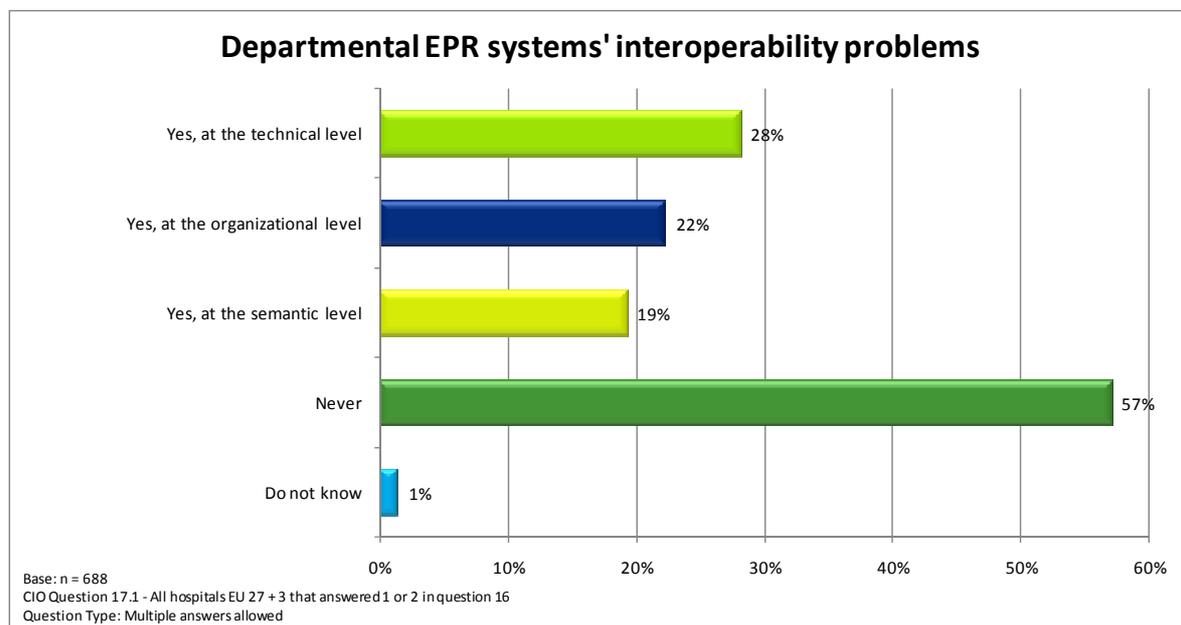
Furthermore, the data indicate that non-university hospitals are three times more likely not to have EPR systems than are university hospitals. University hospitals are nearly twice as likely to have multiple local or departmental EPR systems which share information with central EPR systems than do non-university hospitals.

The next question is related to the interoperability of the EPR systems in place. This question was asked to those hospitals which have multiple local or departmental EPR systems which share information with a central EPR system. The "interoperability of electronic health record systems" means the ability of two or more electronic health record systems to exchange both computer interpretable data and human interpretable information and knowledge.' (COM(2008)3282 final, p13)

Other issues which expand the notion of interoperability are dealt with in greater detail in relation to the section on the integration of computerised systems (section 3.2.3).

The CIO respondents affirmed that over half of hospitals that use either a hospital-wide EPR system or local/departmental EPR system connected to a central EPR system have not experienced interoperability problems between systems as Figure 18 shows. Overall, this would appear to be quite a positive result for the survey.

Figure 18 – Interoperability problems among electronic patient record systems

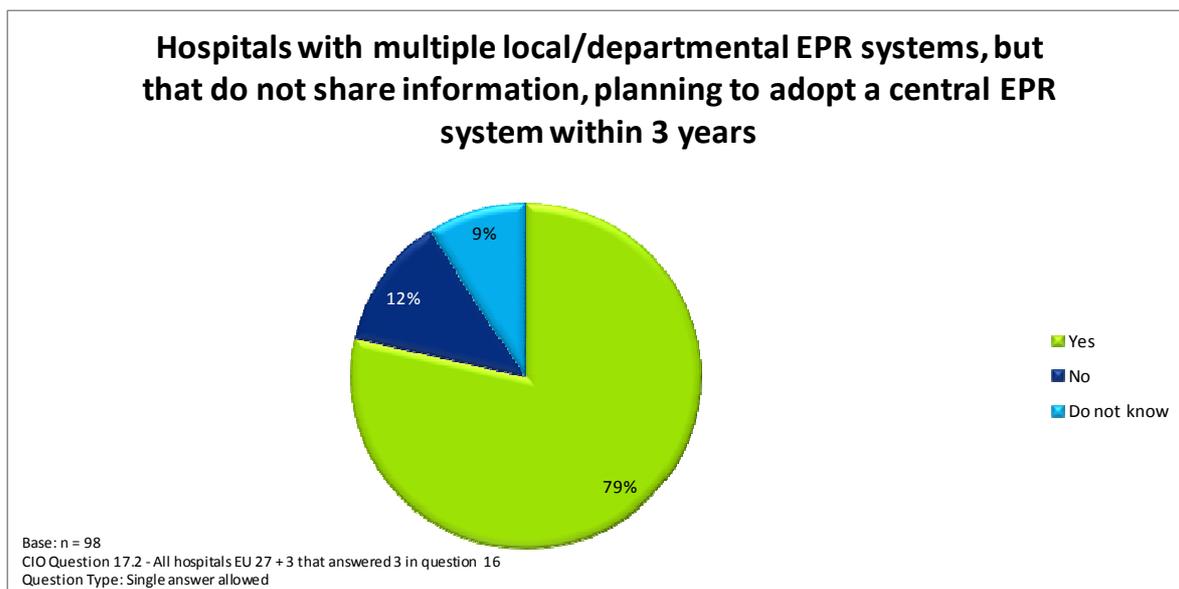


This is especially the case in private hospitals, non-university hospitals, and small hospitals where only about one-third had interoperability problems. Hospitals that belong to large hospital groups are more likely to experience interoperability problems, most probably due to the larger volume of services and units connected.

In terms of the type of interoperability problems, the UK reports above-average figures for all three categories of interoperability difficulties cited in the questionnaire. Around half of the CIOs in the Netherlands also point to interoperability problems. The new – and newer – Member States tend to report fewer interoperability problems: for example, eight out of nine CIOs in Bulgaria and Hungary, and three out of three CIOs in Slovenia, responded that they 'never' had interoperability problems among departmental EPR systems. These are interesting outcomes, which are not easily explained and may be based on quite different rationales. For example, on the one hand it may be that, in certain countries the hospitals are simply not inter-connected and hence do not experience interoperability difficulties. On the other hand, in other countries, the hospitals may be so well equipped with effective EPR systems that they do not experience difficulties with interoperability.

Next the survey asked those hospitals which have multiple/local departmental EPR systems but which do not share information, if they plan to move to a central EPR system within the next three years. As Figure 19 shows, this is seen to be a priority: eight out of ten hospitals plan to move to a central EPR system.

Figure 19 – Plan to adopt a central EPR system within 3 years



The plans to adopt a centralised EPR system are more likely to be found in public hospitals (84%) than in private hospitals (53%). Similarly, a plan to adopt a central EPR system is more likely to be indicated in large hospitals than in small ones.

Adopting the capability and user practice to capture and access clinical data electronically in a hospital organisation is critical to achieving many benefits like decision support, patient safety, efficiency and patient engagement.

Patients may shift their status from inpatient to outpatient, and *vice versa*. Since patients can visit a hospital for the diagnosis or treatment of one or more conditions, the more easily accessible an EPR system is in different parts of the hospital, the more it may facilitate the good level of service that a patient is likely to receive. Patients who are treated for acute conditions may also experience various chronic conditions (all of which may interplay with each other, and with the acute condition). To cite two simple examples: a person with Parkinson's disease experiences a severe fall (and her/his hip or thigh is broken); and/or a person with several co-morbidities<sup>31</sup> such as a cardiac condition, chronic obstructive pulmonary disease (COPD), and diabetes might also have a similar experience. Follow-up and interaction with the patient in any part of the hospital premises, and by any member of the relevant healthcare team, could – as a result – be

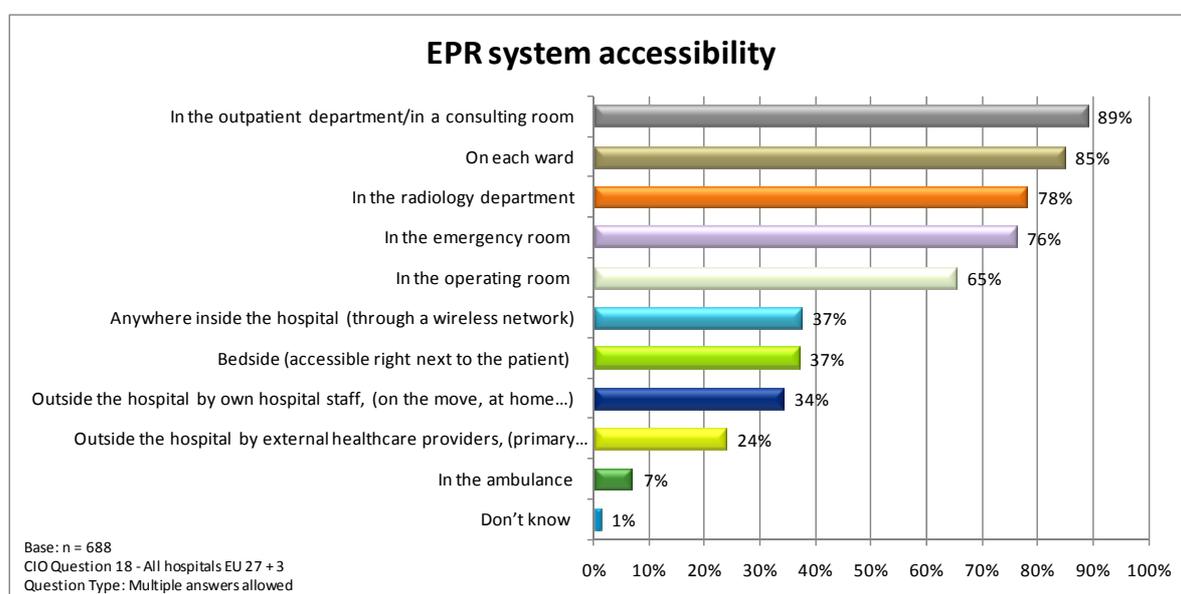
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<sup>31</sup> In medical terms, a co-morbidity implies a number of conditions (one or more) other than the primary condition (or disease) experienced by the patient.

facilitated by a comprehensive approach to the access to an EPR system that is available in different parts of the hospital site (and wider).

Figure 20 shows that EPR systems can be accessed in multiple areas of a hospital. The locations in hospitals where access is possible involve especially the outpatient department or a consultation room (89%), each ward (85%), the radiology department (78%), the emergency room (76%) and the operating room (65%). In a smaller proportion of hospitals, the EPR systems can be accessed anywhere in the hospital through a wireless network (37%), next to the patient’s bed (34%), and even outside the hospital by the hospital’s staff (34%) or external healthcare providers (24%).

Figure 20 – Location in which EPR systems can be accessed



Independent hospitals tend to have lower percentages of locations where EPR systems can be accessed than hospitals which belong to a hospital group. There are no significant differences between public and private hospitals. On the other hand, university hospitals provide more access from all the locations identified than do non-university hospitals. Large hospitals (with more than 750 beds) tend to have more locations from which the EPR system can be accessed than small hospitals (those with less than 101 beds).

This contrast in access locations for the different types of hospitals is most noticeable in the case of the emergency room and operating rooms: almost all large hospitals provide access to the EPR systems whereas only half of small hospitals do.

With regard to country differences, in three-quarters of the hospitals in the 30 surveyed countries, there is access to EPR systems in emergency rooms. The exceptions are Bulgaria, where there is only access in one out of nine hospitals' emergency rooms, and France and Latvia where access occurs in only one in three hospitals.

When it comes to providing EPR systems online access to patients, this has been shown to be still very limited. Only 4% of hospitals offer this possibility, as can be seen from Figure 21.

Currently, patient access to their health records differs in terms of its status throughout Europe. Prospects proposed by the Digital Agenda for Europe indicate that this situation will alter within the next five- to ten-year period (COM(2010)245 final/2). See, in particular, Key Actions 13 and 14 of the Agenda which stipulate that the EC will work with Member States' competent authorities and all interested stakeholders to:

- **Key Action 13:** Undertake pilot actions to equip **Europeans with secure online access** to their medical health data by 2015 and to achieve by 2020 widespread deployment of telemedicine services;
- **Key Action 14:** Propose a recommendation defining a **minimum common set of patient data** for interoperability of patient records to be accessed or exchanged electronically across Member States by 2012<sup>32</sup>.

Experience of the use of patient records by patients in the relatively protected environment of a hospital might lead appropriately to their continued use in the home setting. The degree of patients' health literacy and digital literacy might thus be expected to increase and, in parallel, their role in managed care and self-care could be enhanced through ICT.

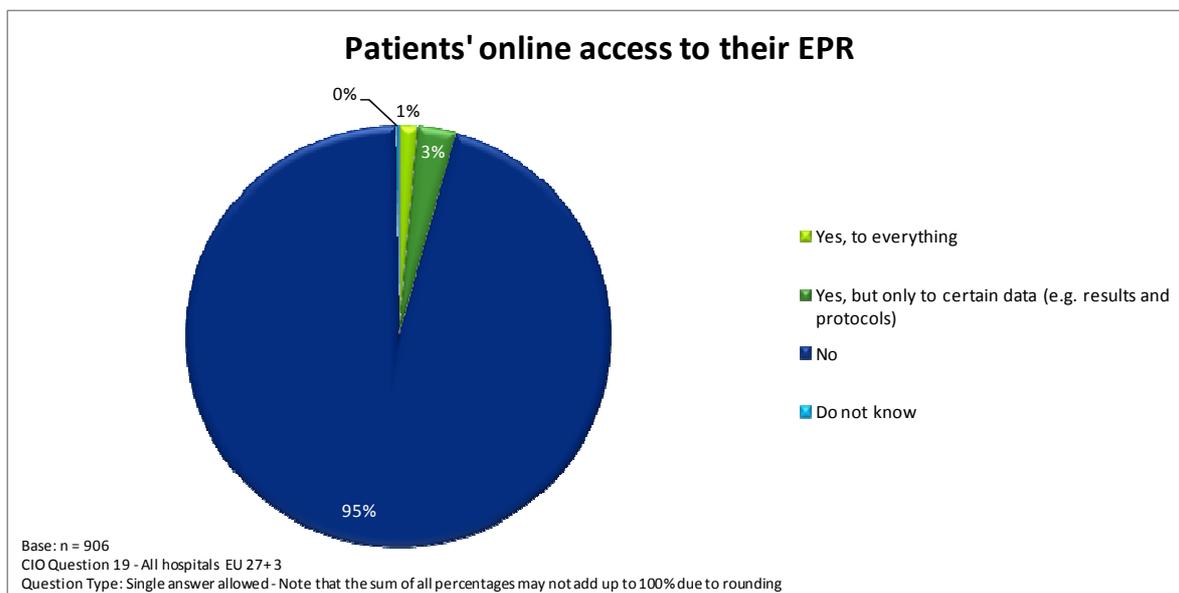
Further data analysis shows that 7% of university hospitals offer patients the possibility of online access to EPR systems in contrast to only 2% of non-university hospitals.

Two out of eight of the Danish hospitals answered positively to this question. Belgium also seems to be among the most advanced countries in terms of this provision: 13% of the surveyed hospitals already provide this service to patients.

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<sup>32</sup> In line with data protection requirements.

Figure 21 – Patients' online access to EPR systems



### 3.2.2 Picture archiving and communication system

Questions 20–22 focused on the availability and use of a picture archiving and communication system (PACS) in acute hospitals. A PACS enables images such as x-rays and scans to be stored electronically and viewed on screens, and thus creates a near filmless process and improved diagnosis methods. Doctors and other health professionals can access and compare images at the touch of a button<sup>33</sup>. PACS were first introduced some thirty years ago in the early nineteen eighties particularly in the UK and USA, and often at leading university hospitals.

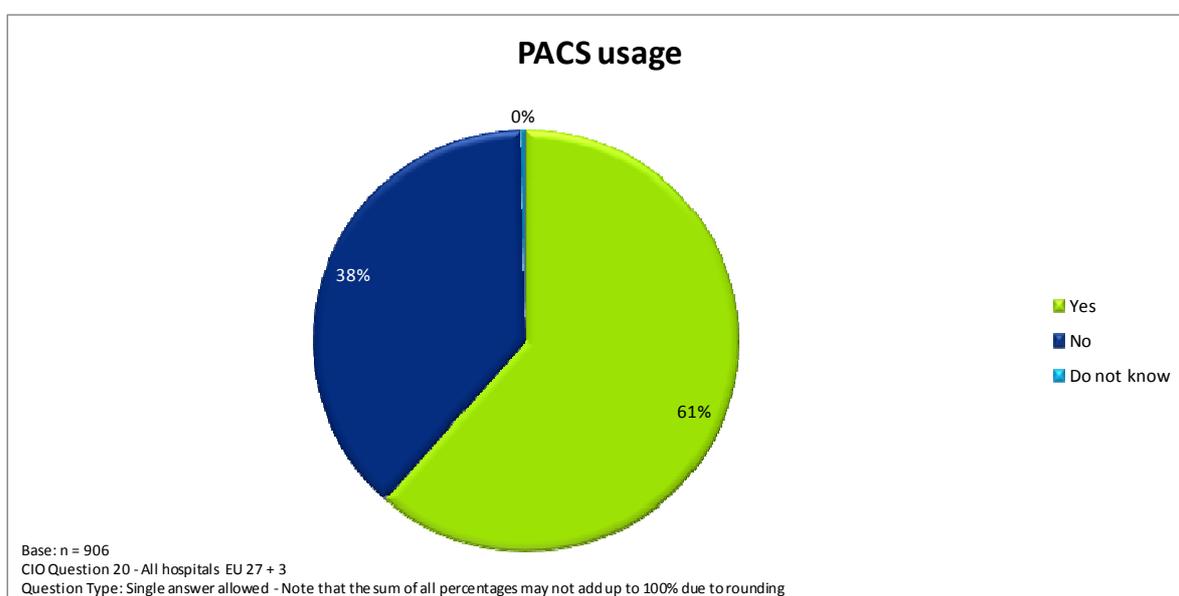
PACS are particularly important for their capacities to enable efficient and timely retrieval, transfer, and display of data within a single institution and/or across institutions. They can also be processed in locations at a distance from the treating hospitals (and, in more and more examples, overnight). They enable the easier offering of second medical opinions. PACS have often been used within the fields of radiology and, increasingly, cardiology. Increasingly, they are being considered for attachment to or association with electronic health records/electronic patient records, and the extent to which they should be available to the patients themselves is also under discussion. These questions would have not only legal and regulatory implications, but would also place demands on infrastructure and

<sup>33</sup> See England, National Health Service, *Connecting for Health* Accessed February 16, 2011 <http://www.connectingforhealth.nhs.uk/systemsandservices/pacs>

communications and/or archiving systems. Lastly, Digital Imaging and Communications in Medicine (DICOM) is a commonly accepted standard for PACS: the regulation of the use of such standards is very important in current trend-setting in relation to ICT and semantics.

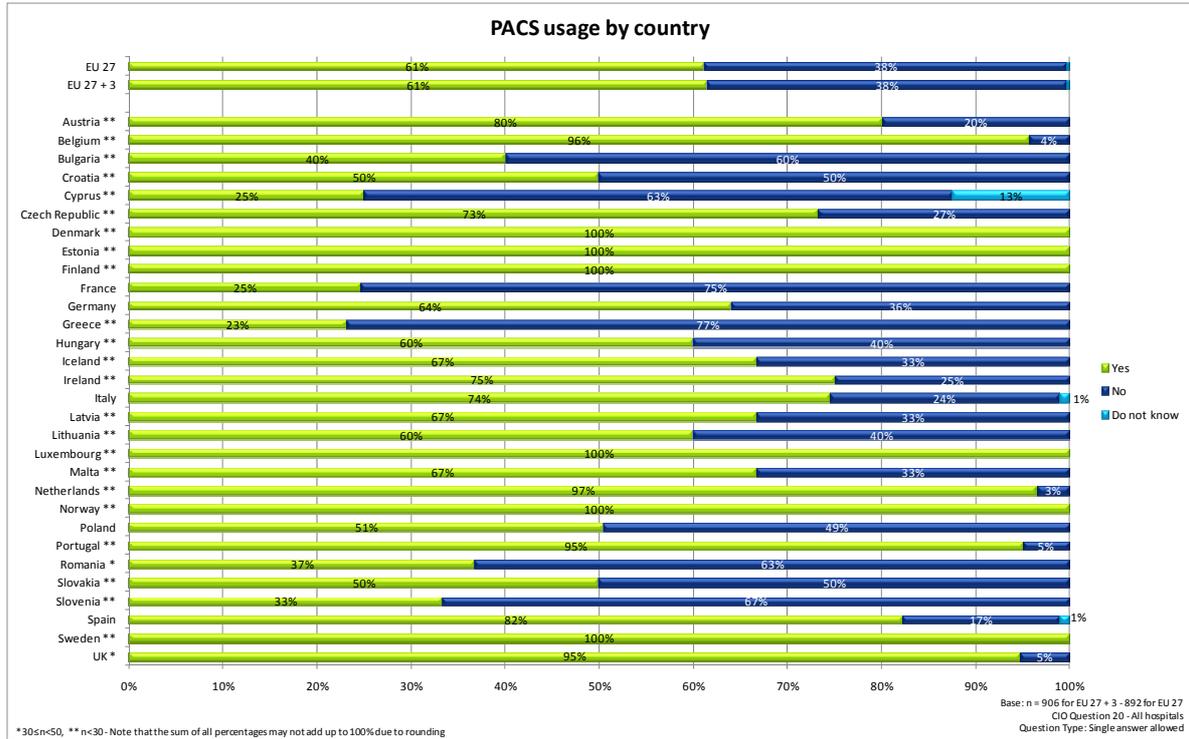
As Figure 22 shows, more than six in ten hospitals in the EU use a PACS. This system appears to be more widespread in large hospitals: it is offered in 73% of hospitals with 251–750 beds and 88% of hospitals with more than 750 beds. Furthermore, about two-thirds of public hospitals have a PACS, whereas only just over half of private hospitals have it. Nearly nine out of ten university hospitals have a PACS. Only about six out of ten non-university hospitals have it.

Figure 22 – PACS usage



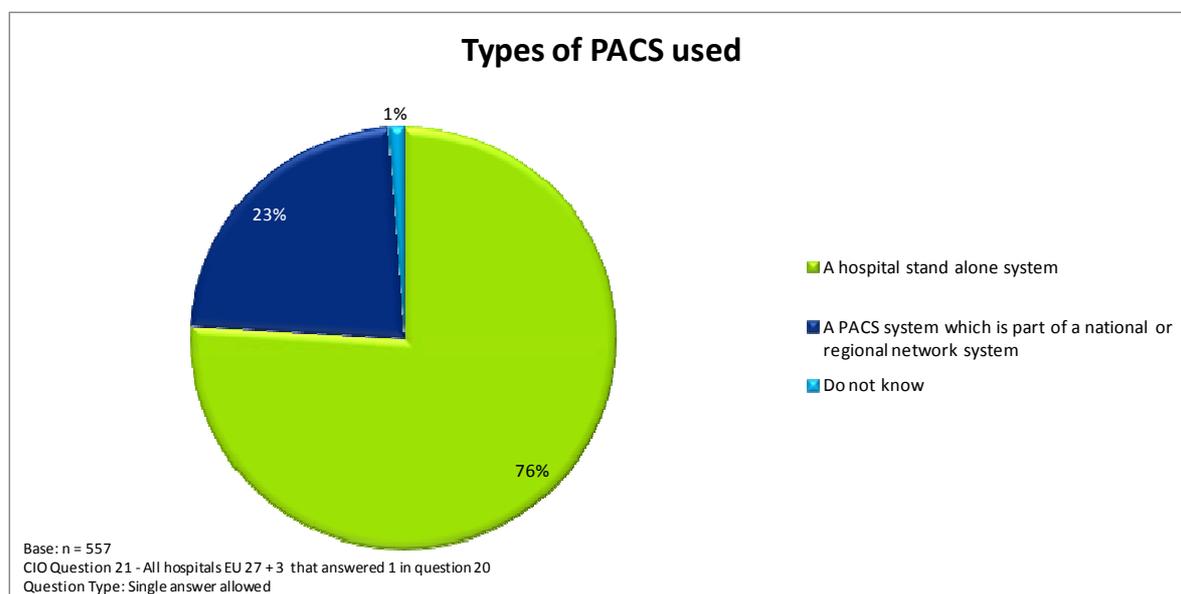
PACS availability is very widespread in Northern Europe: all the hospitals surveyed in Nordic countries as well as in Estonia have it. The uptake percentage of PACS in the hospitals surveyed reaches 97% in the Netherlands, 96% in Belgium and 95% in the UK. In addition, high availability rates can also be found in Austria, Portugal and Spain. On the other hand, only a quarter of French and even fewer Greek hospitals have a PACS in place, as Figure 23 shows.

Figure 23 – Availability of PACS by country



On average, across the hospitals surveyed, three-quarters of hospitals have stand-alone PACS. This share is even higher in private hospitals, where 84% have stand-alone PACS as compared to 73% of public hospitals. On the other hand, almost one-quarter of the hospitals have a PACS which is part of a national or regional network system, as Figure 24 shows.

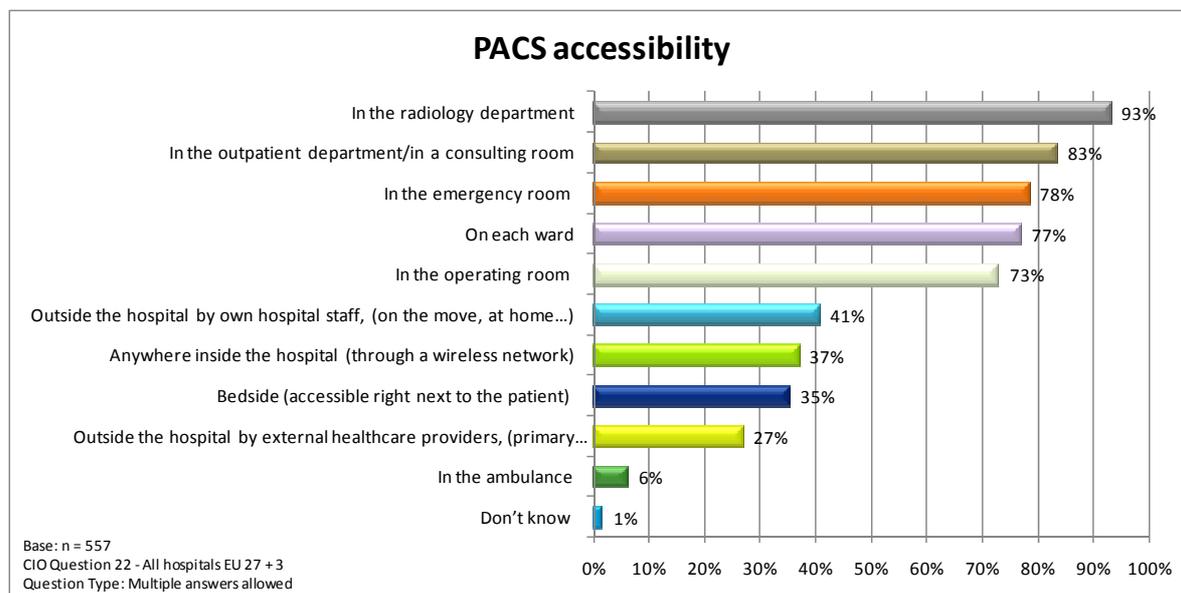
Figure 24 – Types of PACS used



PACS are part of regional or national networks in nearly three-quarters of hospitals in the UK and in seven out of eight Swedish hospitals.

Similarly to what was observed for the EPR systems, a PACS can be accessed in different locations inside the hospital. Figure 25 shows the locations in which PACS can be accessed in hospitals. Almost all PACS can be accessed in the hospital radiology department; eight out of ten can be accessed in the outpatient department or a consulting room with nearly as many in the emergency room; and about three-quarters on each ward and in the operating room. The access of PACS is higher for public hospitals than for private hospitals in terms of all the locations. The access to PACS is also higher in university hospitals than in non-university hospitals. Large hospitals tend to have higher accessibility to PACS.

Figure 25 – Access to PACS



In terms of geographic distribution, Nordic countries appear to display the highest access rates to PACS. A majority of the hospitals surveyed in the Nordic countries as well as Austria and Benelux access PACS from most of the ten different locations named both within (and outside) the hospital. Hospitals in Spain and the UK also have percentages of access in different locations inside and outside the hospital that are higher than the European average in all the locations considered. To date, only small numbers of hospitals indicate ambulance-based access to PACS.

### 3.2.3 Integration of computerised systems

Integration of computerised systems can be related to systems' interoperability and connectedness. Interoperability implies the ability of one or more computers or other electronic devices to communicate with each other. Terms that are often used to express a notion of interoperability include "integrated" or "connected" (European Commission 2006). The term is often used also in relation to electronic health record systems.

There are, of course, different levels of interoperability. In the hospital context, the issues can be mainly technical and semantic. At the regional or national level, the issues may be organisational in character. In COM(2008) 3282 final, "the organisational level" refers to the level of the Member State (country). It is defined as meaning to: "agree on an organisational framework for interoperability that recognises the autonomy of each Member State in relation to the development of the relevant eHealth infrastructure and

services. It should create a common domain, accompanied by the necessary interfaces, that enables the national domains to interact" (p10). However, in this survey, the organisational level referred to throughout is that of the actual organisation (or hospital) itself: the hospital's different units or departments.

At the technical level, interoperability implies that technical standards and architectures are being used or that there are common platforms. An adaptation of the term used in COM(2008) 3282 final indicates that technical interoperability means : "[...] the use of technical standards and architectures, and the establishment of common interoperability platforms." At the semantic level, interoperability implies the use of international terminologies and classifications for clinical, medical, or statistical purposes. In the EC's 2008 Recommendation's definition, it is taken to mean (p10):

[the co-ordination of] efforts geared towards semantic activities by agreeing on common priorities and specific applications. ... Wherever possible, [to] consider the suitability of international terminologies, such as Systematized Nomenclature of Medicine–Clinical Terms (SNOMED–CT) and terminologies and nomenclatures used for pharmacovigilance and clinical trials (see: <http://www.ihtsdo.org/>) and classifications such as WHO International Classification of Diseases (ICD), see: <http://www.who.int/classifications/icd/en/>.

Figure 26 shows the availability of a number of important medical applications which have been integrated into the computer system.

Medical staff in acute hospitals are looking for a more efficient means to enter and retrieve data since they cannot afford the time to look for an available desktop to log in and then enter information into the system. Doctors, and other clinical and health-related personnel in hospitals need robust, Web-based medical reconciliation software. Software can collect, display, and document medical information about patients from the point of admission through to discharge. Furthermore, information can be stored for future needs.

The most commonly integrated application system is eBilling: over three-quarters of hospitals have it. It has obvious associations with the efficiency and organisation of a hospital's management, organisation, workflow, and financing.

For instance, ePrescribing is a computer-assisted prescription of drugs that allows physicians (and other health-related personnel where appropriate) to review patient

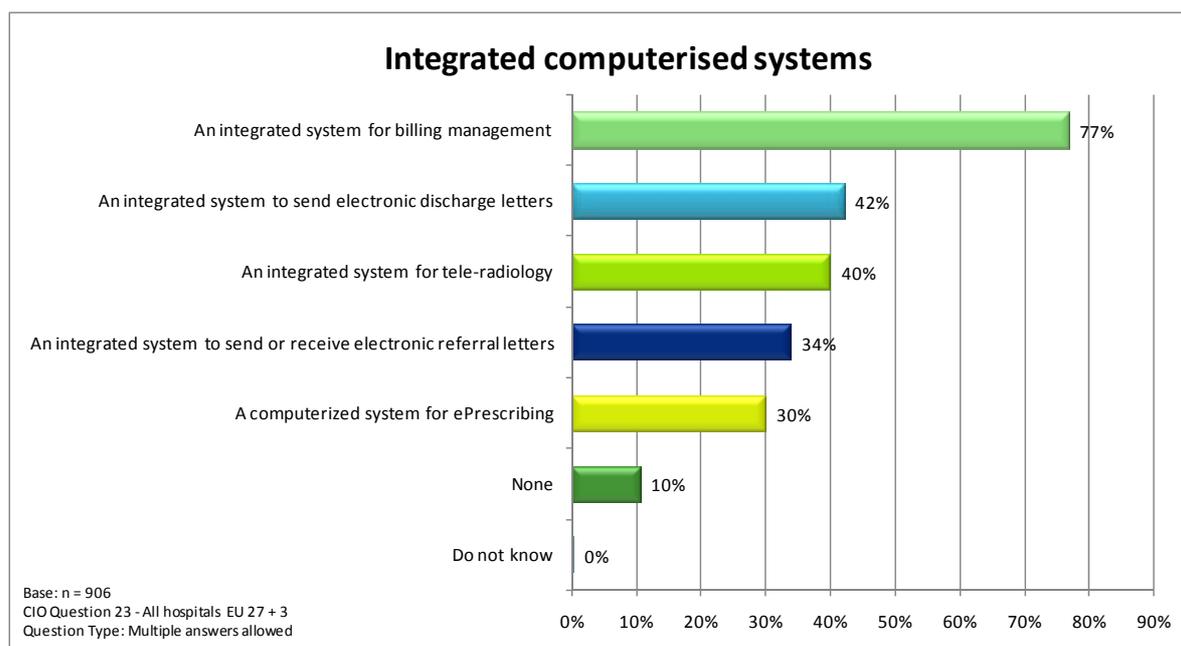
history and recommended drug dosages, access pharmacy formularies, write prescriptions and send them electronically to the pharmacy.

Electronic prescription systems can provide considerable benefits to a hospital and its staff. Some benefits of an ePrescription can include:

- A detailed history of patient drug prescriptions,
- Improved patient safety,
- Reduction in medication errors,
- Electronic prescribing for discharge medications,
- Checks for drug-to-drug and drug-to-allergy interactions.

Yet ePrescription is the least widespread of all these integrated, computerised systems in acute hospitals: just under one-third of hospitals have it.

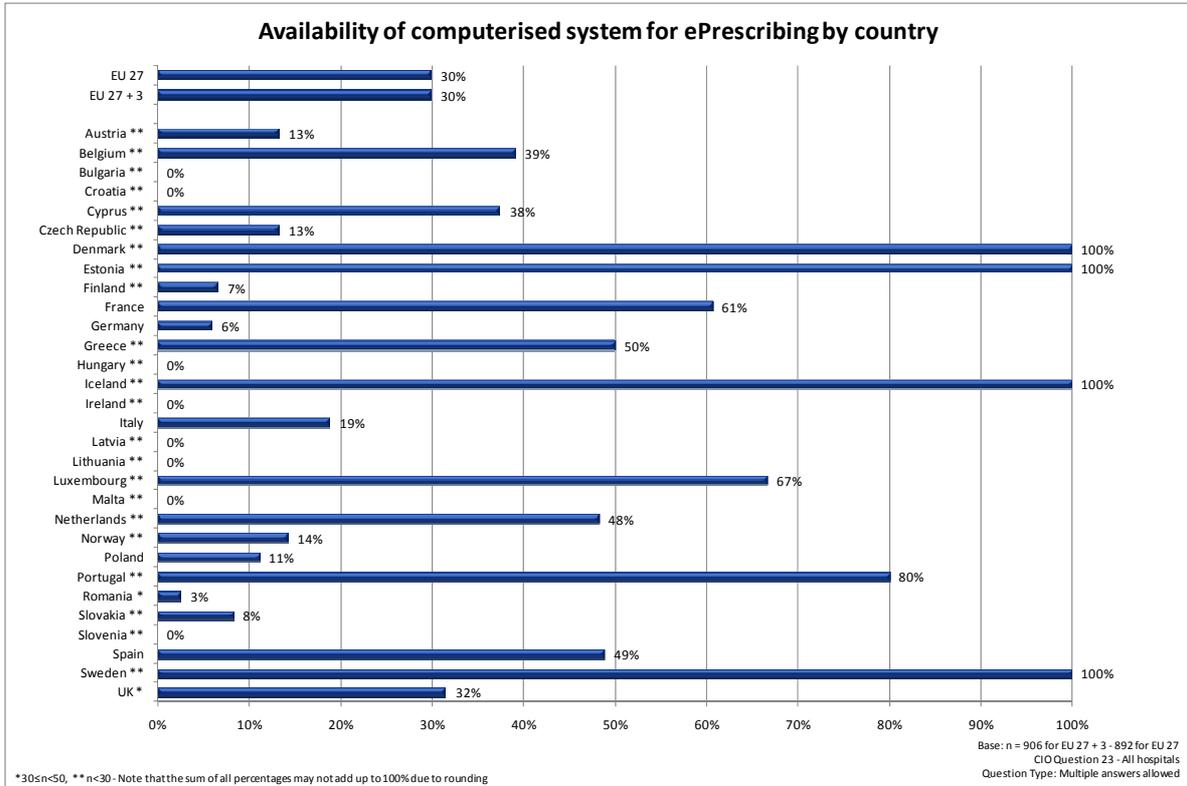
Figure 26 – Integration of computerised systems



ePrescription is more likely to be found in university hospitals and in large hospitals.

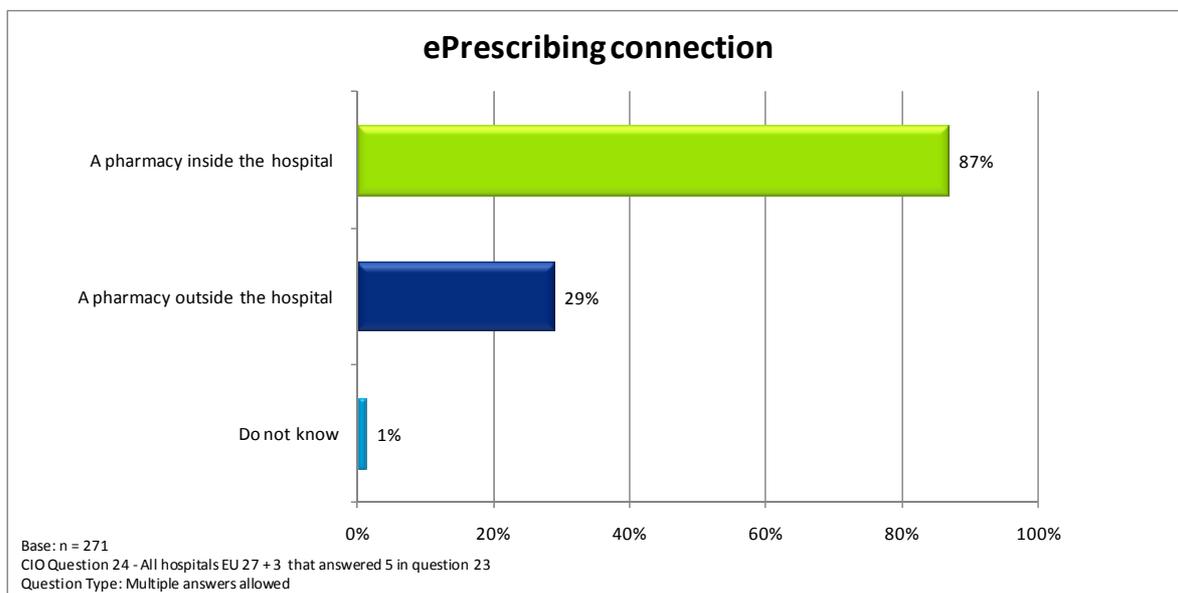
Geographically, ePrescription is more widespread in the Nordic hospitals surveyed (where around three-quarters of hospitals have it). Hospitals in Belgium and Spain also display a higher availability of ePrescribing than the average.

Figure 27 – Availability of ePrescribing by country



In nine out of ten hospitals, a computerised system for ePrescribing is connected to a pharmacy which is located inside the hospital (as Figure 28 shows). In almost three out of ten of the cases, it is connected to a pharmacy outside the hospital. The latter is more likely to be the case with large hospitals.

Figure 28 – ePrescription connection to pharmacies

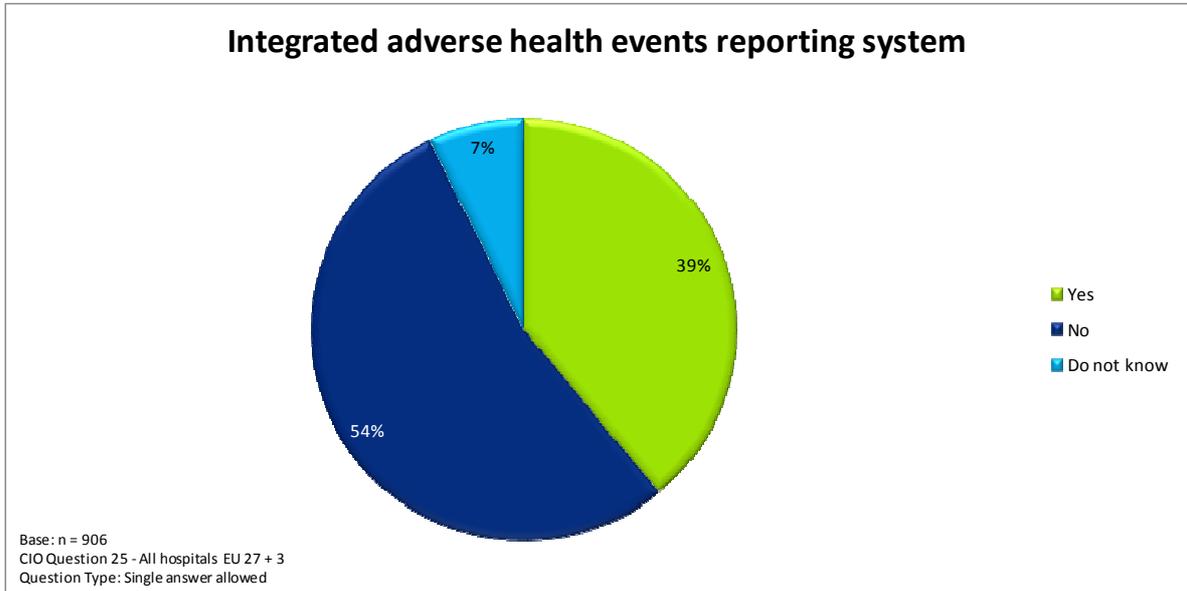


Connection to outside pharmacies exists in more than half of the hospitals surveyed in Denmark, Estonia, Finland, Germany, Iceland, Italy, the Netherlands, Slovakia, Spain and Sweden. Ninety-one out of the 271 respondents to this question are from France, but 97% of these respondents (who are based in French hospitals) have ePrescribing systems that are connected only to the internal hospital pharmacy.

### 3.2.4 Adverse health events reporting system

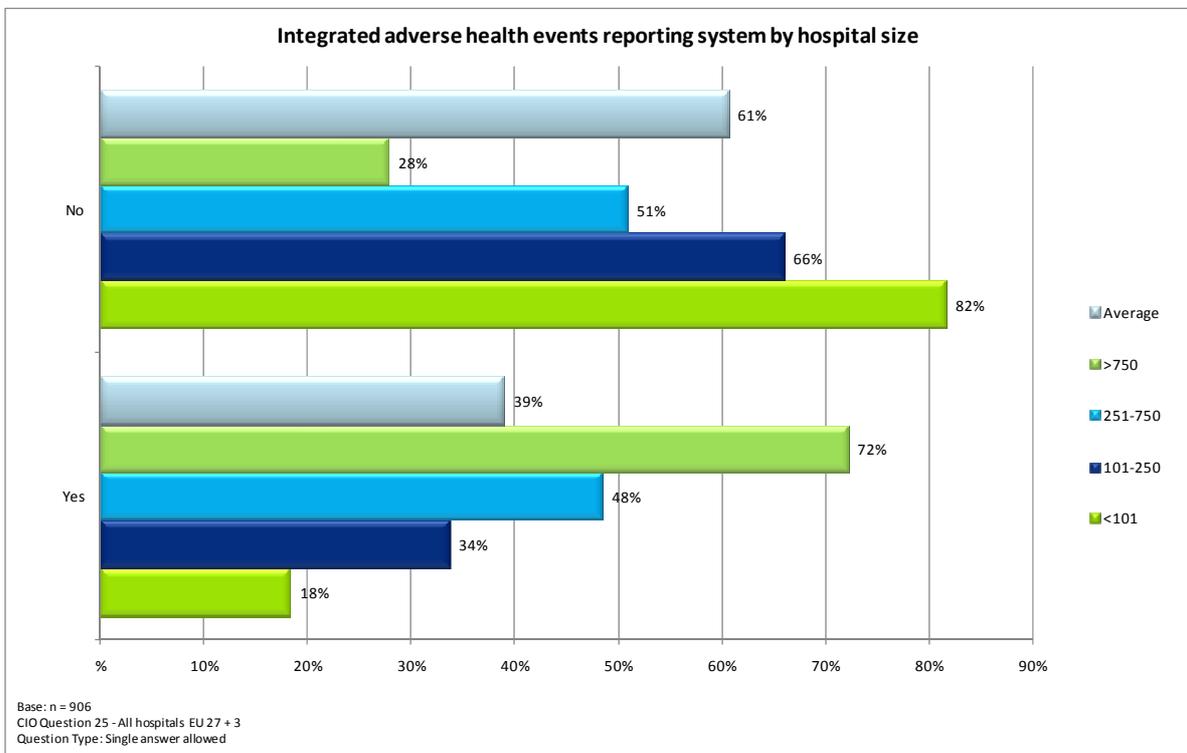
An adverse health events reporting system is an electronic reporting system for adverse health events that take place in a hospital. These health events could occur at the level of a hospital, department or ward and could also include the reporting of near-misses (or events that almost happened). Adverse reporting events are particularly pertinent to clinical care. A little more than half of the hospitals do not have an integrated adverse health events reporting system (as Figure 29 shows).

Figure 29 – Presence of integrated adverse health events reporting system



On the other hand, almost four in ten CIO respondents said that their hospital had such a system. In large hospitals (with more than 750 beds), an integrated adverse events reporting system exists in nearly three-quarters of them.

Figure 30 – Presence of integrated adverse health events reporting system by hospital size



Nearly three-quarters of university hospitals have such a system in place in comparison to just over a half of non-university hospitals.

More than three-quarters of the hospitals surveyed in Ireland, the Netherlands, and Nordic countries have such a system. In the UK, 71% of hospitals have an integrated adverse events reporting system. Only just over one quarter of German and Italian hospitals have such a system. This kind of system is not in place in any of the hospitals surveyed in Estonia, Lithuania, Malta or Slovenia. Evidence indicates that clear differences exist between new and old Member States.

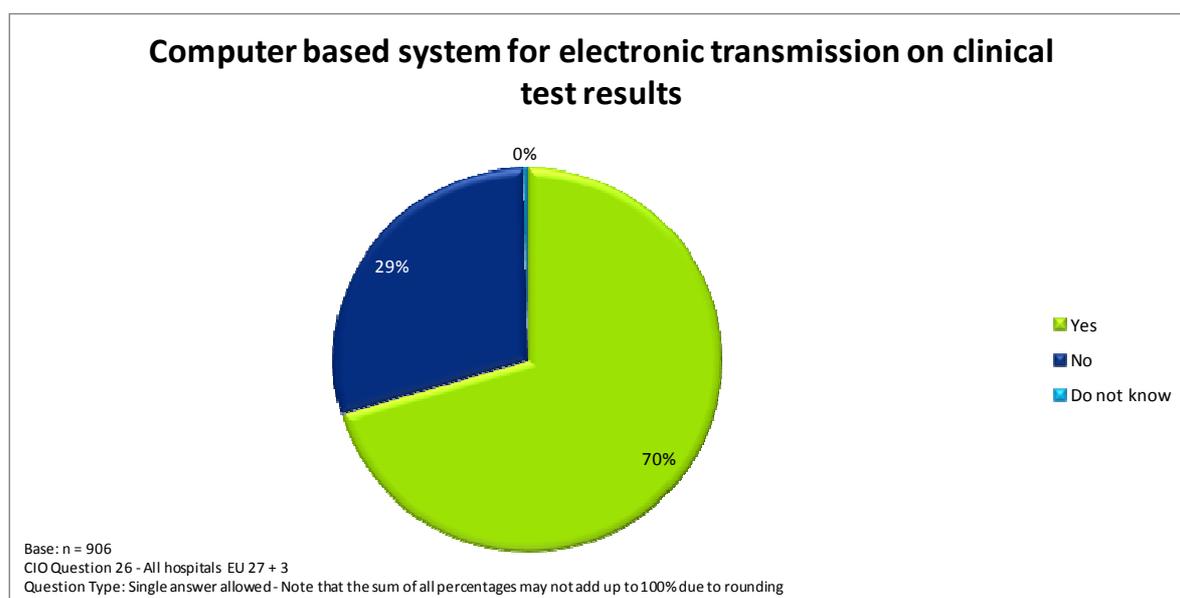
### 3.2.5 Electronic transmission of clinical tests results

The transmission of clinical test results electronically can facilitate rapid and timely treatment of patients. It may also ensure the extent to which second opinions may be sought and provided.

With regard to the electronic transmission of results of clinical tests and laboratory tests, seven out of ten hospitals have a computer-based system for the electronic transmission of results of clinical tests (as

Figure 31 shows). Such a system is more likely to be found in large hospitals (80% of 251–750 bed hospitals and 89% of 750+ bed hospitals) and university hospitals (89% in comparison to 68% of non-university hospitals). The system is present in only just over one half of small hospitals.

Figure 31 – Availability of systems for electronic transmission of clinical test results



From a geographic perspective, all the hospitals surveyed in Belgium, Cyprus, Denmark, Estonia, Ireland, Luxembourg, Malta, Norway and Sweden have such a system in place. The system can also be found in large countries, such as Spain and the UK, where nine out of ten hospitals transmit clinical test results electronically. Italy, however, is below the European average: less than six out of ten of its acute hospitals surveyed have such a system. About one-third of hospitals in Poland and Romania experience electronic transmission of clinical test results.

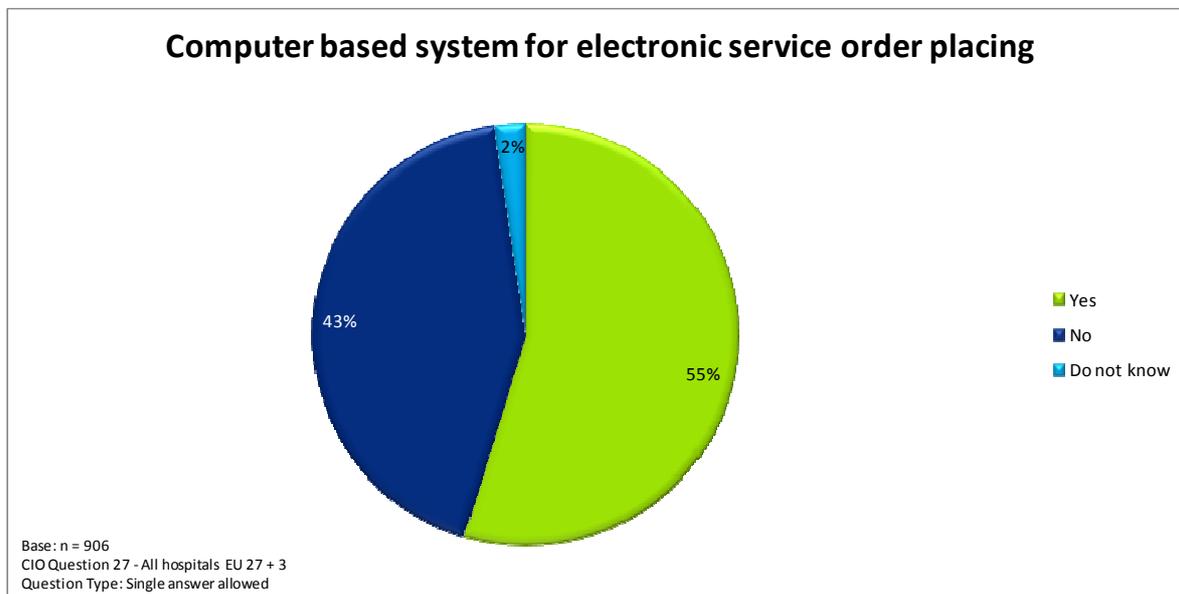
### 3.2.6 Computerised physician order entry

Computerised physician order entry (CPOE), computerised decision support systems and bar-coding for medication administration are all IT applications that are considered to be able to limit errors and improve patient care.

CPOE is a process of electronic entry for medical practitioner instructions about the treatment of patients (it applies particularly to patients who are hospitalised). These orders are communicated over a computer network to the medical staff or to the hospital departments responsible for fulfilling the order (examples include the pharmacy, laboratory, or radiology departments). CPOE decreases delay in order completion, reduces errors related to handwriting or transcription, allows order entry to take place at either the point-of-care or off-site, provides error-checking for duplicate or incorrect doses or tests and simplifies inventory procedures and the posting of charges.

More than half of the surveyed hospitals have an order entry system in place (as Figure 32 shows). Such a system exists in about three-quarters of university hospitals, but only in just over a half of the non-university hospitals. It is available in 57% of public hospitals in comparison to 49% of private hospitals. In large hospitals (with more than 750 beds), seven out of ten hospitals have such a system, but in small hospitals (with fewer than 101 beds) only four out of ten have it.

Figure 32 – Availability of systems for electronic service order-placing



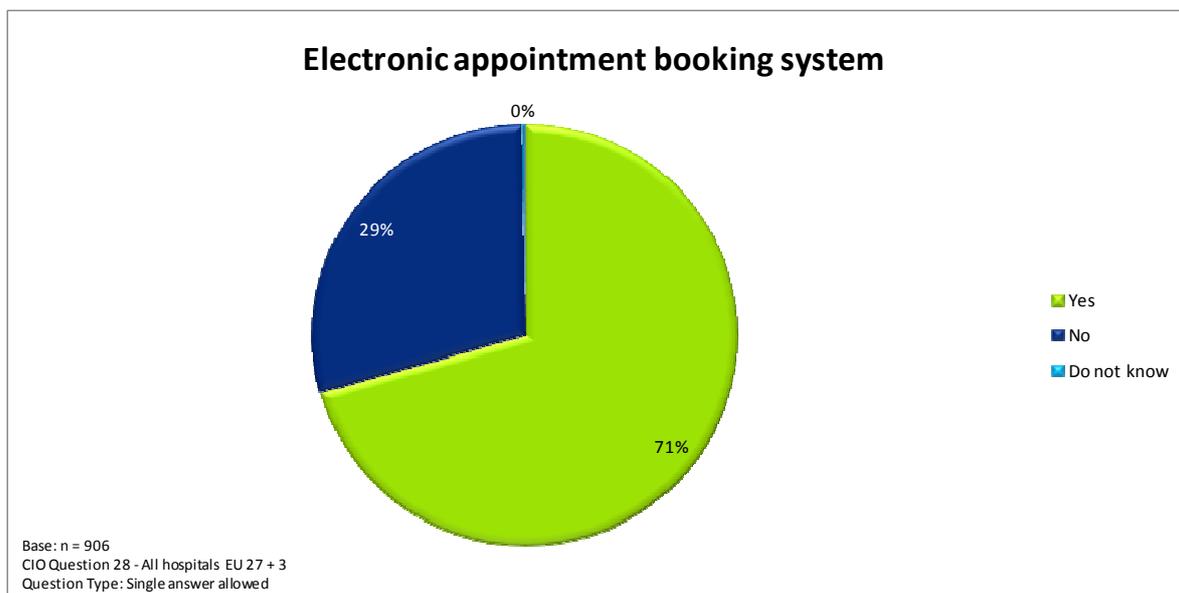
All the hospitals surveyed in Denmark, Estonia and Luxembourg have electronic service order-placing systems. France is well below the EU+ average: only 35% of its hospitals have electronic service order-placing. Other low rates for CPOE can be found in hospitals in Belgium, Poland and Romania.

### 3.2.7 eBooking

The availability of electronic appointment booking systems is widespread in EU+ hospitals: more than seven in ten hospitals have it (as Figure 33 shows). The system is even more prevalent in university hospitals and large hospitals. Hospitals that belong to hospital groups are more likely to have these systems in place in comparison to their independent counterparts.

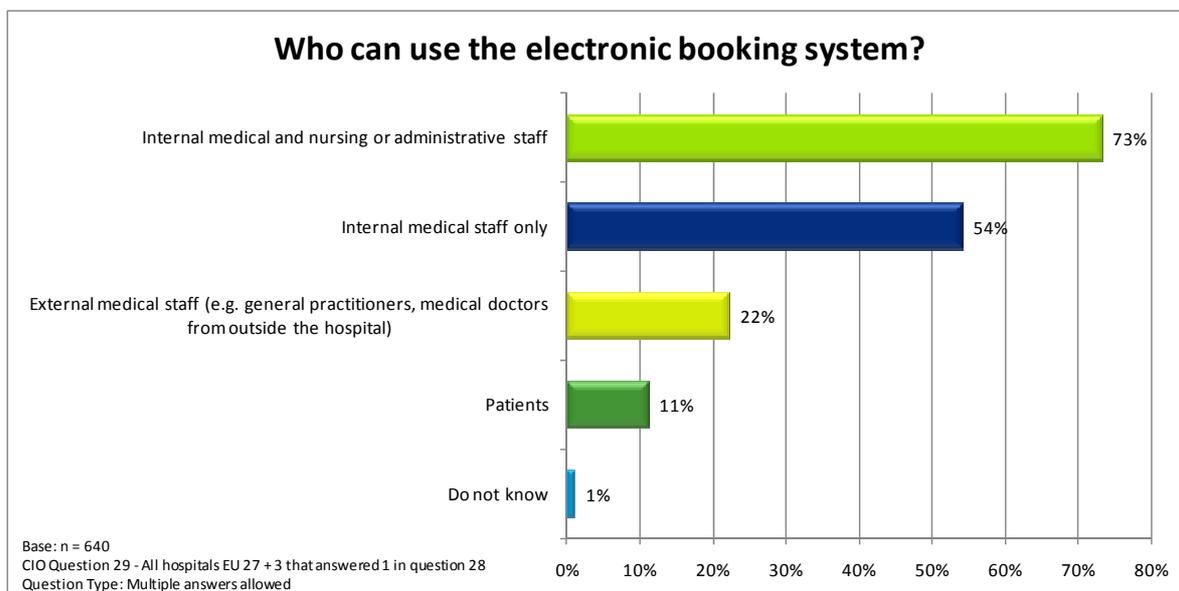
In all the hospitals surveyed in the following seven European Member States, there is an eBooking system in place: Croatia, Estonia, Hungary, Ireland, Luxembourg, Malta and the UK. Most western European countries are well above the average in terms of appointment booking electronically in their hospitals except for Germany (which is exactly on the average) and France (which is 12 percentage points below). Of the Eastern European countries, Poland displays a lower existence of eBooking: less than half of its hospitals have it available. In Bulgaria, only one in 15 hospitals has an eBooking system in place.

Figure 33 – Availability of eBooking



In most of the hospitals with this system, appointments can be made directly into the system by all internal medical and nursing staff as well as the administrative staff (as Figure 34 shows). In over half the number of hospitals, its use is restricted to internal medical staff only. Only in about one out ten cases can patients use the system.

Figure 34 – Use of electronic booking systems



More than half of hospitals in Greece allow patient access to eBooking, as do about one quarter of UK hospitals and one-fifth of Spanish hospitals. Fifteen per cent of the Finnish hospitals surveyed indicate that they allow patient booking. No German hospital out of the

107 whose CIOs replied to this question has an eBooking system that allows patient access.

### 3.2.8 Telemonitoring

Telemonitoring is a telemedicine service aimed at monitoring the health status of patients at a distance: Telemedicine refers to "the provision of healthcare services at a distance" (COM(2008) 689 final, p3). It is the:

provision of healthcare services, through use of ICT, in situations where the health professional and the patient (or two health professionals) are not in the same location. It involves secure transmission of medical data and information, through text, sound, images or other forms needed for the prevention, diagnosis, treatment and follow-up of patient. (Ibid., p4)

Telemedicine is used in a variety of circumstances, which – in this instance – can include the hospital setting. While it is often used in contexts that relate to chronic conditions and chronic care rather than acute care, telemedicine communications can nevertheless be of considerable use in terms of accident and emergency; in circumstances of some urgency which might occur either in geographically isolated settings and/or in the first so-called golden hour following a traumatic episode of some sort when rapid diagnosis and/or treatment permits a higher rate of survival.

In the telemonitoring of out-patients, data can be collected either automatically through personal health monitoring devices or through active patient collaboration (by patients entering weight or daily blood sugar level measurements into a web-based tool, for instance). Once processed and shared with relevant health professionals, data may be used to optimise the patient's monitoring and treatment protocols (COM(2008)689 final, p4). This kind of telemonitoring can be combined with different forms of telecare (the provision of social care from a distance supported by means of telecommunications and computerised systems (European Commission 2008); tele-homecare (services using ICT can contribute to the management of chronic diseases from the home or "the application of information and communication technologies to the management and delivery of home health care services"<sup>34</sup>) or tele-homecare monitoring when "... a patient management

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<sup>34</sup> Health Canada Accessed February 16, 2011

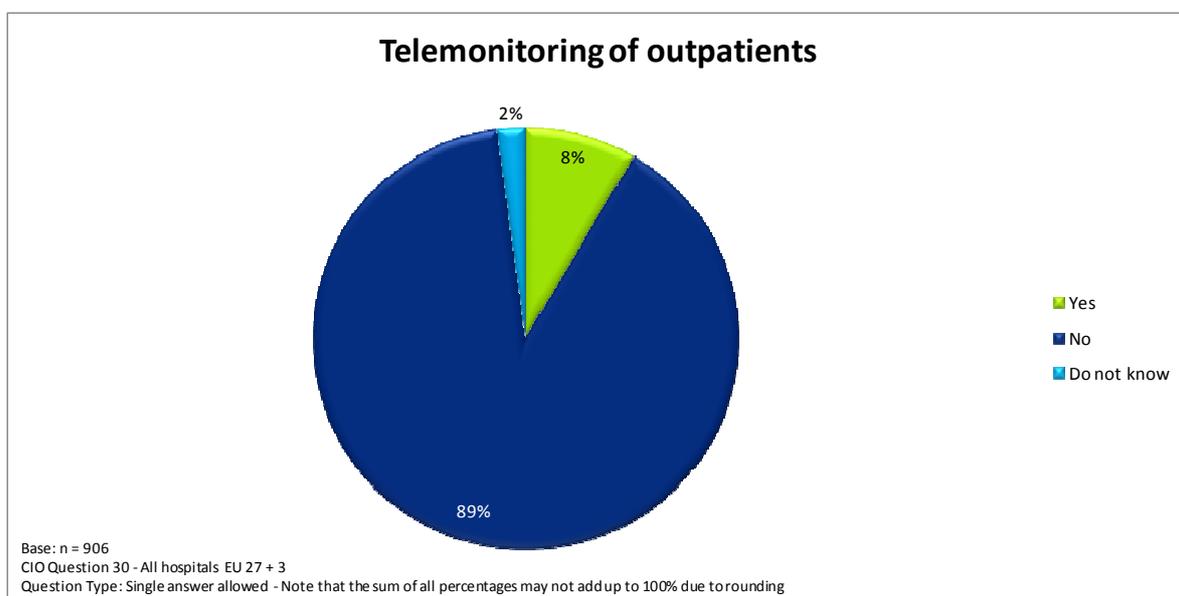
<http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/1998-tele-workatel/index-eng.php>

approach combining various information technologies for monitoring patients at distance." (Paré et al 2007)

This survey was designed to focus on the availability of telemonitoring systems for out-patients to hospitals which – in this case – are acute hospitals.

The availability of telemonitoring systems for out-patients in EU+ acute hospitals is not common. Only 8% of acute hospitals in the EU+ offer tele-homecare/telemonitoring services to out-patients at home (as Figure 35 shows). This will have to increase considerably in the future to reach the Digital Agenda for Europe target of achieving widespread deployment of telemedicine services by 2020.

Figure 35 – Telemonitoring of outpatients



As in the case of other electronic systems, tele-homecare/telemonitoring is more likely to be offered in public hospitals than in private ones and in university hospitals rather than in non-university hospitals (as Figure 36 and Figure 37 show).

Figure 36 – Telemonitoring by public and private hospital

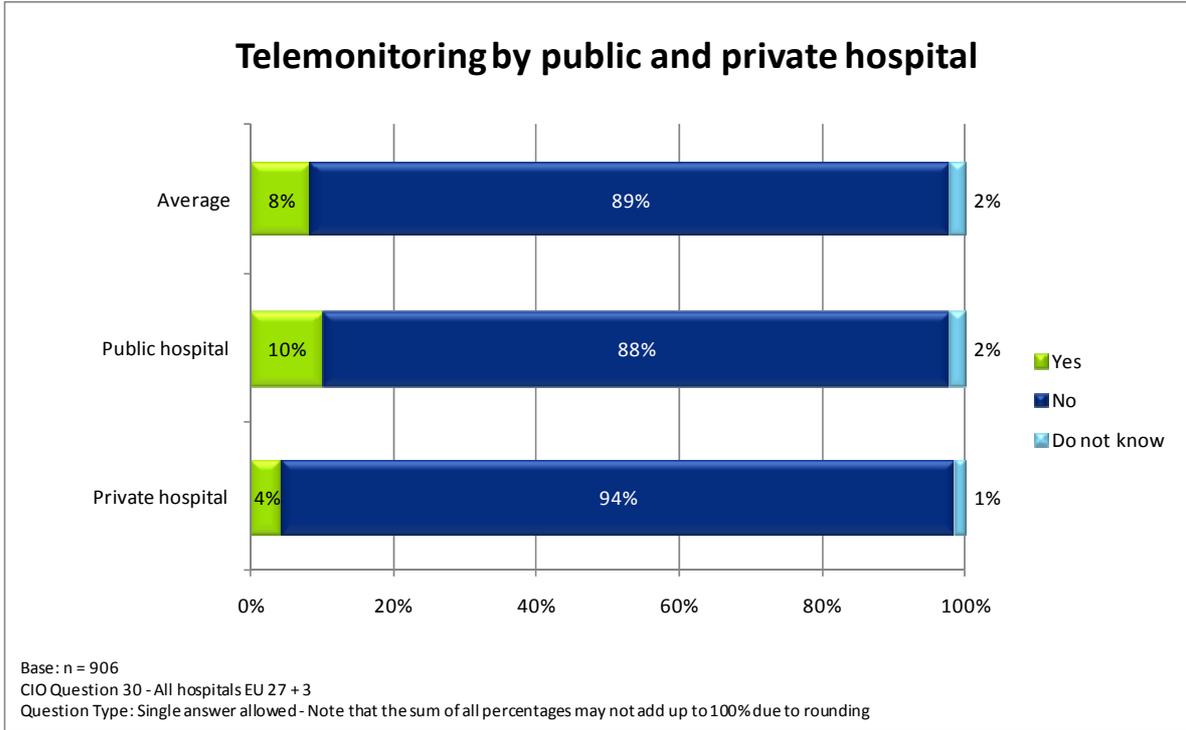
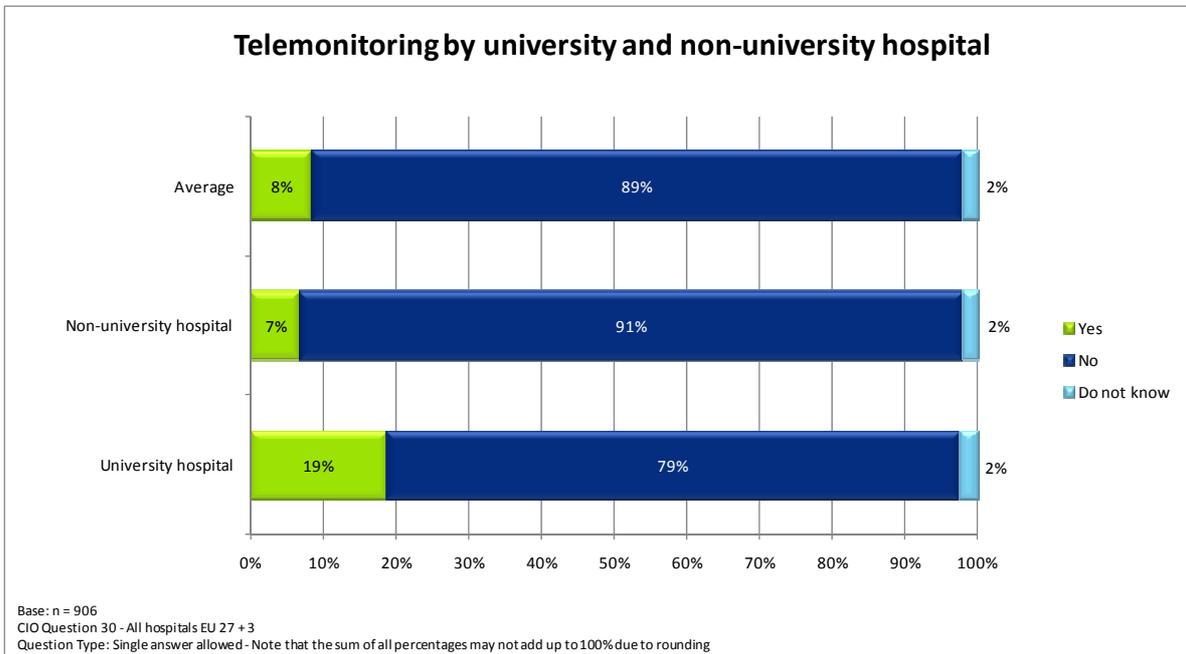


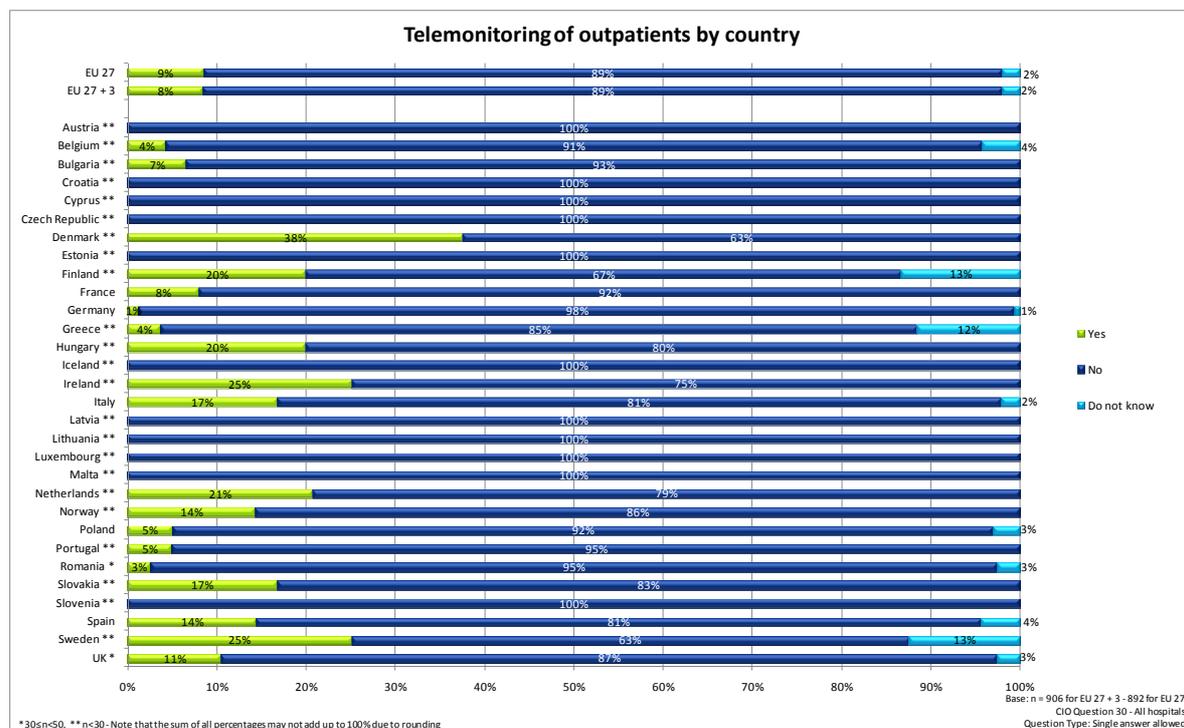
Figure 37 – Telemonitoring by university and non-university hospital



In terms of geographic coverage, the hospitals in Denmark, Ireland, the Netherlands and Sweden lead in terms of the use of telemonitoring systems. In all these countries, around one-quarter of the hospitals surveyed have a telemonitoring system in place. The survey shows that 11 countries do not offer telemonitoring services to out-patients. This is

particularly the case in a number of small old and new Member States. Among the large Member States, telemonitoring is more common in Italy, Spain and the UK (as Figure 38 shows).

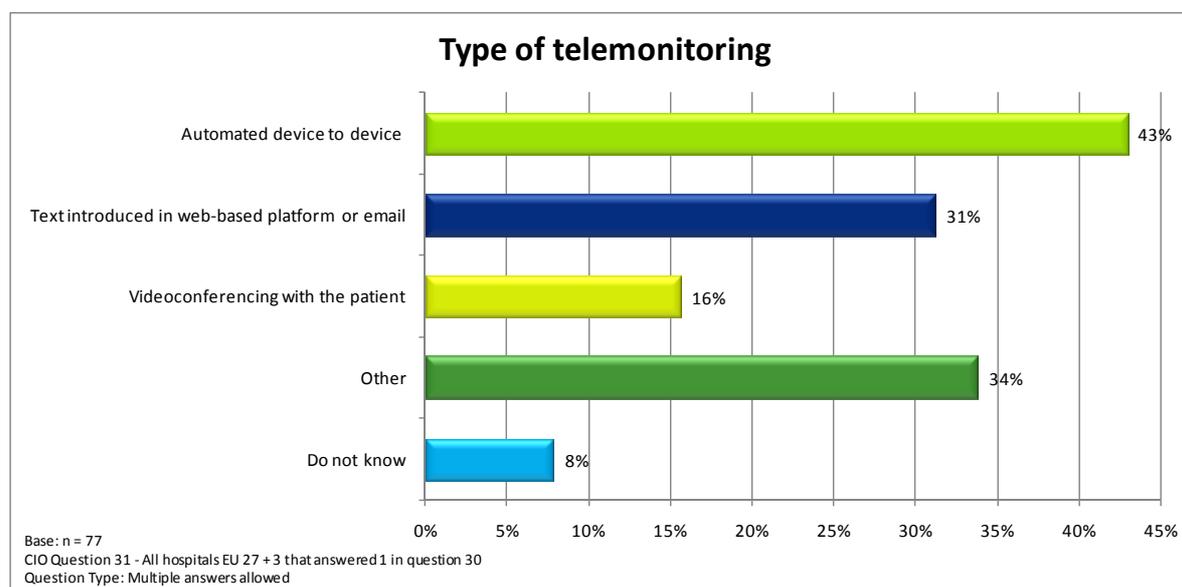
Figure 38 – Telemonitoring of outpatients by country



Of the hospitals that do offer telemonitoring, 43% have telemonitoring that is automated device-to-device, as Figure 39 shows.

Public hospitals outpace private ones in all categories of tele-homecare and telemonitoring except “other”. Moreover, the category of “other” was chosen by one-third of the CIO respondents, which implies that the proposed list of options offered in this particular question was incomplete. As discussed in chapter 7 with regard to possible methodological enhancements in surveying health professionals' views of eHealth, a set of qualitative interviews could be helpful in identifying in greater detail the use of telemonitoring in acute hospitals and clinicians' views on the implementation of telemonitoring.

Figure 39 – Type of telemonitoring



The small number of responses to this question (77 in total) makes it impossible to draw statistically sound conclusions at the country level from the data. It is also difficult to generalise the findings with regard to telemonitoring to the European level. Anecdotal evidence indicates that the overall figure of the availability of telemonitoring in 8% of European hospitals may even be on the high side.

### 3.2.9 Online chronic disease management capabilities

Chronic diseases are diseases of long duration and generally slow progression<sup>35</sup>. Self-management techniques in terms of the treatment or handling of chronic diseases or conditions are becoming more and more popular. Certain aspects of online support, facilitated by the use of computers or telecommunications, can facilitate the self-management of chronic diseases by patients.

Online programmes are often used with patients who are affected by chronic diseases, such as diabetes, heart disease, and cancer. Patients can learn how to maintain their conditions stably at home. They can be helped to reduce risk and acute care episodes. Indeed, many patients with a chronic condition or multiple chronic conditions spend time in acute hospitals because they experience an episode that is implicitly due to a mismanagement of their condition. Improving a patient's knowledge of chronic diseases

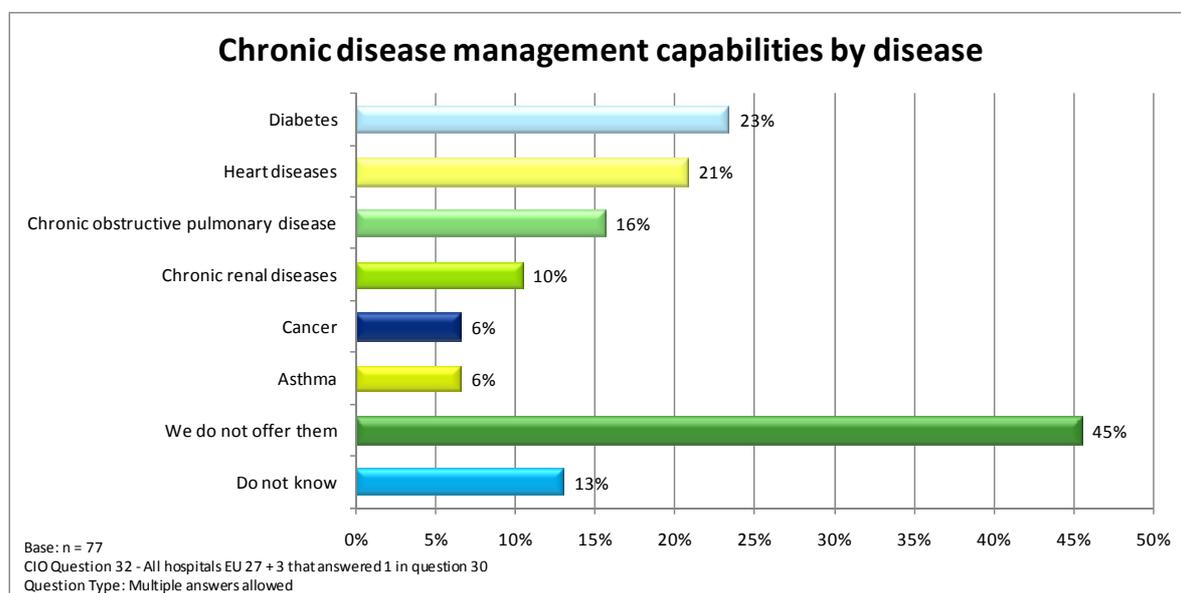
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<sup>35</sup> World Health Organisation, online definitions. Accessed February 16, 2011  
[http://www.who.int/topics/chronic\\_diseases/en/](http://www.who.int/topics/chronic_diseases/en/)

and helping him or her to avoid acute care episodes can not only make a positive difference to the patient but also, as a result, to the whole health system<sup>36</sup> since it would have an effect on the positive running of a hospital's – and even a region's or a nation's – health system, its management, and its budget.

Online chronic disease management capabilities are offered to patients in more than four out of ten hospitals that have telemonitoring systems in place whatever the chronic disease. An equivalent proportion of hospitals do not offer these services. Diabetes is the most common disease for which the service is available (as Figure 40 shows).

Figure 40 – Chronic disease management capabilities



The small number of observations gathered in relation to chronic disease management capabilities makes it impossible to draw statistically sound conclusions at the country level. However, it is worth noting that, in only 13 countries, do hospitals offer chronic disease management. Cancer and asthma monitoring are on offer in only four of the surveyed hospitals which offer telemonitoring.

### 3.3 Electronic patient data exchanges

Question 33–37 concern the exchange of electronic patient-level information and data with external providers.

<sup>36</sup> Adapted from Chronic disease management solutions page at Microsoft Accessed February 16, 2011

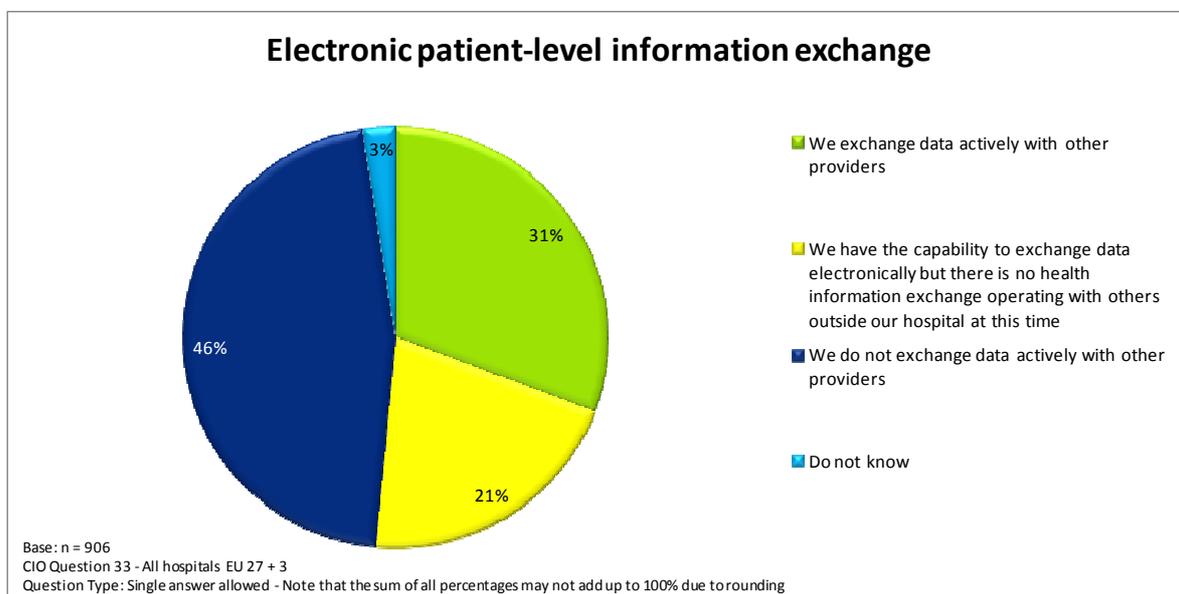
[http://www.microsoft.com/industry/government/solutions/health\\_chronic\\_conditions/default.aspx](http://www.microsoft.com/industry/government/solutions/health_chronic_conditions/default.aspx)

Sharing (whether providing and/or receiving) electronic clinical data between hospital organisations, consulting physicians in the community and other community health care providers is essential in order to track the level of take-up by hospitals and the implementation of eHealth aims at European level. Improved levels of medical exchanges across countries also remain relevant in the view of the single market (even if health remains outside the remit of the Services Directive (Directive 2006/123/EC), and the mobility of patients and workers across countries for personal or professional purposes.

However, the external exchange of patient-level information takes place in only three out of ten hospitals, as Figure 41 shows. This is especially the case in public hospitals: over one-third of them exchange information in contrast to fewer than one-quarter of private hospitals. University hospitals are also more likely to exchange information than non-university hospitals. Furthermore, the larger the hospital is, the more likely it is to exchange information.

In around half of all hospitals there is, however, simply no active data exchange with other providers (as Figure 41 also shows).

Figure 41 – Exchange of electronic patient-level information with external providers



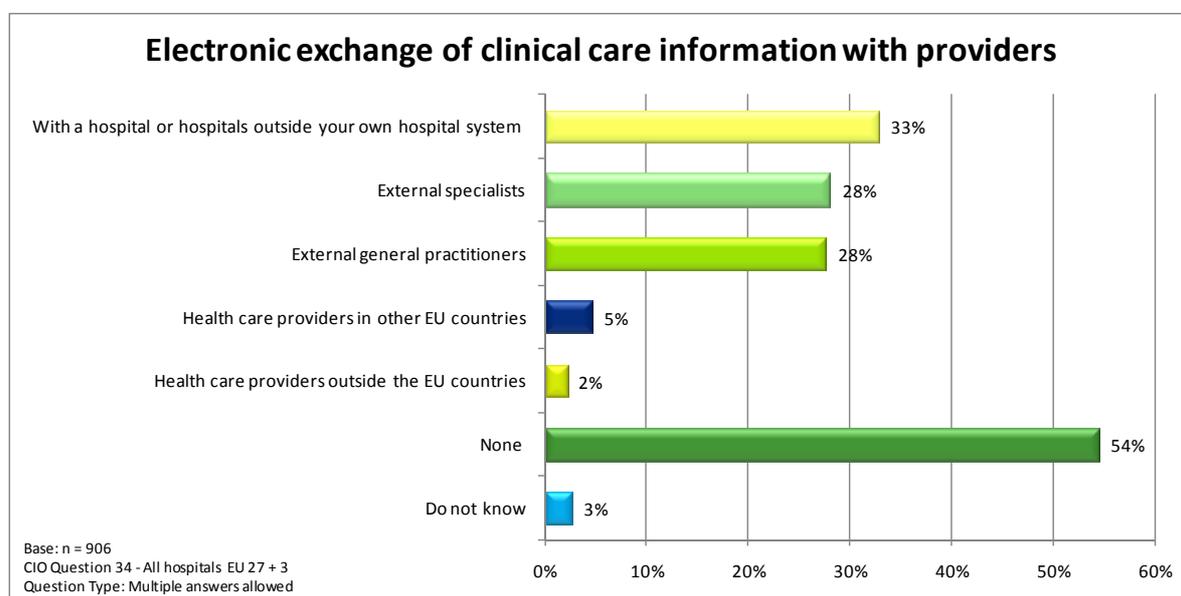
High levels of electronic patient data exchanges with external providers are more prevalent in Nordic and in some western European countries. Three-quarters of the hospitals exchange data actively in Belgium as do more than half of the hospitals in Austria, Denmark, Estonia, Finland, Ireland, the Netherlands, Spain, Sweden and the UK.

Large countries such as France, Germany, Italy and Poland are less advanced in their patient-level information exchange. Nor do any of the CIOs in the acute hospitals surveyed in Bulgaria, Croatia and Slovenia say that they exchange data with other providers external to the hospital.

Figure 42 shows the distribution of external clinical care information with a number of external providers. The majority of hospitals do not exchange information about patients (such as the clinical history of results from medical tests) with any other provider. When the exchange of clinical care information does occur, it takes place between hospitals and other hospitals outside their own system in one-third of the cases, and with external practitioners/specialists in a little over one-quarter of the cases.

Public and university hospitals are generally more likely to exchange information with providers. Large hospitals tend to share more information than small ones. Independent single-site hospitals are less likely to exchange information, while hospitals that are part of a care group are more likely to do so. Size also matters: six out of ten large hospitals exchange information with providers.

Figure 42 – Exchange of clinical care information with providers

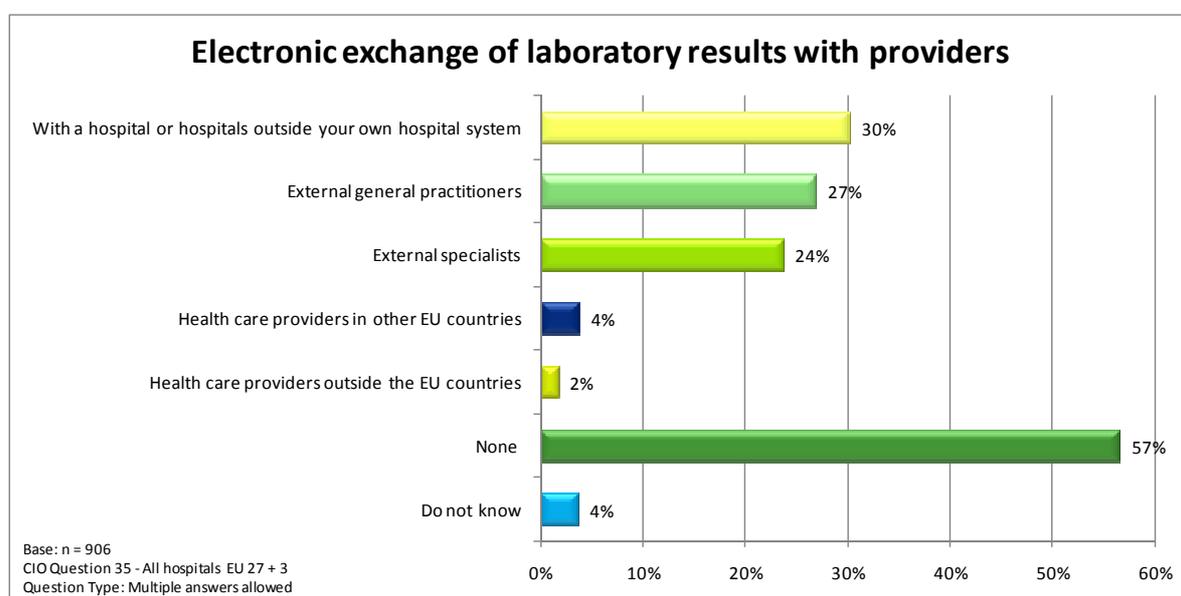


A geographic gap is evident: in several new Member States three-quarters or more of the hospitals surveyed do not exchange information with providers. This is true of Bulgaria, the Czech Republic, Lithuania, Poland and Romania. In the Greek hospitals surveyed, 85%

of the hospitals do not share information; the same observation can also be made of 69% of German hospitals.

Concerning the exchange of laboratory result information about patients, Figure 43 shows that nearly six out of ten hospitals have no such exchange. However, in three out of ten hospitals, an exchange takes place with hospitals outside their own system. In about one-quarter of hospitals, it takes place with external practitioners and with external specialists. The exchange of laboratory results happens more often in public hospitals than in private hospitals, more in university hospitals than in non-university hospitals, and more in large hospitals than in small.

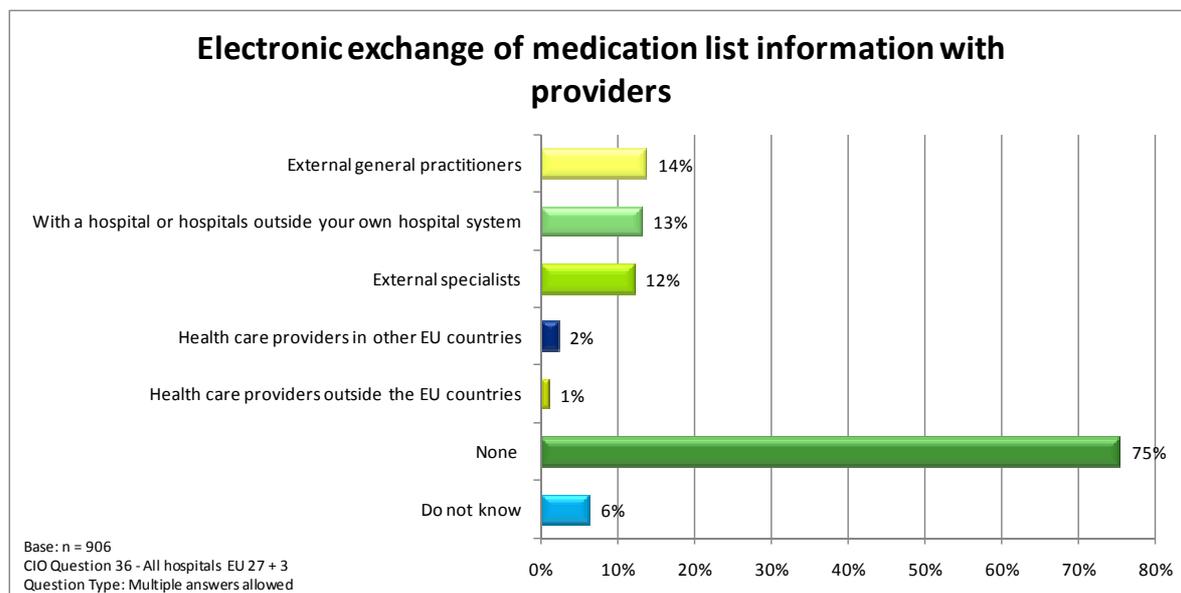
Figure 43 – Exchange of electronic laboratory results information with external providers



Electronic exchange of laboratory results is widespread in Belgium, Denmark, Finland and Norway. Only a quarter of the hospitals in Germany exchange laboratory results with providers. Similar results are apparent for France and Italy. Very limited exchange of laboratory results (less than 10%) can be seen in EU+ acute hospitals in Bulgaria, Croatia, Greece and Poland.

The exchange of medication lists information with external providers is to be seen rarely in the hospitals that were surveyed, as Figure 44 shows. Public, university and large hospitals are, however, slightly more likely to offer such a service. Cross-border exchange of medication list information is performed by fewer than 30 of the 906 European hospitals that were surveyed.

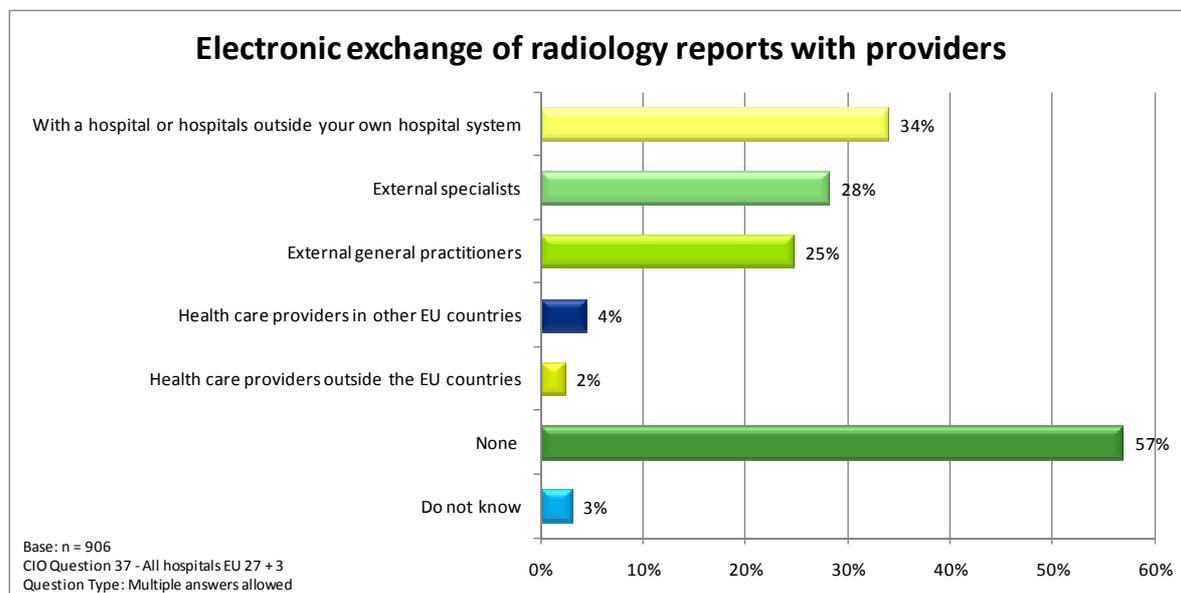
Figure 44 – Electronic exchange of medication lists information with providers



At the geographic level, Norway and Sweden are the most advanced countries as half of the surveyed hospitals in these two countries offer at least an in-country exchange service. The electronic exchange of medication lists information is non-existent in all the new Member States. Overall, in all hospitals surveyed, cross-border exchanges with health care providers in other European countries take place only in one out of fifty hospitals.

With regard to the exchange of radiology reports with providers, it is more widespread in Europe than is the exchange of medicine lists even though cross-border exchange is extremely limited (as Figure 44 shows). Public hospitals are more likely to offer this service to at least one of the providers: this is evident in nearly half of public hospitals as opposed to just over one-quarter of private hospitals. The same is true for university hospitals (where six in ten offer the service) whereas only about one-third of non-university hospitals offer it. Large hospitals are also more likely to exchange radiology reports than are smaller hospitals. For the electronic exchange of radiology reports, nearly two-thirds of large hospitals (with more than 750 beds) connect with a hospital outside their own hospital system in comparison to less than one-fifth of small hospitals (with fewer than 101 beds).

Figure 45 – Electronic exchange of radiology reports with providers



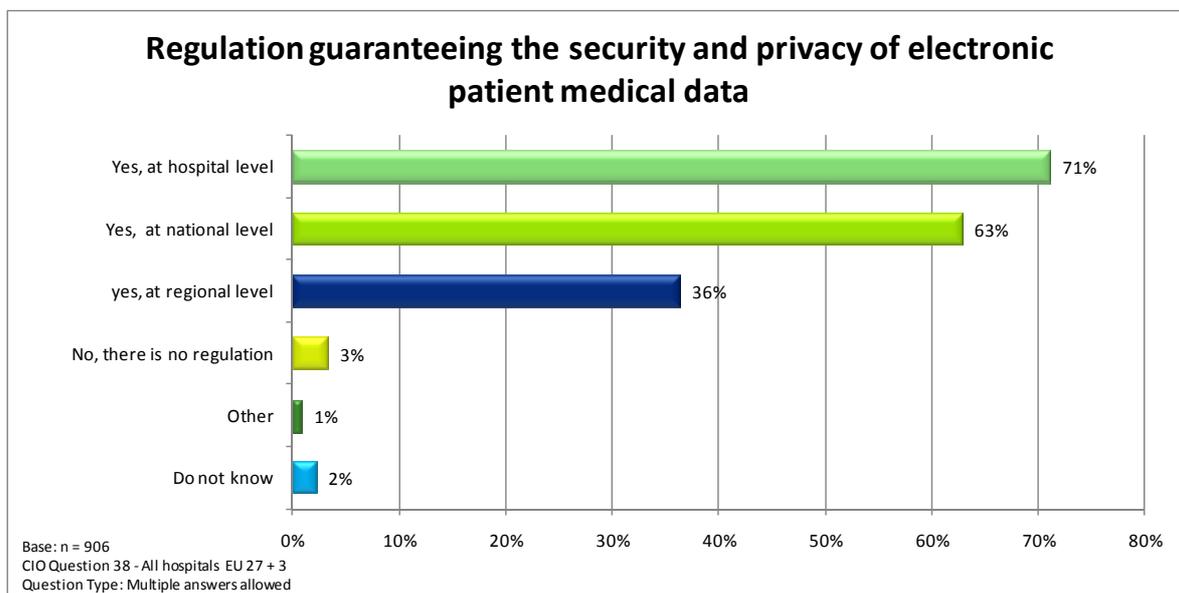
In geographic terms, exchange of radiology reports with providers in hospitals outside the respondent's hospital system is widespread in most Nordic and Western European hospitals. The service is also in place in most of the hospitals in the Czech Republic and Estonia. France, Germany and Italy are below the EU+ average of availability of this service for all the types of services. Other low users of such services include Poland (where 82% of respondents said that none of the services listed are available).

### 3.4 Data protection and security

This last section of the CIO questionnaire refers to issues of data protection and of data security strategies in the hospitals. Questions 38–46 deal with the issue of data security and resilience of the hospital ICT infrastructure.

The presence of regulations aimed at guaranteeing the security and privacy of electronic patient medical data at hospital level is present in more than seven out of ten hospitals. For a little more than six in ten, this regulation also exists at national level; for one-third, it also exists at regional level, as Figure 46 shows.

Figure 46– Regulation in use to guarantee the security and privacy of electronic patient medical data



Regulations at the hospital level are more likely to exist in hospitals which are either part of a group or are a university hospital. The presence of regulations does not seem to depend on hospital size.

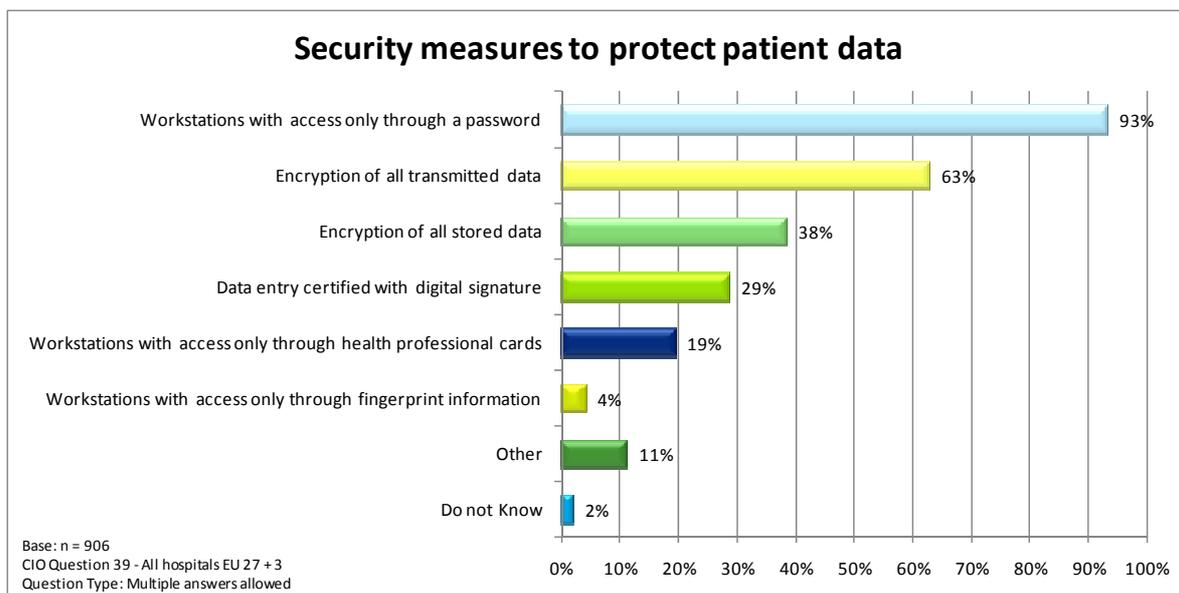
Different security measures are taken to protect the patient data stored and transmitted by the hospitals' IT systems. The most common measure used by a vast majority of hospitals, whatever the hospital type, is the use of workstations with *passwords* as the means to access workstations as shown in Figure 47. The second most used security measure is the *encryption of all transmitted data* and is used in about two-thirds of all hospitals.

To a lesser extent, hospitals have taken the following measures to protect patient data:

- Encryption of all stored data (38%)
- Data certified with a digital signature (29%)
- Workstations with access only through health professional cards (19%).

The differences in treatment of transmitted and stored data are to be noted.

Figure 47 – Security measures to protect patient data



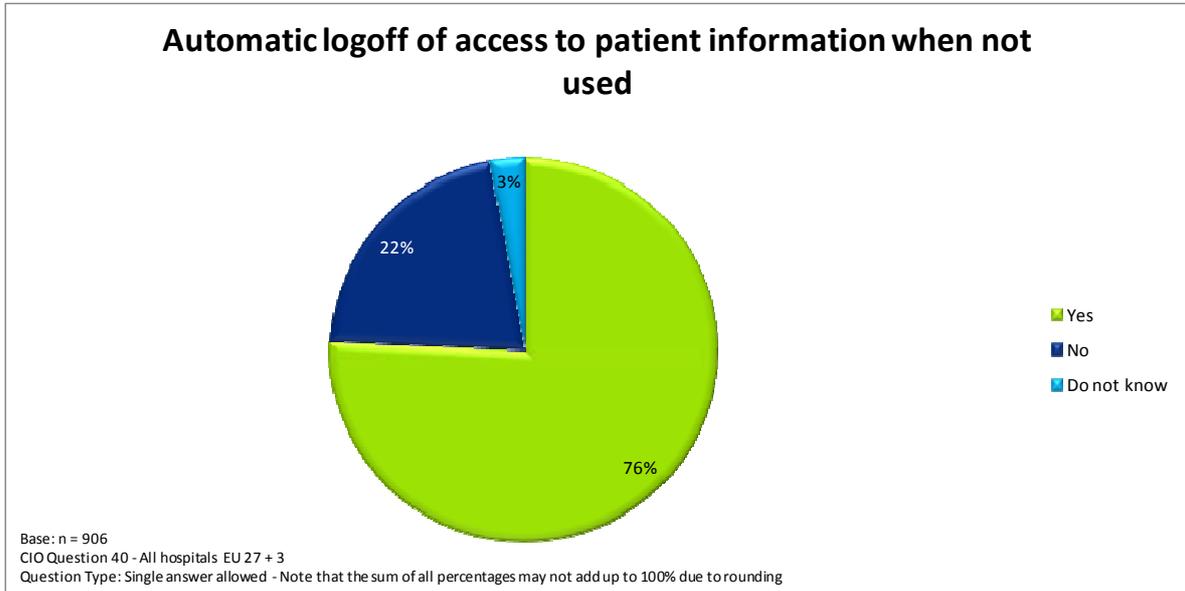
The use of passwords is common across all the types of hospitals considered. More sophisticated systems such as encryption of transmitted data and data entry certified by a digital signature are more likely to be found in large hospitals belonging to groups of hospitals or care institutions.

In geographic terms, the use of a password as a means of access to workstations is common across all of the Member States, and data entry certification as a practice is followed by almost half of the hospitals in Spain and the UK.

Automatic logoff of from access to patients' information when it is not being used takes place in three-quarters of all hospitals, as Figure 48 shows.

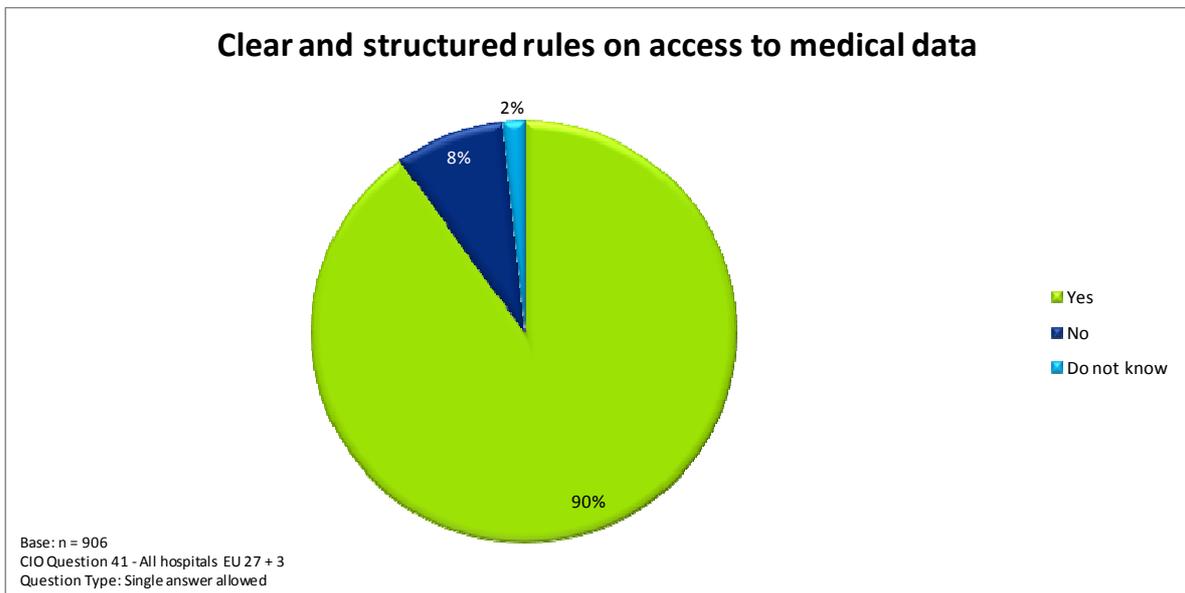
This function is much more likely to be found in large hospitals than in small ones. Hospitals which belong to a group are also more likely to have this function in place. In geographic terms, Nordic and Western European countries generally use this mechanism more, with the exception of Finland where only around one-quarter of hospitals surveyed has such a system in place.

Figure 48 – Automatic logoff function



Nine out of ten hospitals have clear and structured rules on accessing patients' electronic medical data (reading or writing), as shown in Figure 49.

Figure 49 – Clear and structured rules on access to medical data

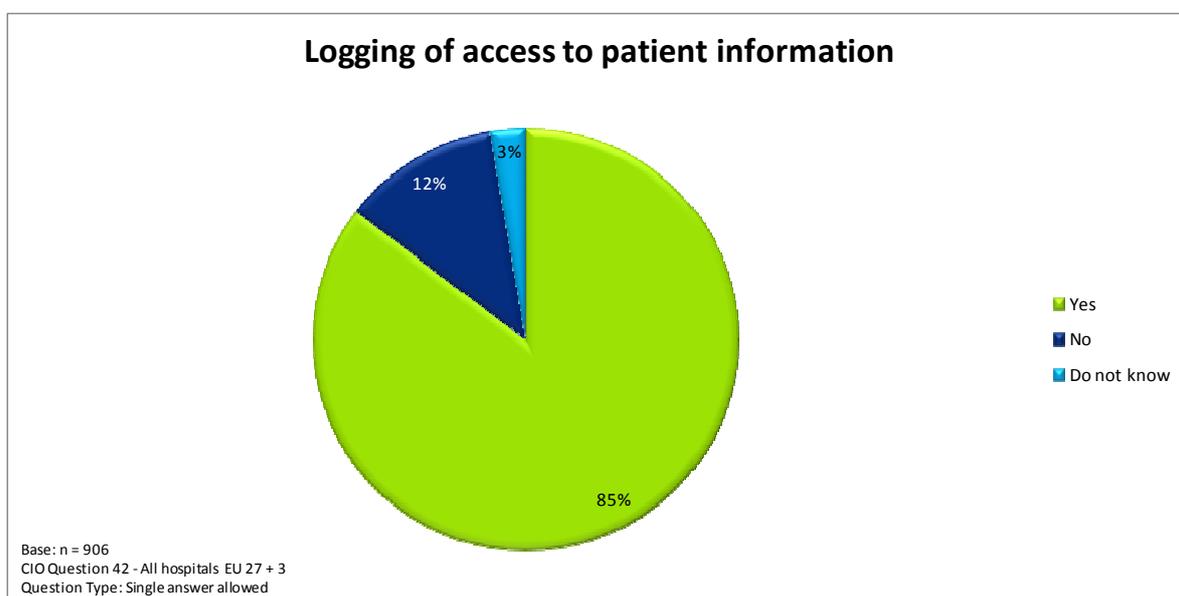


Large hospitals are also slightly more likely to have clear rules on access. All of the hospitals surveyed in 11 of the Member States and two of the EEA countries (13 countries in total) report having clear and structured rules on accessing patients' data. The countries involved are Croatia, Cyprus, Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Luxembourg, Norway, Slovakia, Slovenia and Sweden. The exceptions with regard to clear

and structured rules are hospitals in Greece, where only three-quarters of hospitals have it, and in Romania where only two-thirds of hospitals have it.

With regard to the logging of access electronic patient information, more than eight acute EU+ hospitals in ten log the access to this type of information, as Figure 50 shows. This is true of 94% of large hospitals (750+ beds) and 75% of small hospitals (with less than 101 beds). University hospitals are also more likely to log access to patient information than are non-university hospitals.

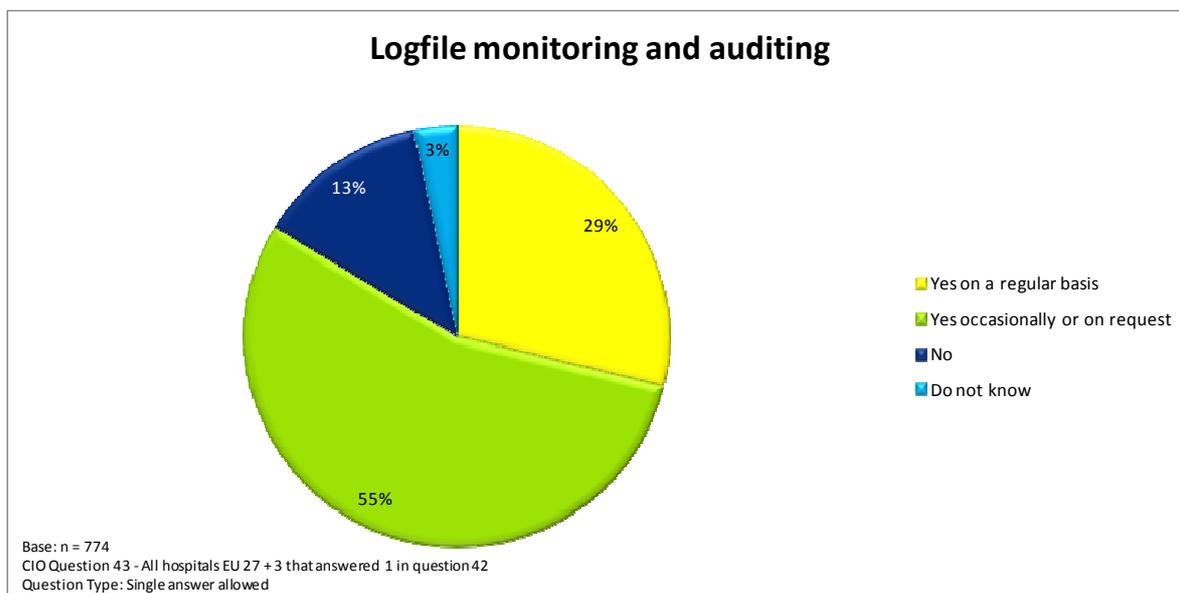
Figure 50 – Logging to access to electronic patient information



All the hospitals surveyed in 13 European countries (Austria, Croatia, Denmark, Estonia, Finland, Iceland, Latvia, Malta, the Netherlands, Norway, Slovenia, Sweden and the UK) have logging of access to patients' information in place. The lowest percentages are found in Greece (62%) and Romania (61%).

Of the hospitals that have logging of access to patient information in place: the log file is audited and monitored in more than eight out of ten hospitals. However, in more than half the cases this occurs only on an occasional basis or on request, as Figure 51 shows.

Figure 51 – Monitor and audit of log files



The process is carried out in 96% of the university hospitals in comparison to 82% of non-university ones. It is also done in 96% of large hospitals (750+ beds) and in 78% of small hospitals (with fewer than 101 beds).

Monitoring and auditing is not carried out in between one-quarter and one-third of French hospitals, nor in one out of four Bulgarian and Portuguese hospitals surveyed. At the other end of the spectrum, all the Icelandic and Swedish hospitals included in the sample undertake monitoring and auditing on a regular basis.

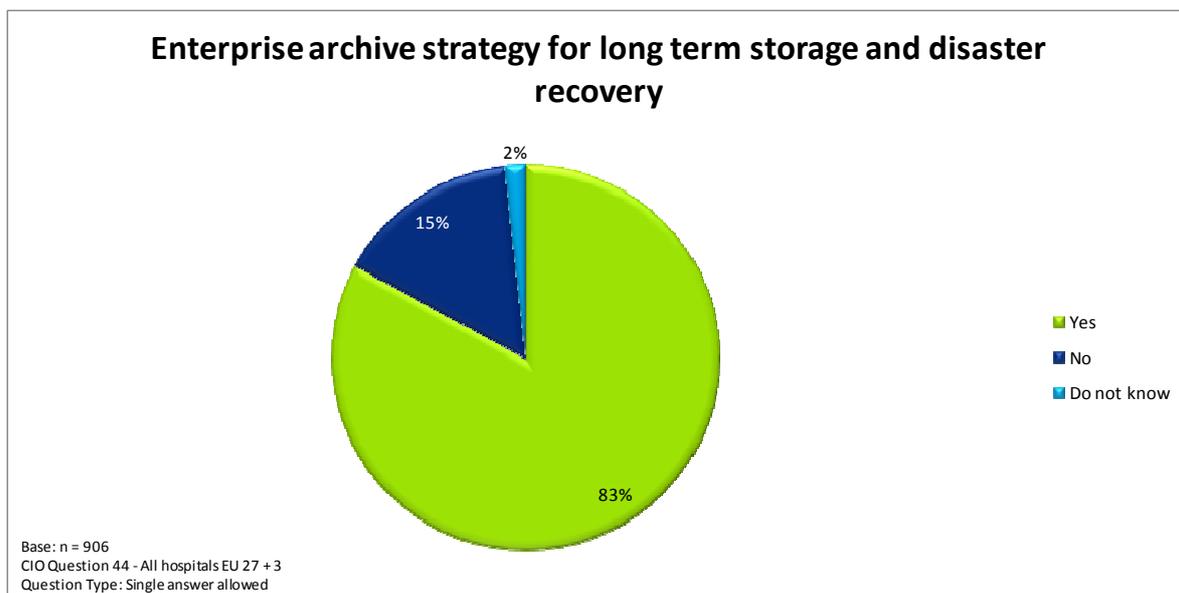
Disaster recovery implies the ability to recover those mission-critical computer systems that are required to support the business's continuity – in this case, the business is the hospital.<sup>37</sup> As Figure 52 shows, more than eight in ten hospitals have an enterprise archive strategy for long-term storage and disaster recovery. This is the recovery mission-critical computer system required to support the hospital's continuous functioning.

This result is observed regardless of whether it takes place in a public or a private hospital. However, university and large hospitals are more likely to have a system in place than non-university and small hospitals.

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<sup>37</sup> This terminology was originally elaborated by the SHARE organisation. SHARE group website. "SHARE > Technology – Connections – Results." Accessed February 16, 2011. <http://www.share.org/>.

Figure 52 – Enterprise archive strategy



Enterprise archive strategies relate to "a comprehensive information archiving strategy aligned with [an organisation's] goals and performance needs."<sup>38</sup> In the context of this survey, the strategy relates to the specific hospital concerned.

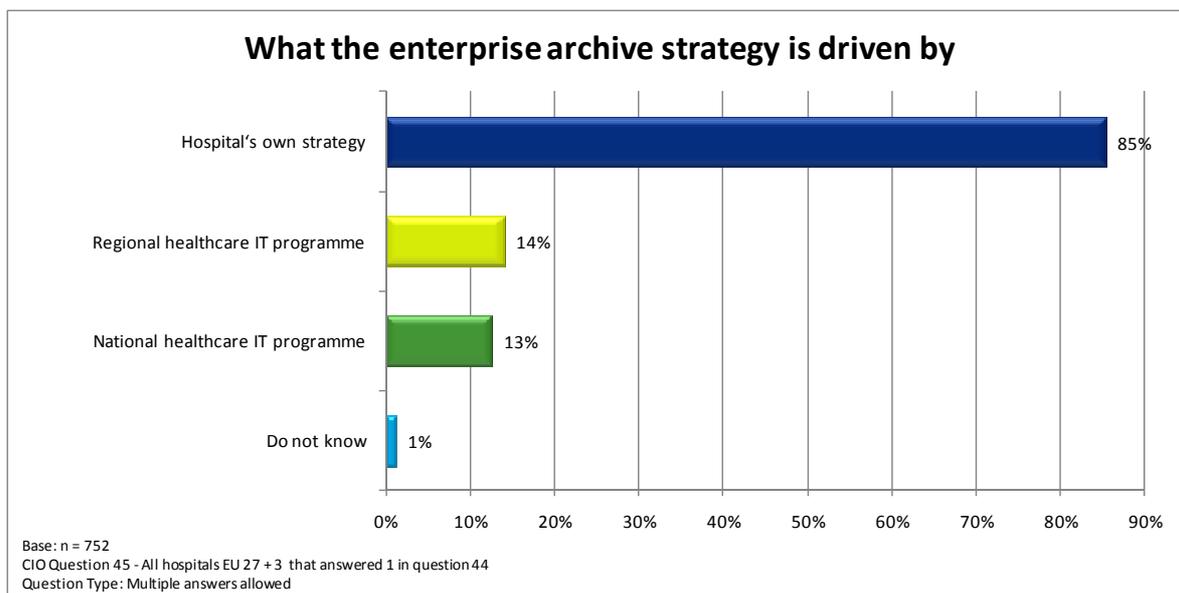
All the hospitals surveyed in eight European countries (Austria, Croatia, Cyprus, Denmark, Estonia, Iceland, Norway, and Sweden) have an enterprise archive strategy for long-term storage and disaster recovery. This observation also reflects the situation in close to all of hospitals surveyed in Belgium, Germany, Spain and the UK. France and Italy, however, are both below the EU+ average.

Of the hospitals which have an enterprise archive strategy, for most of them it is driven by the hospital's own strategy. Only in a few hospitals is it driven by national or regional healthcare IT programmes, as can be seen in Figure 53.

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<sup>38</sup> IBM [International Business Machines Corporation]. "IBM – Information Lifecycle Management Services – Enterprise Archive – North America." Accessed February 16, 2011. <http://www-935.ibm.com/services/us/index.wss/offering/its/a1030346>.

Figure 53 – Drivers of enterprise archive strategy

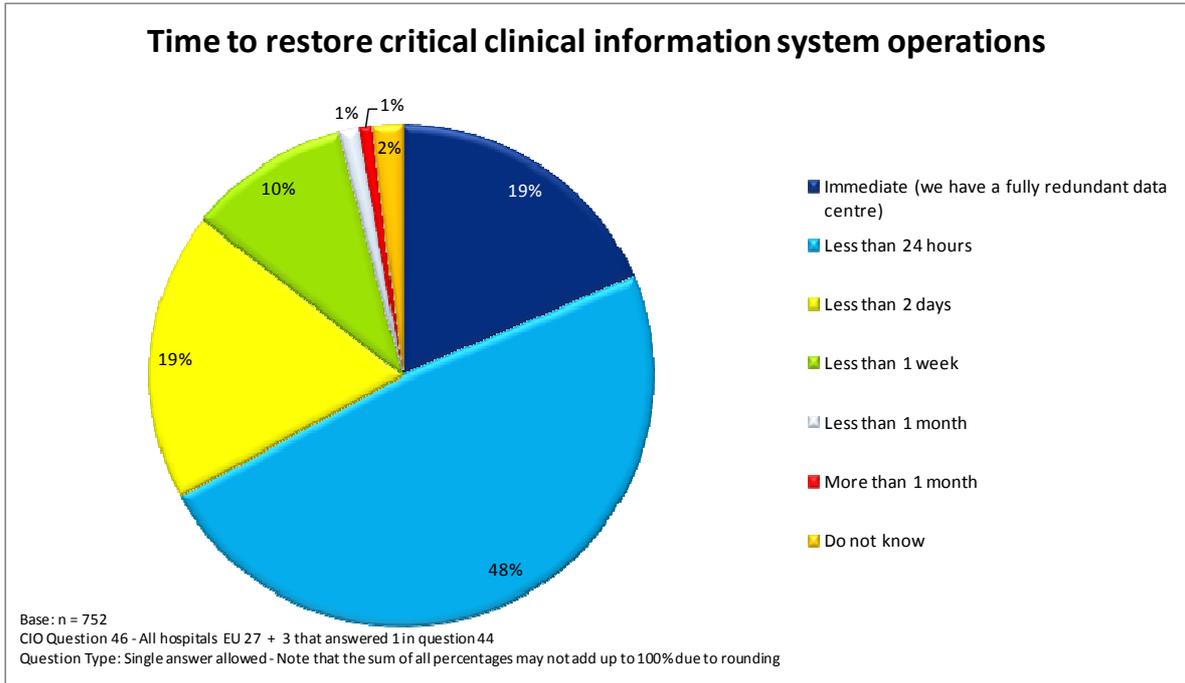


Hospitals whose strategy is internally-driven are slightly more likely to be private hospitals than public. They are also more likely to be independent single-site hospitals than to belong to a group.

In terms of geographic spread, Denmark, Ireland and Sweden are the only three countries where the strategy is driven by either regional or national health care IT programmes more than by the hospital's own strategy.

Finally, how fast a hospital can restore its critical clinical information system operations is important. As can be seen from Figure 54, almost half of all the hospitals' critical clinical information system operations can be restored within 24 hours in the event that a disaster were to cause the complete loss of data at the hospital's primary data centre. However, 10% of hospitals say that this can only be done in less than one week. Shockingly, 1% say that it would take up to a month and, even worse, in another 1% of hospitals it would take more than a month.

Figure 54 – Speed at which hospitals can restore important clinical information



With regard to those hospitals which are able to restore critical operations immediately, university hospitals are more likely to have the system restored immediately (23% in comparison to 18% of non-university ones).

Immediate recovery is possible in more than half of the hospitals in Luxembourg and Sweden. More than nine out of ten hospitals in Austria, Bulgaria, and Sweden would restore data immediately or within 24 hours. The response time is longer than 24 hours for more than half of the hospitals surveyed in Finland, Greece and Norway.

## Some key messages from the European CIO respondents

### On connectivity and infrastructure

Nearly all hospitals are connected to broadband (92%). In 52% of respondents' cases, the typical bandwidth is below 50Mbps. Only 24% of connected hospitals have a bandwidth over 100Mbps. Of hospitals with broadband, slightly more than half have wireless communication systems. Wireless internet can be accessed from a number of locations, especially from workstations. Only 28% of hospitals do wireless monitoring of inpatients.

Videoconferencing facilities are common – they are available in nearly 40% of the hospitals surveyed. The most common use of videoconferencing facilities is for consultation between internal medical staff and external healthcare providers.

### On the type of application and data exchanges inside and outside the hospitals

A majority of the hospitals have a common EPR system in place and a PACS. These can be accessed from a number of locations inside the hospitals (especially operating and emergency rooms), but only 4% of hospitals in the survey grant online access to patients. Wireless access to the PACS and EPR systems from anywhere inside the hospitals is not yet common, nor is access by external healthcare providers based outside the hospitals.

ePrescription is available only in 30% of the hospitals surveyed. It is used mostly for connection to a pharmacy which is inside the hospital (in 87% of cases). eBooking is more widely developed. It is used by 71% of the hospitals in the survey: in the main, it is used as a service by internal medical staff, nurses and administrative staff. Only 11% of hospitals offer patients the opportunity to book a hospital appointment online.

More than half of hospitals have a system for electronic transmission of clinical test results (70%) and a system for electronic service order-placing (55%). The picture is different for adverse health events reporting systems which are present in only 39% of the hospitals.

Telemonitoring undertaken by the hospitals surveyed is still at low levels: only 8% of European hospitals have telemonitoring systems for outpatients and patients with heart conditions. The potential opportunities for increasing these rates, and their usefulness to both health professionals and especially patients, are considerable.

Electronic medical data exchanges with providers outside the hospital are not common for electronic exchange of clinical care information, laboratory results and medication lists: this is done by fewer than 50% of the hospitals surveyed. Exchange of radiology reports is similarly widespread (40%), especially with specialists and general practitioners.

A final, important, remark is that cross-institution electronic medical exchanges across countries and across institutions are still extremely rare in the hospitals surveyed.

#### On security and data protection

With regard to regulations aimed at guaranteeing the security and privacy of electronic patient medical data, more than seven in ten hospital CIOs said there was a regulation in use at hospital level that guarantees security. For a little more than six in ten, this regulation also exists at national level, and for 36% it is said to exist at regional level.

Among the different security measures that are taken to protect the patient data stored and transmitted by the hospitals' IT systems, the most commonly used measure is the use of passwords to access workstations. Passwords are used across all the types of hospitals considered. The more sophisticated systems, such as encryption of transmitted data and data entry certified by a digital signature, are more likely to be found in large hospitals or those which belong to groups of hospitals or care institutions.

In more than eight in ten hospitals, the access to electronic patient records is logged. A large majority of hospitals also have an enterprise archive strategy and can recover critical infrastructure in less than 24 hours.

There appear to be notable differences among countries in terms of their responses to infrastructure, applications available, data exchanges, and security levels and the approaches used in their hospitals. The Nordic countries are leading generally in terms of the eHealth deployment in all the technical and clinical applications surveyed<sup>39</sup>. Large hospitals, public hospitals, and university hospitals are in the main more advanced than smaller, private, and non-university hospitals.

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<sup>39</sup> Similar conclusions – at least for the countries' systems as a whole – have been reached in work undertaken on the TEMPEST model (developed by examining the strategies of 12 EU Member States). It states that, in eHealth, "Denmark and Sweden are front-runners in eHealth, whereas Poland and Romania are laggards." (Currie, 2010.)

## 4 Key Results and Conclusions relating to Medical Directors

This chapter summarises the findings of the interviews conducted with 280 hospital Medical Directors. It is important to note that each Medical Director is responsible for a hospital where the survey agency had already interviewed the CIO. This comparison between a CIO's and a Medical Director's responses to the survey questions has allowed the study team to compare and contrast some of their responses on common topics. In particular, three items were compared in terms of these responses to:

- The gap between availability of applications and their use in the same hospital,
- The interoperability of EPR systems,
- Telemonitoring.

The Medical Directors were, however, mainly posed different questions to those asked of the CIOs: the wording of the questions asked of the two types of respondent was somewhat different. For example, CIOs were asked about more sophisticated forms of applications, and the Medical Directors generally about less elaborate applications. Any findings related to questions which are worded differently should be treated with some caution.

Overall, this approach was used, however, because it was intended to offer an added dimension and perspective on the subject of eHealth in hospitals in terms of the impacts and perceived barriers of the implementation for specific clinical applications which are of high policy relevance to the EC. It was expected that CIOs and Medical Directors would have different perspectives on ICT in hospitals and have differing capacities to answer particular questions: CIOs were expected to be able to answer more organisational, technical, and functional questions. Medical Directors, on the other hand, were anticipated to be able to respond to questions about their perceptions towards technology and their actual use of that technology.

It could be a common expectation that, for any given technological application, the CIOs responses might be anticipated as being higher than the Medical Directors' answers. This would mean that, despite their deployment, the applications were paid less attention by – and used less – by the medical staff. In most of the example questions, this is the result. On the other hand, four questions were answered by the Medical Directors with the

reverse result: they indicated that they used the applications more than the CIOs appeared to think that they did. One overall explanation for this might be that: it is the Medical Directors and their staff who actually use these applications (eReferral letters, ePrescription, and PACS). Given the Directors' familiarity with these applications, they are more knowledgeable about their actual use than is the CIO (whose interest is likely to be more managerial and organisational, and less clinical).

However, it is important to be cautious about these results: many of these questions are differently worded and hence cannot be considered to be directly comparable. In section 4.1 (which follows), associated with Table 1 each of these four cases is provided with a potential explanation for any observed difference.

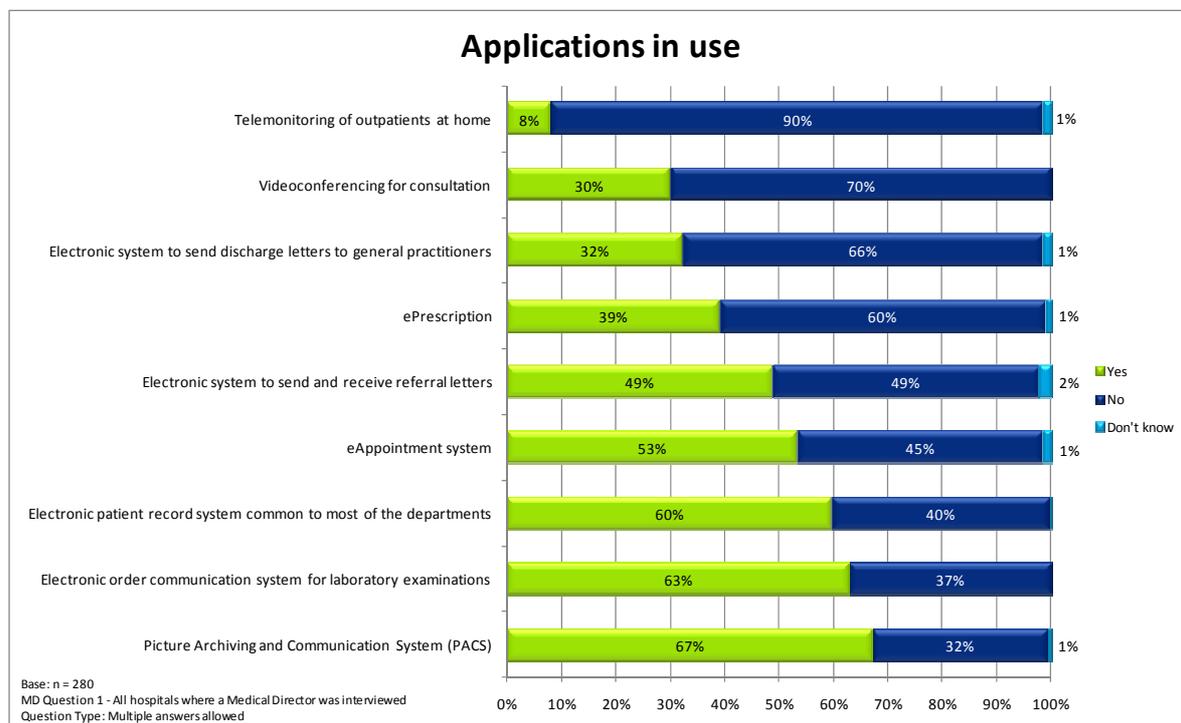
The Medical Directors were posed a total of 12 questions. (In this chapter the information given in response to questions 8, 9 and 10 by the Medical Directors are not reproduced, as the respondents' base was too small – there were fewer than 50 responses at the EU+ level.)

The text of the full Medical Director questionnaire can be found in Annex 4.

#### 4.1 Use of ICT applications by medical staff

The Medical Directors interviewed were provided with a list of eHealth applications and asked which of these were already in use in their hospital. The results of this first question to them are shown in Figure 55.

Figure 55 – eHealth applications already in use in hospitals



Similar questions had already been asked to the CIOs, as we have seen throughout chapter 4. However, CIOs were asked about the *availability* of these applications whereas Medical Directors were asked about the *actual use* of the applications. Hence, there is the potential for results which might indicate a comparison or a contrast between *availability* and *use*.

Given the fact that in all 280 hospitals where a Medical Director was interviewed, the CIO was also interviewed, it is worthwhile exploring how their responses differ and correlate. Any differences in their responses could indicate a gap between *deployment* and *take-up* of applications. The table which follows identifies those questions asked of the CIOs and the Medical Directors which have the potential for comparison in terms of these two areas of measurement. The first column identifies questions asked of the Medical Directors and the second column identifies the parallel or similar questions posed to the CIOs.

Methodologically speaking, it should be emphasised that many of the interpretations of the data which follow are indicative rather than absolute. It is evident that it is not possible to make exact comparisons between the two types of personnel's responses to the two questions since precisely the same questions were not posed to both.

Table 1 – Comparison of questions which could indicate any potential gap between availability and use of clinical applications in the same hospital

	CIO: questions on the <i>availability</i> of integrated systems for...		Medical Director: questions on the applications in <i>use</i> for ...	
	%	Question number	%	Question number
Electronic patient record system common to most of the departments	77	Q16.1, 2	60	Q1.1
Electronic order communication system for laboratory exams	66	Q26	63	Q1.2
Electronic system to send and receive referral letters	36	Q23.2	49	Q1.3
Electronic system to send discharge letters to general practitioners	45	Q23.3	32	Q1.4
ePrescription	31	Q23.5	39	Q1.5
eAppointment system	72	Q28	53	Q1.6
Picture Archiving and Communication System (PACS)	61	Q20	67	Q1.7
Telemonitoring of outpatients at home	9	Q30	8	Q1.8
Videoconferencing for consultation	30	Q15	30	Q1.9

For some of the clinical applications, the replies given by the Medical Directors were more or less in line with those of the CIOs (with only a few percentage points' difference). This is certainly the case for telemonitoring, electronic order communication system for laboratory exams and for videoconferencing use for consultations.

It is, however, important to note that the question on videoconferencing that was asked of the CIOs dealt with a variety of uses of videoconferencing facilities, whereas the Medical Directors' questionnaire covered consultations through videoconferencing only. This has been taken into account in Table 1, where only answers 1, 2 and 3 from the CIO question has been included, therefore the comparison between the CIO questionnaire answers and the Medical Director questionnaire answers on the matter of the use of video conferencing for consultations is appropriate. Thirty per cent of both groups of respondents said videoconferencing was used for consultations, which shows a clear match between the results from the two surveys.

Three of the applications listed were given higher average rates in the CIOs' responses to the questionnaire (there was over 10% points difference or more): this illustrates a potential gap between the availability and take-up of the solutions in the hospitals. These

include EPR systems common to most of the departments, electronic systems to send discharge letters to general practitioners and eAppointment systems. This could indicate a potential gap where the systems are in place but are not yet as much in use.

First, ePrescription availability, was slightly lower according to CIOs. Three out of ten CIOs say that the hospital had a computerised system for ePrescription as opposed to four out of ten Medical Directors who state that ePrescription is in use. Considering that the two sets of responses are given by personnel in the same hospital, they may possibly indicate a misconception of what ePrescription is. CIOs may have in mind more sophisticated types of computerised systems which are available *across* the entire hospital, whereas Medical Directors may be referring to the use of ePrescription even when it is available only in some hospital specialities or hospital departments.

Second, similarly, Medical Directors indicate a higher take-up of eReferral. The question posed to them related only to discharge letters sent to general practitioners whereas the question asked of the CIOs (question 23.3) was associated with an integrated system for both sending and receiving referral and discharge letters. Hypothetically, this observable difference might therefore be explained, again, by the fact that the question posed to the CIOs might refer to a more sophisticated system than that about which the Medical Directors were questioned.

A third example where the Medical Directors' responses are slightly higher than those of the CIOs was with regard to PACS. The actual use of PACS appears to be higher than their availability. This discrepancy could be explained by the fact that (in responding to question 20) the CIO is considering a more sophisticated system when he or she answers the question than does the Medical Director.

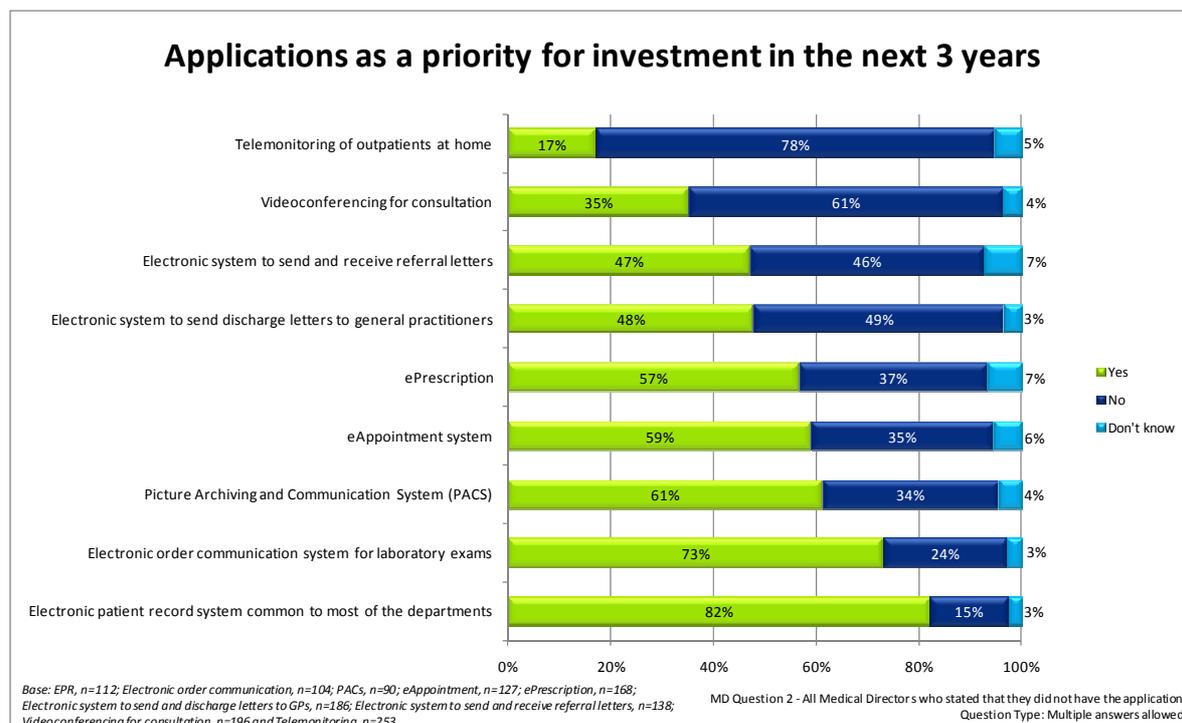
#### 4.2 Investment priorities in the next three years

In their second question, the Medical Directors were asked for each application that their hospital does not possess (as reflected in question 1), if it was a priority for investment in the next three years. Thus, this question was not posed about those applications that their hospitals already had. It referred only to those applications which the hospital did not use yet.

As Figure 56 shows, the large majority of Medical Directors (82%) in hospitals that did not have EPR systems common to most of their departments viewed this application as a

priority investment within the next three years. This is notably similar to the results presented in the CIO component of the survey, indicated in Figure 19. There, CIOs also see central EPR systems as a key priority for investment in the next three years.

Figure 56 – Priorities for investment in the next 3 years



Around three-quarters of Medical Director respondents who did not have an electronic order communication system for laboratory exams in their hospitals felt this was a priority investment in the next three years. Six in ten of those without a PACS reported it to be a priority investment in the next three years. Thus these three applications (EPR systems, electronic order communication systems, and PACS) are the top three priorities for investment.

It should be emphasised that some lower priorities for investment within the next three years include telemonitoring and videoconferencing. The majority of Medical Directors respondents whose hospitals do not have telemonitoring and/or do not have videoconferencing for consultations do not deem these to be investment priorities over the next three years. Given the low penetration of telemonitoring to date – in 8% of hospitals – this response could be a source of concern to policy makers since telemedicine remains high on the eHealth policy agenda. On the other hand, however, the focus for provision of telemedicine facilities may lie elsewhere: for example, in primary care,

nursing care, social care, and/or the home or dwelling place – provisionally also the so-called hospital at home.

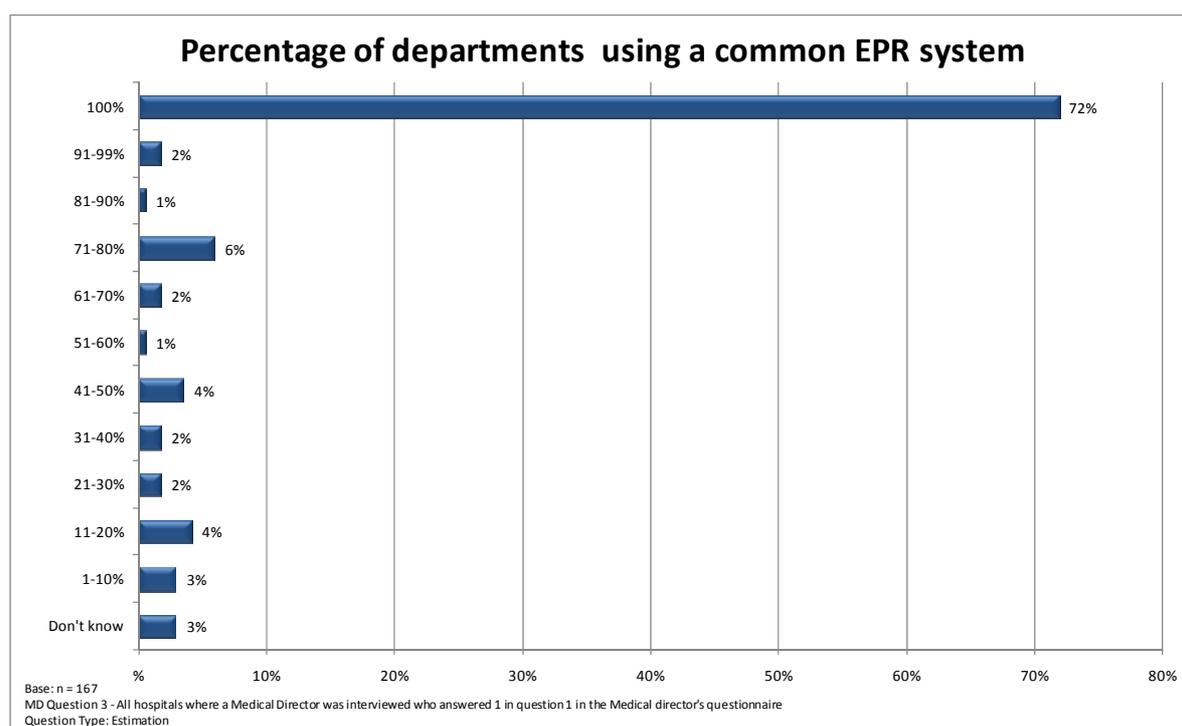
### 4.3 Electronic patient record systems

This section of the Medical Directors' questionnaire module contains four questions focused on their views on EPR systems. They include the use of EPR systems, the impact of EPR systems, perceptions on barriers encountered when implementing EPR systems and, finally, the barriers to not having implemented an EPR system yet.

#### 4.3.1 EPR system use

Nearly three-quarters of Medical Directors surveyed stated that all the departments in their hospital are using a common EPR system (as Figure 57 shows). The proportion of hospitals that do not use a common EPR system in most of their departments is low: only nine per cent of Medical Director respondents estimated that under 30% of their hospital's departments are currently using a common EPR system. A mere 3% of Medical Director respondents estimated that fewer than 10% of departments in their hospital use a common EPR system. This response rate correlates well with the answers given by the CIOs to question 16 (which indicates that an EPR system in place is common to all departments or with local systems that share a central EPR system).

Figure 57 – Share (%) of departments in your hospital that are currently using a common EPR system

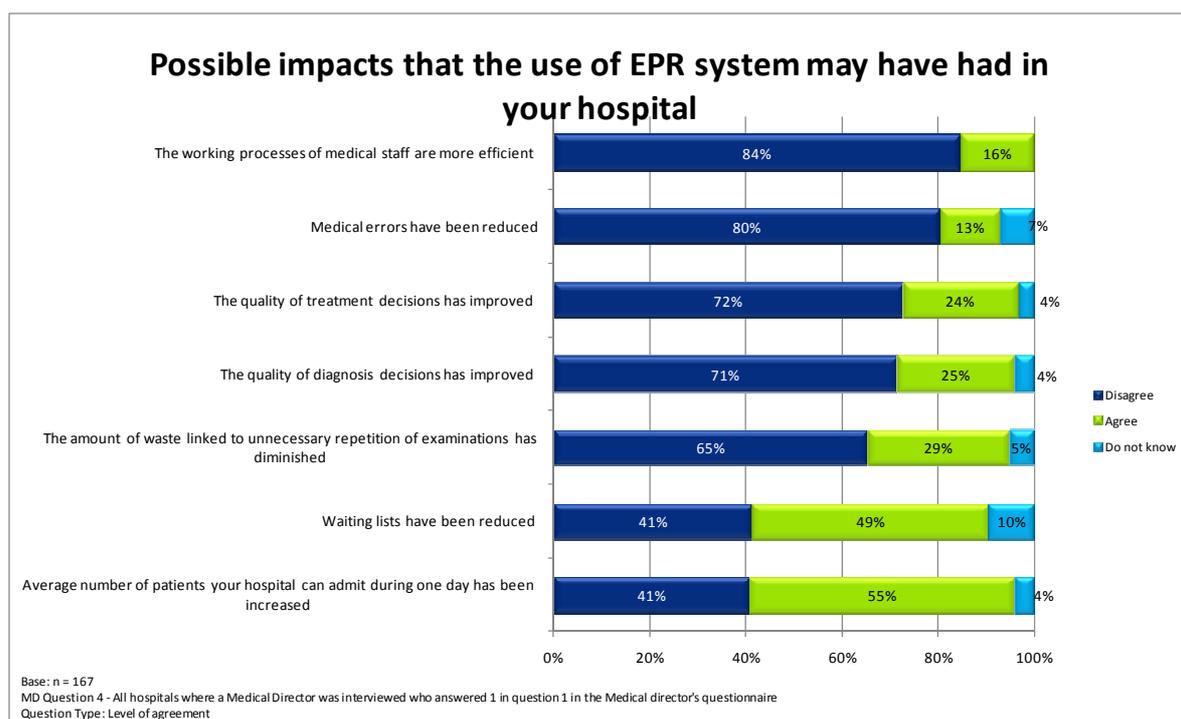


The high usage rate of common EPR systems across departments in hospitals is likely to be due to the hospitals' need for easy access to patient records. Since such records include the patients' treatment history in other departments, the data may affect the patients' further treatment and health improvement. Records are centralised through a common system so as to ensure that they are as complete as possible, and the healthcare professionals can provide the best possible patient treatment and care.

#### 4.3.2 Impact of EPR systems in the hospitals

Medical Directors with EPR systems already in place in their hospitals were asked a number of questions about their perception of the impact of these systems. They were queried about the extent to which they agreed with a number of statements concerning the possible impacts that the use of an EPR system may have had in their hospital.

Figure 58 – Possible impacts that the use of EPR may have had in hospitals



Medical Directors identified two clear, positive, impacts related to improved efficiency from the list of possible impacts put forward. As Figure 58 shows, over half of Medical Director respondents agreed that the average number of patients that the hospital could admit during a single day has increased, and about half agreed that waiting lists have been reduced. This trend indicates that, in the opinion of Medical Directors, the

implementation and use of EPR systems can reduce the administrative burden and/or can enable hospitals to use their resources more efficiently.

Conversely, most respondents disagreed with the remaining possible impacts listed. Thus, the vast majority of Medical Directors disagrees with the statements that the use of an EPR system has improved the efficiency of the working processes of medical staff, and that the quality of treatment decisions and diagnosis decisions have improved. Eight out of ten did not agree that medical errors have been reduced. Almost two-thirds of respondents felt that the amount of waste linked to unnecessary repetition of examinations has also not diminished.

Yet it is important to highlight that approximately one in four Medical Directors felt that the quality of treatment decisions has improved, and a similar proportion agreed that the quality of diagnosis decisions has improved. Just under one-third of respondents also felt the amount of waste linked to unnecessary repetition of examinations has diminished.

The other, more mixed, aspect of the responses offered by Medical Directors might point to a variety of other possible explanations. For instance it is possible that the EPR systems which are in place are not yet sufficiently sophisticated so as to account for possible impacts that would be expected in a clinical transformation; secondly, they might not yet be sufficiently interoperable so as to obtain impact benefits across the hospital; and, thirdly, they have not yet been in place long enough. It is also possible that they do not have precise figures with regard to the work organisation, workflows, or procedures in their hospitals.

#### 4.3.3 Barriers encountered during the implementation of the EPR system

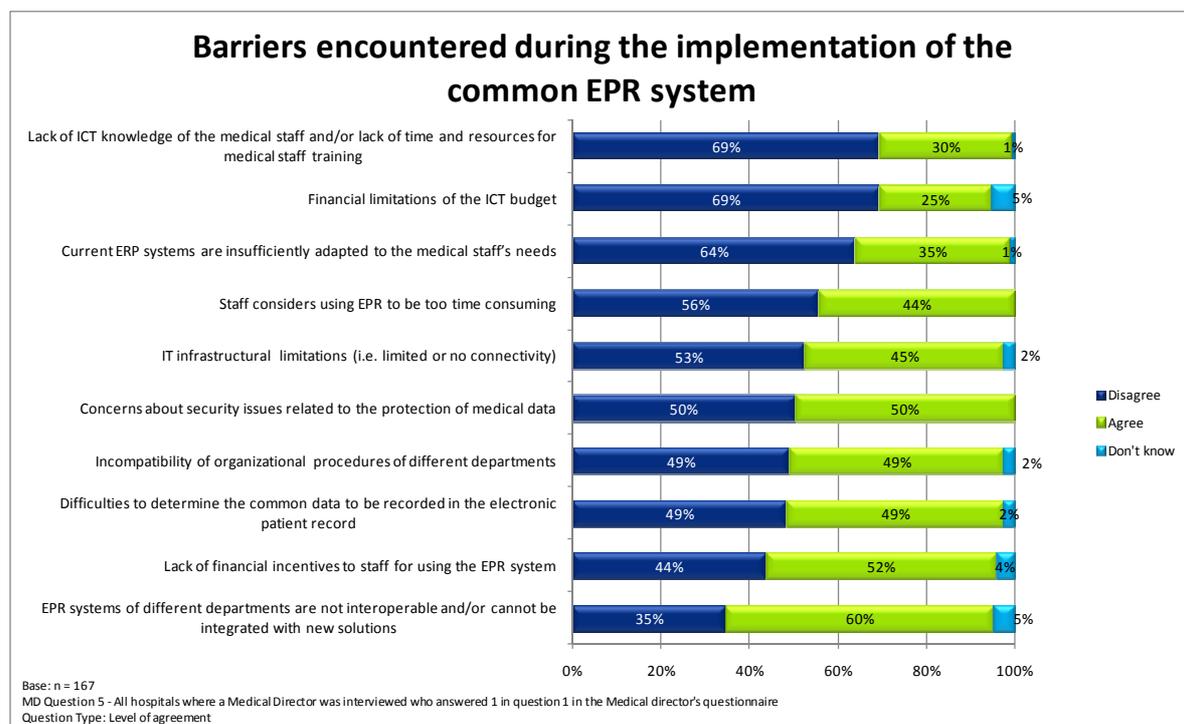
Medical Directors who are in hospitals with EPR systems in place which are common to most of their departments were provided with a list of possible barriers that could have been encountered during the implementation. They were asked to what extent they agreed that they had encountered these barriers during implementation of the system.

Medical Directors found that the main barrier encountered during implementation to be that EPR systems in their departments were not interoperable and/or could not be integrated with new solutions (as Figure 59 shows). This is also an statement that have been provided by the CIOs question, since many had encountered different types of interoperability problems (at technical, semantic and organisational levels).

Secondly, just over half of Medical Director respondents agreed that a lack of financial incentives for staff to use the system is another barrier encountered. It is feasible that these responses were given principally by Medical Directors in hospitals where the clinicians are not directly salaried, but rather work as independent consultants. It could be expected that there would be a range of types of replies according to the specific employment models operating in specific countries and, hence, in particular countries. Recent studies tend to indicate diversity of responses to organisational change and technological innovation, depending on the kind of financial and salary structure operating in relation to the introduction of integrated care in Denmark (such as work by Strandberg-Larsen and Krasnik 2008).

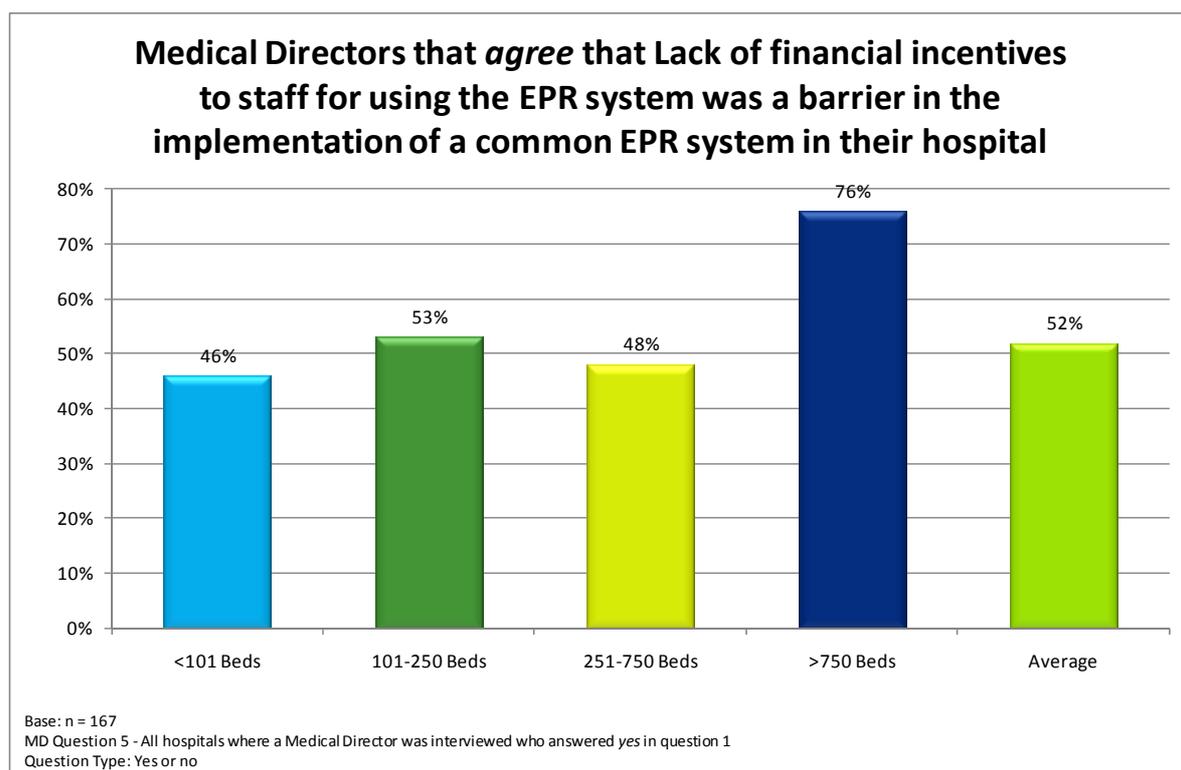
There were mixed reactions on the part of the Medical Directors with regard to some of the possible barriers listed. Equal proportions of Medical Director respondents agreed or disagreed that they had encountered these barriers during implementation. Their responses included experiencing concerns about security issues related to the protection of medical data, the difficulties in determining the common data set to be recorded in the EPR, and the incompatibility of organisational procedures in different departments.

Figure 59 – Possible barriers encountered during the implementation of the common EPR system in hospitals



Approximately half the respondents agreed that a lack of financial incentives to staff for using the EPR systems was a barrier during the implementation of the system. However, as shown in Figure 60 below, this barrier was significantly higher in larger hospitals, where over three-quarters of the respondents from hospitals with more than 750 beds agreed that it was problematic.

*Figure 60 - Medical Directors that agree that lack of financial incentives to staff for using the EPR system was a barrier in the implementation of a common EPR system in their hospital*

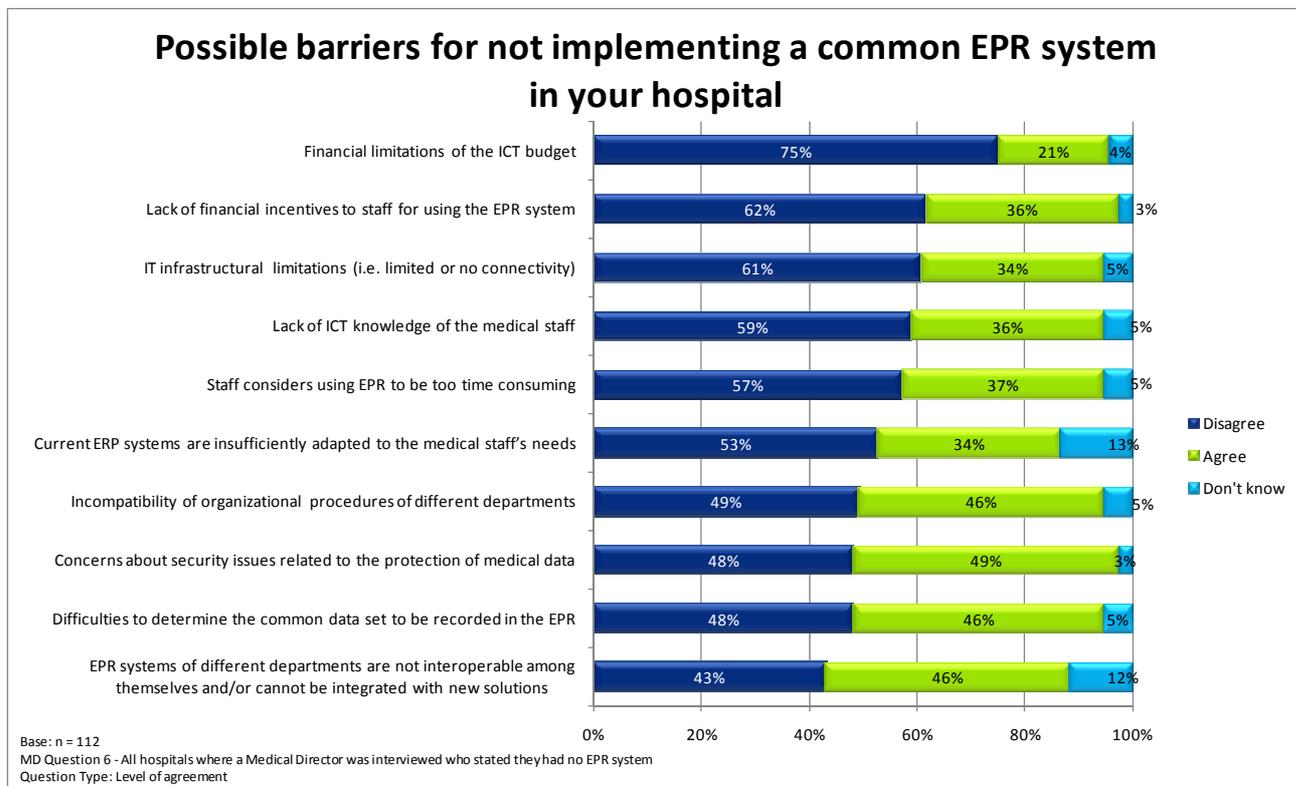


On average, just over half the Medical Director respondents did not find that a lack of incentives to the personnel in hospitals was a barrier to EPR systems' deployment.

#### 4.3.4 Possible barriers to not implementing a common EPR system in hospitals

Those Medical Directors in hospitals which had not implemented a common EPR system were asked about possible barriers for not having implemented them yet. They were asked to what extent they agreed with the reasons listed for not having implemented a common EPR system in their hospital.

Figure 61 – Possible barriers for not implementing common EPR systems in hospitals



There were only two barriers where the proportion of respondents who agreed that the barrier to implementing a system was greater than those who disagreed. These were having:

- Concerns about security issues related to the protection of medical data,
- EPR systems of different departments that are not interoperable among themselves and/or cannot be integrated with new solutions.

However, the differences between those Medical Directors who agreed and those who disagreed was only marginal: 48% of respondents disagreed that the barriers were security issues relating to the protection of medical data; and 43% of respondents disagreed that this was the case with EPR systems of different departments being interoperable among themselves and/or could not be integrated with new solutions.

It is interesting that the highest proportion of respondents indicated the barrier of having EPR systems of different departments that are not interoperable among themselves and/or that cannot be integrated with new solutions. Similarly, this was also the main barrier

during implementation that was reported by the Medical Directors who had implemented an EPR system.

There were two other barriers where approximately equal proportions of respondents agreed and disagreed that these posed difficulties to implementing a common EPR system in their hospital. These two barriers were: first, the incompatibility of organisational procedures of different departments and, second, the difficulties determining the common data set to be recorded in the EPR. The same mixed reactions were shown in the responses to these barriers among Medical Directors who had implemented a common EPR system.

The factors considered as lowest barriers for not having implemented common EPR systems were: financial limitations of the ICT budget, IT infrastructural limitations, and a lack of financial incentives to staff for using the EPR system.

#### 4.4 Chronic disease management programmes and telemonitoring

This section presents the data about the question posed to Medical Directors on chronic disease management programmes and telemonitoring to obtain their views about key barriers and impacts observed to these services.

##### 4.4.1 Availability of programmes including telemonitoring services

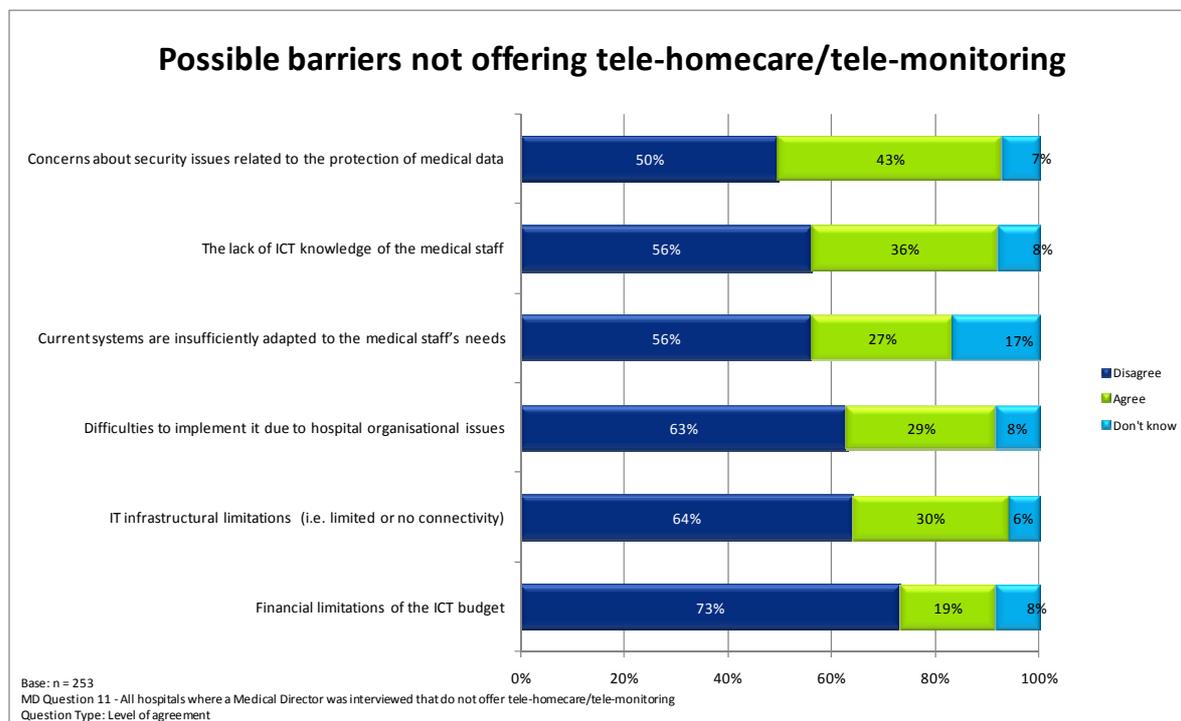
As was also the case in the CIO questionnaire analysis, the first aspect that is clear is that telemonitoring and online chronic disease management programmes are not common in hospitals. Nine out of ten Medical Directors do not run electronic/online chronic disease management programmes for outpatients. Under half the respondents who ran electronic/online chronic disease management programmes for outpatients at home from their hospitals stated that their hospital offered telemonitoring services to outpatients at home.

Among the hospitals that run electronic/online chronic disease management programmes for outpatients at home and provide telemonitoring services to outpatients at home, the majority of these services were offered to patients with COPD. It is important to note as a caveat, however, that this finding is based on a small base size of respondents (n=23).

##### 4.4.2 Possible barriers for not offering telemonitoring

Medical Directors whose hospitals did not use telemonitoring were asked to what extent they agreed with a list of barriers for not offering telemonitoring in their hospital.

Figure 62 – Possible barriers for not offering telemonitoring



For each barrier mentioned, a higher proportion of Medical Directors disagreed than agreed that the barrier was a reason for their hospitals not offering telemonitoring. This indicates that it is possible there were other barriers (not provided in the list) which may have a greater effect on their hospital's decision not to offer telemonitoring. Hence, further investigation of this field is necessary, perhaps involving qualitative, information interviews.

Of the barriers that were mentioned, the highest proportion of Medical Director respondents stated that concerns about security issues relating to the protection of medical data were a barrier. However, even in this case, a higher proportion of respondents said that this was not a barrier to their hospitals implementing telemonitoring.

Three-quarters of the Medical Directors felt that financial limitations of the ICT budget were not reasons for their hospital not offering telemonitoring.

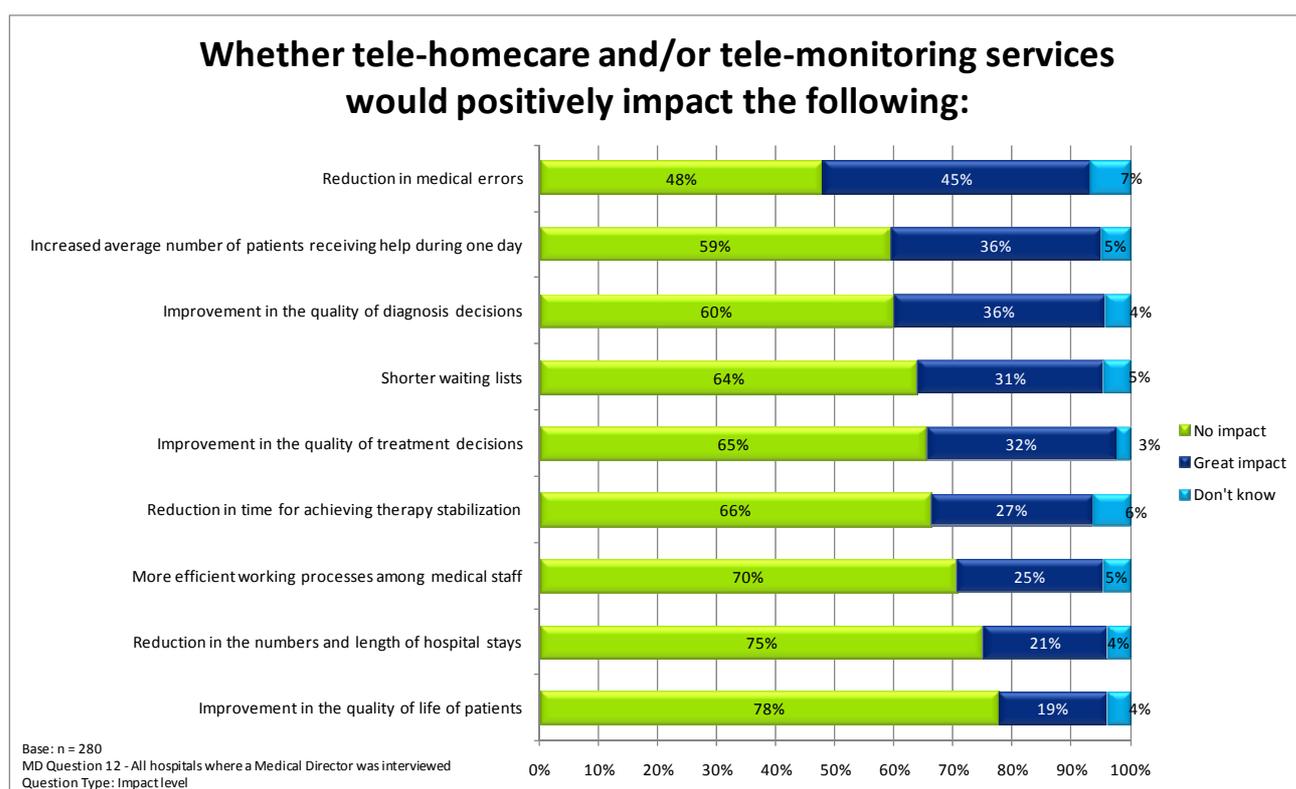
#### 4.4.3 Possible impact of telemonitoring

Medical Directors were asked to what extent tele-homecare and/or telemonitoring services would impact positively on several services offered by their hospital. If their hospital offered the service, they were asked to comment according to the experience in

their hospital. If the hospital did not offer the service, they were asked for their general opinion as a Medical Director.

As telemonitoring was only offered as a service in the hospitals of eight per cent of Medical Director respondents. It is therefore important to highlight the limited number of responses, and the way in which this impacts on the interpretation of this question.

Figure 63 – To what extent tele-homecare and/or telemonitoring would positively impact services



As Figure 63 shows, the main area where a reasonably high proportion of respondents felt that telemonitoring would have an impact is in the reduction of medical errors (45%). However – even for this service – a slightly higher proportion of respondents disagreed than agreed that it would have an impact (48%). Notwithstanding these findings, 36% of respondents felt that telemonitoring would have an impact on the improvement in the quality of diagnosis, and the same percentage of respondents felt it would increase the average number of patients who could receive help during a single day.

Thus, it would appear that the majority of Medical Director respondents felt that telemonitoring would have little positive impact on many of the services listed. The highest proportion of respondents disagreed that it would improve the quality of life of

patients (78%); it would result in a reduction in the number and length of hospital stays (75%); and/or it would result in more efficient working processes among medical staff (70%).

With regard to the list of barriers provided with relation to telemonitoring implementation, most Medical Directors disagreed that these were the reasons why telemonitoring had not been implemented in their hospital.

Several reasons for hospitals not implementing telemonitoring are plausible. This could be due largely to the perception that it is likely to have little impact on services. Thus, although there may appear to be no barriers to telemonitoring, there may be no or little incentive to introduce it. Given that the hospitals where these Medical Directors are located are acute hospitals rather than hospitals which deal with prolonged care or chronic diseases; this may provide an explanation for the Medical Directors' perceptions. Indeed, the Medical Directors may see little direct implication of telemonitoring for the work of the clinicians and nurses. Last but not least, perverse incentives may apply, which cause the Medical Directors and clinicians to concentrate in the main on what happens to the patient when he or she is inside the hospital rather than how treatment would either accelerate their release back to the external (or home) environment or, equally well, prevent them from actually entering the hospital in the first place.

#### **Some key messages from the European Medical Directors' survey**

The component of the survey which targeted hospital Medical Directors has shown their perceptions and attitudes towards eHealth, in particular vis-à-vis EPR systems and telemonitoring.

EPR systems remain a top priority for investment in those hospitals where there is still not a common central system that shares information. On the other hand, according to the Medical Directors, telemonitoring, despite being used in only 8% of hospitals, is the lowest priority for investment over the next three years.

The Medical Directors' results also indicate that the benefits of EPR systems are concentrated around efficiency. As a result of their introduction, the numbers of patient admissions per day are perceived to have increased, and waiting lists are judged to have been reduced. However, there is little evidence that the quality of the treatment of patients has been improved due to EPR systems. It is potentially of concern that the quality of care

has not yet been impacted positively as a result of these developments. According to the Medical Directors, this situation might be due to prevailing interoperability problems. The Medical Director respondents identified interoperability between different departments' EPR systems as the largest barrier to their implementation. This was followed by the lack of financial incentives for the staff to use these systems, a barrier that is more evident in large hospitals. Future studies or surveys might wish to explore in more depth the implications of reimbursement mechanisms.

No clear barriers or impacts were identified concerning the adoption of telemonitoring. However, the low rate of implementation might be explained by the Medical Directors' lack of perception that – in their hospitals – telemonitoring will lead to improvements in care if implemented. However, important factors to explore in the future would be those potential barriers associated with security and/or privacy issues, knowledge of ICT, and the degree of perceived change on organisational systems, work systems and reimbursement mechanisms.

As a result of these rather ambiguous findings, it would be particularly appropriate to undertake a) interviews with Medical Directors, clinicians and other healthcare professionals, b) a qualitative study with regard to their potential use of telemedicine and telemonitoring, and to consider c) conducting a survey that would concentrate on these issues specifically.

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## 5 Best practices – The acute hospital eHealth profile

A number of best practices were identified during the analysis of the survey data. These practices are discussed in this chapter. The chapter is divided into three main parts:

- *An explanation of the acute hospital eHealth profile.* First, the methodology of this eHealth profile is presented.
- *The acute hospital eHealth profile by country:* Second, a scoreboard method is applied to the 30 countries that participated in the survey. A profile index is used to assess how well the countries' acute hospitals are doing in terms of a number of advanced indicators. The status of the individual countries is illustrated using 30 spider diagrams<sup>40</sup>.
- *eHealth best practice according to hospital type:* The third section of this chapter presents a more in-depth exploration of a number of hospital types which have proven to be more advanced in terms of eHealth take-up and deployment. Four types of hospitals are discussed: large hospitals, public hospitals, university hospitals and hospitals that belong to regional networks. For each type of hospital, the profile results are displayed as well as a number of additional key indicators where these hospitals outperform other hospital types.

### 5.1 Acute hospital eHealth profile

The most advanced hospitals in the eHealth Benchmarking III survey have been explored in relation to their level of eHealth adoption. A profile (or index) has been built that uses 13 eHealth indicators that were selected from the total number of indicators available in the CIO survey<sup>41</sup>. The indicators are illustrated through the use of spider diagrams.

The four sets of indicators used are intended to reflect a set of issues that are at the forefront of European policy in relation to eHealth, and very important for it. They are

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<sup>40</sup> Spider diagrams are a graphical means of displaying multi-variate data. A range of quantitative variables are displayed on axes which emerge from the centre of the diagram. Many alternative expressions are used for the same technique. These include, but are not limited to: cobweb, polar, and star diagrams.

<sup>41</sup> Scoreboards originated in the domain of sports and games. They initially identified the score between the various teams or players. Today, most are electronic. The terms of scoreboard or dashboard have increasingly been adopted in organisational and technical domains where they imply the capacity to measure, monitor or score progress in specific fields.

those factors which are considered to be key in getting ahead in terms of the way that eHealth can support better health for European citizens, and are being taken on board in hospitals. They provide strong indicators of hospitals' eHealth uptake, and present a range of factors against which hospitals can be perceived to be more advanced in terms of ICT deployment and take-up. More detail on each indicator is included in section 5.1.1.

#### 5.1.1 Categorisation of the 13 indicators into four sets

The 13 indicators have been classified into four sets. Clearly, this restricted selection of indicators does not reflect the wide variety of indicators covered by the whole survey<sup>42</sup>.

These indicators identify the best practices in European acute hospitals in terms of eHealth in four areas: *infrastructure, applications, integration and data security*. The detail which underpins the selection of each of these four sets of indicators is explained below.

1. *Infrastructure*: In the CIO questionnaire module, there were nine indicators which tracked the type of infrastructure. For the acute hospital eHealth profile index, the study team has selected three indicators which are more relevant from a policy perspective and for identifying movement towards "ubiquitous hospitals"<sup>43</sup>.

- Externally connected: This indicator is important to enable hospitals to have access to the infrastructure outside the hospital-specific site. It was selected because inter-connectivity between healthcare providers is essential in ensuring a high-level of healthcare service to the general public. Thus, it is a strong indicator of eHealth uptake.
- Single wireless communications: More sophisticated ICT-using hospitals are characterised by the fact that they allow wireless communication access to different applications and services throughout the hospital departments and wards or rooms. Since wireless connectivity enables the equipment that

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<sup>42</sup> This data analysis avoids any duplication with the parallel data analysis which has been performed by the EC's Joint Research Centre (JRC), the Institute for Prospective Technology Studies (IPTS). The institute has undertaken a more comprehensive ICT compound analysis of the survey dataset. It has applied multivariate factor and cluster analysis to the survey's overall results. As a result of this analysis, it has identified a number of robust dimensions and clusters.

<http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=4179>

<sup>43</sup> The three terms of hospital of the future, virtual hospital and ubiquitous hospital are often used synonymously. They imply functions that locations other than hospitals (including the home) are places where functions which previously only took place in the hospital now occur.

is connected to be mobile and to be used more efficiently, this indicator indicates the profile of the hospital.

- High-speed next generation broadband: Next generation networks are a key policy priority within the EC Digital Agenda for Europe. In the case of acute hospitals, these networks will be needed as the hospitals are processing increasing numbers of digital images and telemonitoring services. There are already over 92% of European acute hospitals connected to broadband, but they mainly have speeds which are below 50Mbps.

2. *Applications:* For this part of the index, the study team has considered the important medical applications that hospitals have in place that are integrated in their system, and which are needed for their clinical digital transformation. They include:

- A common, single EPR system,
- PACS,
- eReferral,
- ePrescription,
- Telemonitoring of outpatients.

All these application areas remain very important in terms of the EU eHealth current and future agendas. They have been included in the actions laid out in EC Communications such as COM(2004)356 final; COM(2008)689 final; and the LMI's eHealth Taskforce Report (European Communities 2007); they have received considerable attention by Member States; and they have in the main been explored and applied in the various large-scale and smaller-scale pilot actions. Their inclusion in these pilots indicates the degree of their implementation by the Member States, since this is necessary a prerequisite for involvement in any CIP ICT PSP proposal.

3. *Integration:* This dimension of the index includes the connectivity of the hospital with providers outside its own site, with other hospitals and healthcare levels. *Extramural* activities are incorporated. The level of intra-organisational integration is considered to be an important factor. It can enable future healthcare IT-based systems to provide a better and more efficient service to the public. Some systems

currently offered on the market require a specific minimum level of integration to work effectively when they are externally connected. Therefore, the indicators included in this part of the index are based on the degree of exchange of:

- Clinical care information with external providers,
- Laboratory results with external providers,
- Radiology reports with external providers.

These are all indicators which have core importance for the clinical work of health professionals or medical staff, are key in terms of the health of the citizens of Europe, are closely related to the interoperability of eHealth applications and can also be included within the broad domain of telemedicine.

4. *Security*: Having a strategy for data security and resilience of the IT system is an important element for an advanced hospital. Advanced hospitals should be able to restore their critical information within a short time-length, and will possess clear rules on how to handle patients' data. This component of the index includes two indicators:

- Whether the hospitals are able to restore clinical information facilities in less than 24 hours,
- Whether the hospitals have a clear strategy on the handling of data.

These indicators are obviously important as restoring clinical data is essential to providing the best possible healthcare service and it is potentially life-saving. The handling of data is also essential as all health data are sensitive and must be handled correctly. These indicators fit well with the EC's concern to ensure high levels of patient safety, and solid levels of compliance with data protection regulation. These indicators are likely to be of keen concern to health professionals and medical staff; reflect the robustness of the hospitals that provide the services; and, in addition, guarantee day-by-day, hour-by-hour assurance of treatment for patients. Ensuring these kinds of degrees of continuity of performance would reflect in an effective manner the degree of trust that health professionals and patients might have in the systems, services, and institutions that are providing Europe's populations with healthcare.

## 5.2 Acute hospital eHealth profile by country

The entire profile of 13 indicators is presented in two series of spider diagrams. This sub-section contains the first series: it compares the EU+ average against each of the 30 European countries. The second series illustrates four types of best practice hospitals (large hospitals with over 750 beds, public hospitals, university hospitals and hospitals that are a part of a regional or national network). It is presented in section 5.3.

In this sub-section, wherever feasible, contextual observations are made which relate either to the eHealth strategy of the Member State or country or to the use of ICT in the country's hospitals (Commission of the European Communities, 2007). Information has been extracted from a 2007 study which surveyed EU Member States', and other European countries', eHealth priorities and strategies. A similar survey, entitled *eHealth strategies*, has been undertaken in 2009–2010<sup>44</sup> and is expected to deliver its findings publically in spring 2011. A validation workshop for that study was organised on September 16, 2010. Equally comprehensive studies that concentrate on eHealth development in countries (rather than specific to certain health sectors) (Currie 2010).

### 5.2.1 How to read the spider diagrams

In each of the spider diagrams which follow, the red line represents the average uptake across all the indicators for the hospitals surveyed in the specific country. The dotted blue line indicates the uptake for each indicator across the entirety of the EU + 3. This line is repeated on each of the diagrams so as to provide a standard basis for comparison.

Each of the 13 indicators used to define the acute hospital eHealth profile has been converted to represent a range of 0 to 5. While nought (or 0) corresponds to a response rate of 0%, the figure 5 corresponds to a response rate of 100%.

The questions that were used for the 13 indicators are shown Table 2.

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<sup>44</sup> eHealth strategies. Accessed February 16, 2011 <http://www.ehealth-strategies.eu/news/new.html>

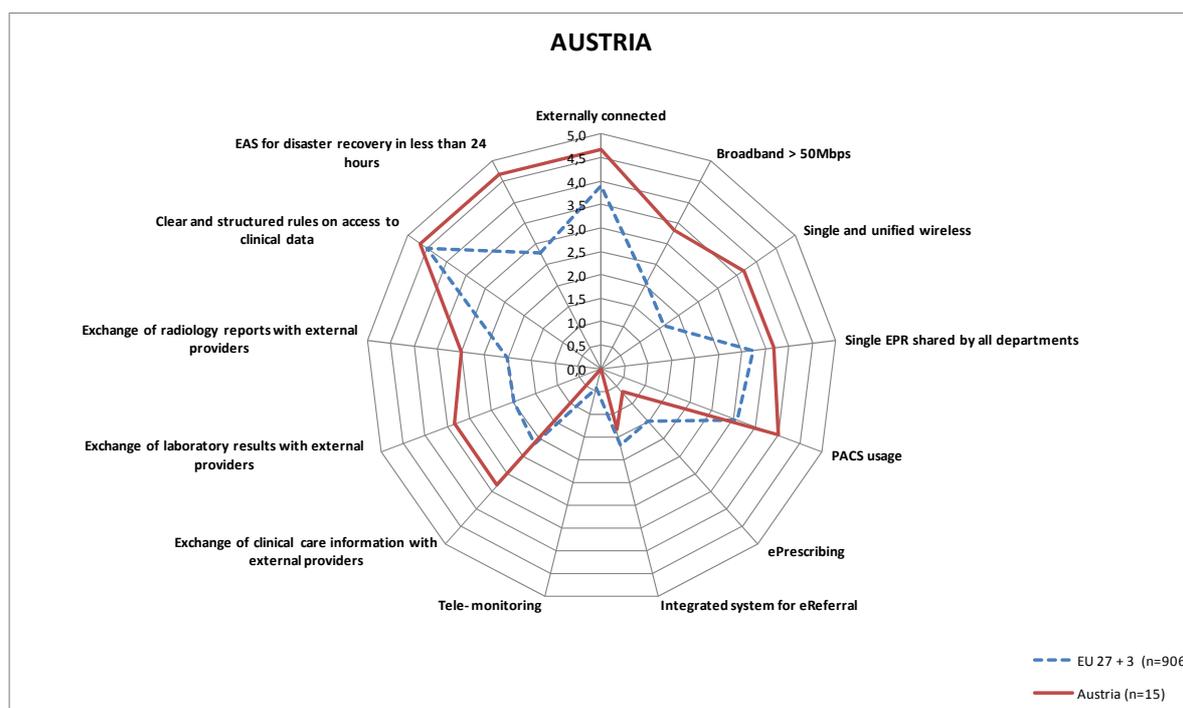
Table 2 – Source questions for the eHealth profile indicators

INDICATOR	SOURCE
Externally connected	Question 8 answer 1 and 2
Broadband > 50Mbps	Question 10 answer 3 and 4
Single and unified wireless	Question 11 answer 1
Single EPR shared by all departments	Question 16 answer 1
PACS usage	Question 20 answer 1
ePrescribing	Question 23 answer 5
Integrated system for eReferral	Question 23 answer 2
Tele-monitoring	Question 30 answer 1
Exchange of clinical care information with external providers	Question 34 minus none and don't know
Exchange of laboratory results with external providers	Question 35 minus none and don't know
Exchange of radiology reports with external providers	Question 37 minus none and don't know
Clear and structured rules on access to clinical data	Question 41 answer 1
EAS for disaster recovery in less than 24 hours	Question 46 answer 1 and 2

### 5.2.2 Austria's acute hospital eHealth profile

Figure 64 shows Austria's acute hospital eHealth profile in comparison with the EU+ average.

Figure 64 – Austria's acute hospital eHealth profile



This spider diagram shows that Austria's acute hospitals' have an eHealth profile which is more mature than the EU+ average on all of the indicators except for three. These three are: ePrescribing, an integrated system for eReferral, and telemonitoring. As an observation, an extension of Austria's eMedication system to an ePrescription system, and telemonitoring use in care and in rural, isolated communities, are expected to take place (Commission of the European Communities 2007, p19).

On the high-speed broadband indicator, Austria is well above the EU+ average. However, as shown in Figure 4, 7% of Austria's hospitals also have narrowband Internet connection which is also over the EU+ average. Furthermore, in terms of its hospitals, Austria is also much more mature than the average EU+ country with respect to a single unified wireless infrastructure. Austrian acute hospitals are also much more mature on the indicator that

relates to EAS for disaster recovery in less than 24 hours. These findings reflect Austria's leadership in the fields of security, infrastructure and standards<sup>45</sup>.

A 2007 survey of all acute care hospitals was undertaken in both Austria and Germany (Hübner et al, 2009; Hübner et al, 2010). The survey's focus was particularly on nursing IT systems or what could be more generally-defined as clinical IT systems. Austrian hospitals replied in larger numbers than did German hospitals. The authors concluded that a generally wider use of clinical IT in Austria was due to what were described as 'rigorous organisational changes, legal constraints and a general IT-friendly climate' (Hübner et al. 2009) and also 'good infrastructure of medical-technical devices, rigorous organisational changes which had led to leaner processes and to a lower length of stay' (Hübner et al. 2010). They queried whether hospitals in smaller countries, such as Austria, are "more ready to translate innovation into practice" (Hübner et al. 2010). If this is so, they propose that larger countries would be better advised to handle ICT adoption at a smaller or regional level.

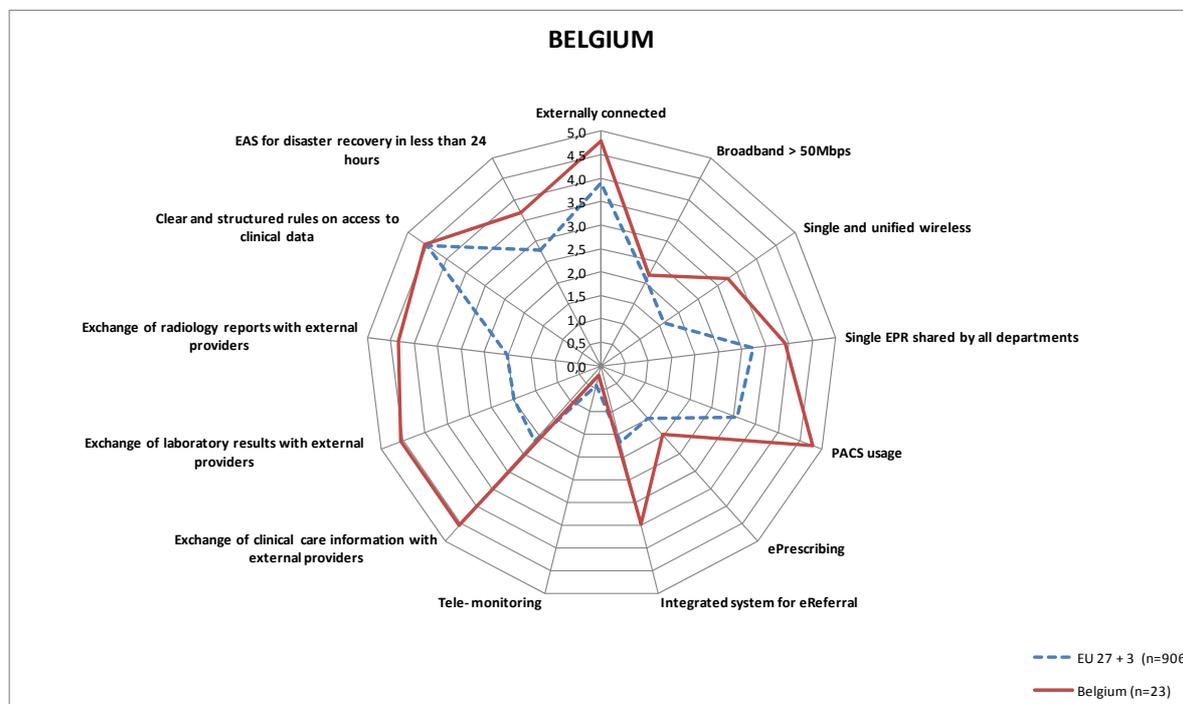
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<sup>45</sup> eHealth strategies. Accessed February 16, 2011 <http://www.ehealth-strategies.eu/news/new.html>

### 5.2.3 Belgium's acute hospital eHealth profile

Figure 65 shows Belgium's acute hospital eHealth profile compared with the EU+ average.

Figure 65 – Belgium's acute hospital eHealth profile



This figure shows that Belgium's hospital-based eHealth is more mature than the EU+ average on all indicators except for telemonitoring. Belgium is slightly above the EU+ average for high-speed broadband. The three indicators where Belgium's acute hospital eHealth profile is most advanced, when compared to the EU+ average, are those which relate to sharing data with external providers.

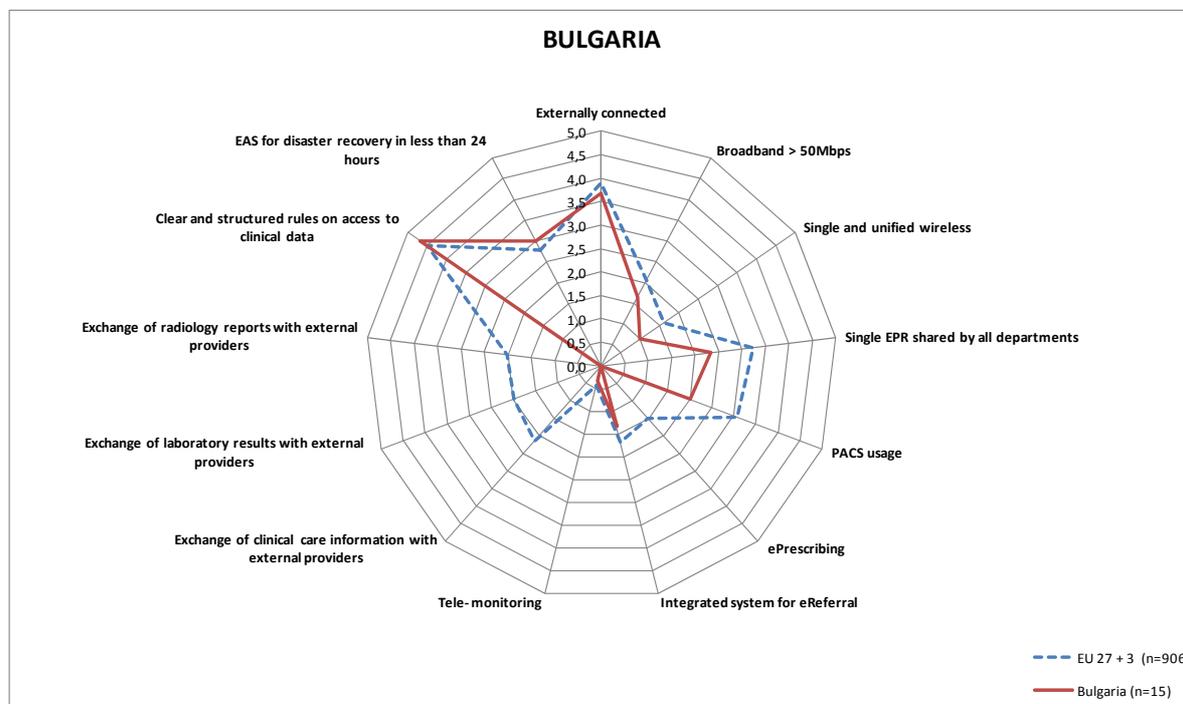
Belgium and its regions have a longstanding profile in terms of eHealth development and implementation. A Health Telematics law in Belgium has been under discussion since 2005, and the country's legal environment could be expected to be strengthened by a new law on telemedicine. It is possible that the advances seen in the country's acute hospitals could be attributed to organisational commitments as the country's incentivisation programmes (Commission of the European Communities 2007, p21):

Belgian hospitals ... depend for part of their funding on the delivery of anonymised minimal electronic data sets related to hospitalisation description, including diagnosis and procedures. This provides a powerful incentive to implementation of an integrated electronic hospital medical record which are then adapted to include patient-centred functionalities and information.

## 5.2.4 Bulgaria's acute hospital eHealth profile

Figure 66 shows Bulgaria's acute hospital eHealth profile compared with the EU+ average.

Figure 66 – Bulgaria's acute hospital eHealth profile



This spider diagram shows that Bulgaria's acute hospital eHealth profile is below EU+ average except with respect to two indicators: these are the clear and structured rules on access to clinical data, and EAS for disaster recovery in less than 24 hours, which are both just above average. There are, however, four indicators that are only just below the EU+ average. These are: external connectivity, high-speed broadband, an integrated system for eReferral, and telemonitoring. On the broadband indicator, Figure 4 shows that 27% of Bulgarian hospitals have narrowband Internet connections, 20% have broadband under 50MBps, 13% have broadband between 50 and 100MBps, 20% have Internet connection speeds of over 100MBps, and 20% do not know.

In 2007, prior to Bulgaria's entry into the EU, the difficulties that face the Bulgarian health system were already well noted, and it was observed that (Ibid., p23):

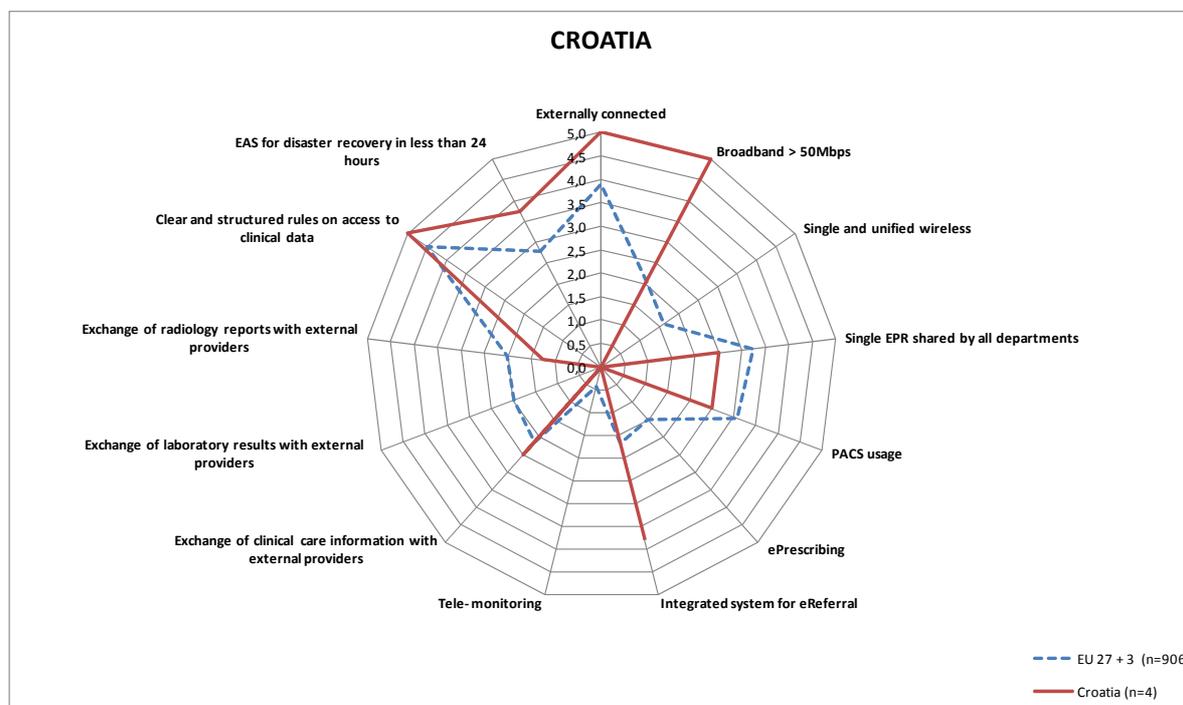
[c]urrently only a fraction of the medical service providers (some physicians, hospitals and private medical centres), some producers and distributors (of medications, medical materials and medical devices), and some pharmacies use special software.

The Bulgarian eHealth action plan has therefore planned, as one of its activities, to place an emphasis on the introduction to the country's hospitals of hospital information systems (ibid., p24).

### 5.2.5 Croatia's acute hospital eHealth profile

Figure 67 shows Croatia's acute hospital eHealth profile in comparison with the EU+ average.

Figure 67 – Croatia's acute hospital eHealth profile



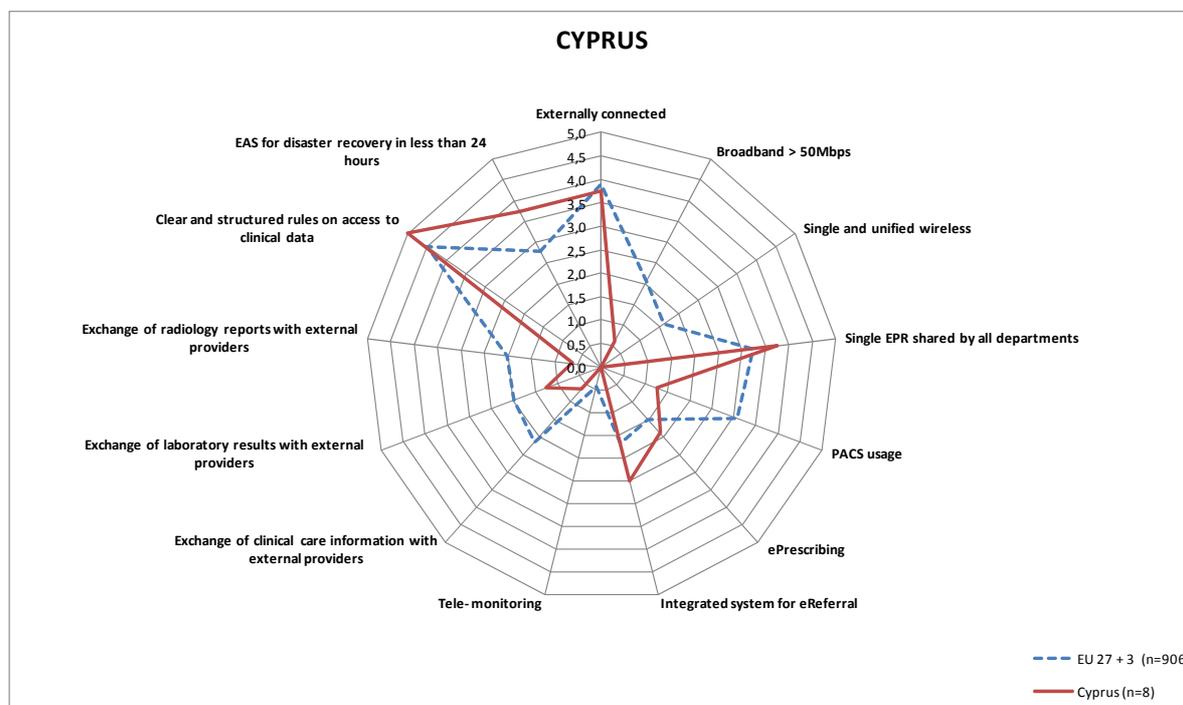
This figure shows that Croatia's acute hospital eHealth profile is higher than EU+ average on six indicators and below for the seven others. Croatia's eHealth uptake in hospitals is higher than the EU+ average for external connectivity as all the Croatian hospitals surveyed appear to be externally connected. Furthermore, they all have high-speed broadband connections. Croatia is also above the EU+ average profile for integrated systems for eReferral, exchange of clinical care information with external providers, clear and structured rules on access to clinical data, and EAS for disaster recovery in less than 24 hours<sup>46</sup>.

<sup>46</sup> Croatia was not included in either the 2007 eHealth ERA study or the 2009–2011 eHealth strategies study, accessed February 16, 2011. See <http://www.ehealth-strategies.eu/>.

### 5.2.6 Cyprus' acute hospital eHealth profile

Figure 68 shows Cyprus' acute hospital eHealth profile in comparison with the EU+ average.

Figure 68 – Cyprus' acute hospital eHealth profile



This spider diagram shows that the eHealth profile of Cypriot hospitals is higher than EU+ average for four indicators and below the EU+ average for the remaining indicators.

Cypriot hospitals are more mature in relation to several applications: a single EPR shared by all departments, integrated systems for eReferral, clear and structured rules on access to clinical data, and EAS for disaster recovery in less than 24 hours.

It is worth noting, for two of the indicators that are below; single and unified wireless and for tele-monitoring that these are not at all present in the hospitals that were surveyed.

By the mid-stage of the last decade, Cyprus's Ministry of Health decided to proceed with the implementation of a Health Care Information Support System in **all government hospitals**<sup>47</sup>, outpatient departments and rural health centres (Ibid., p26). In 2007, the tender contractual processes were "at their final stages and implementation [was]

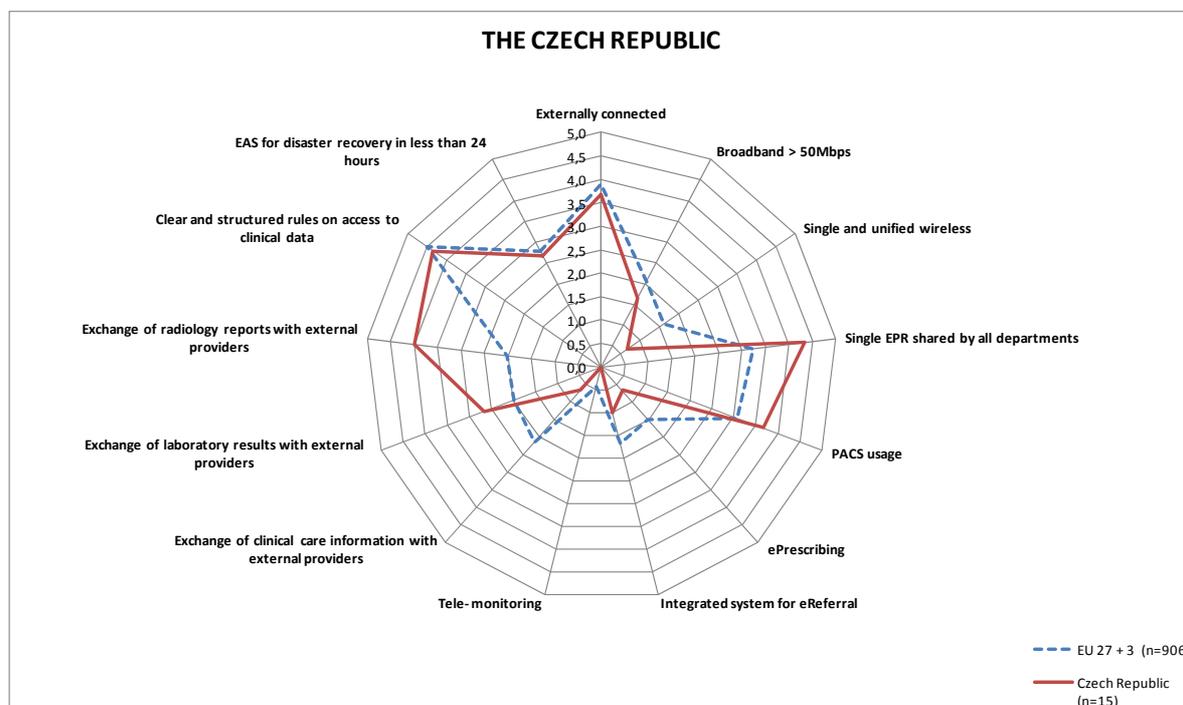
<sup>47</sup> emphasis added.

scheduled to begin with the computerisation of two flagship hospitals: the New Nicosia General Hospital and the Famagusta General Hospital." (Ibid., p27).

### 5.2.7 The Czech Republic's acute hospital eHealth profile

Figure 69 shows the Czech Republic's acute hospital eHealth profile in comparison with the EU+ average.

Figure 69 – The Czech Republic's acute hospital eHealth profile



This figure shows that the Czech Republic's acute hospital eHealth profile is higher than the EU+ average for four indicators. These are the single EPR shared by all departments, PACS usage, exchange of laboratory results with external providers, and the exchange of radiology reports with external providers. The Republic has long been identified as undertaking best practices in those fields which relate to its national plan eEurope+ Czech Republic. These were associated especially with reimbursement, health insurance, and connectivity: "Many activities supporting these objectives are currently underway. For instance, the electronic health record system was developed and provided by IZIP Inc. to insurees and health care institutions. It is currently the most visible eHealth-related activity in the Czech Republic." (Ibid., p27)

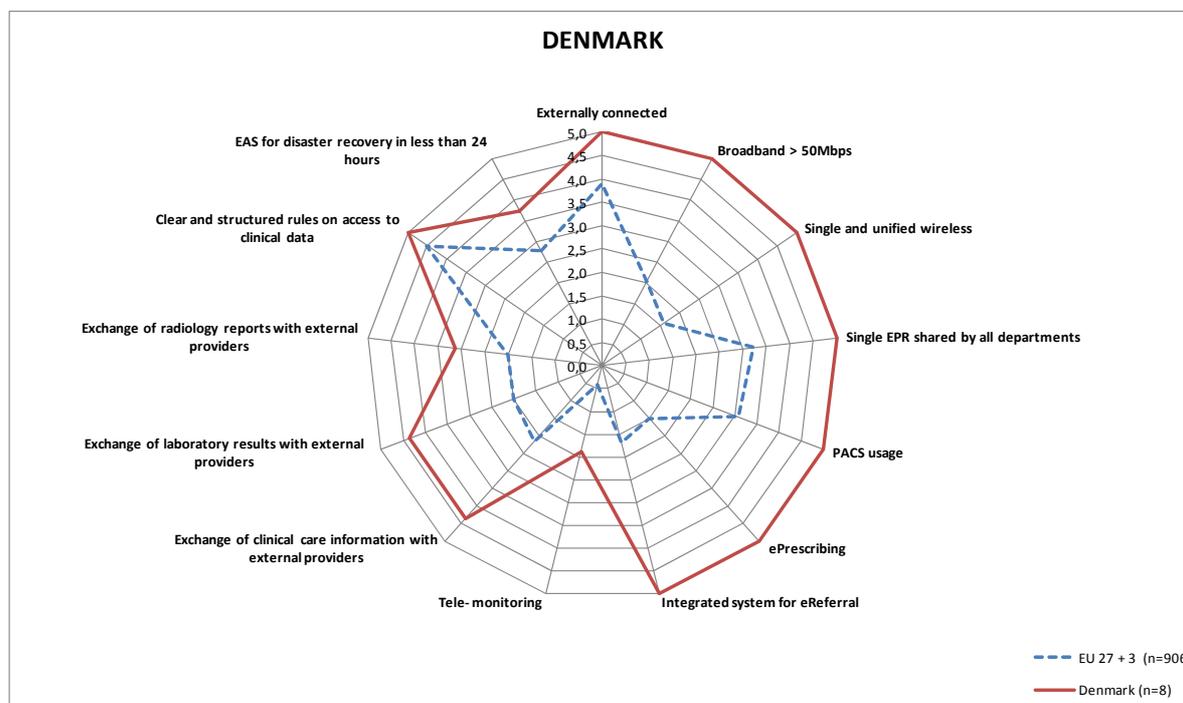
As Figure 4 shows, the Czech Republic is very close to the EU+ average on Internet connection type distribution. Single and unified wireless infrastructure, ePrescribing, integrated system for eReferral, and the exchange of clinical care information with

external providers, are significantly lower than the EU+ average. Telemonitoring is not at all available in the Czech Republic's acute hospitals.

### 5.2.8 Denmark's acute hospital eHealth profile

Figure 70 shows Denmark's acute hospital eHealth profile in comparison with the EU+ average.

Figure 70 – Denmark's acute hospital eHealth profile



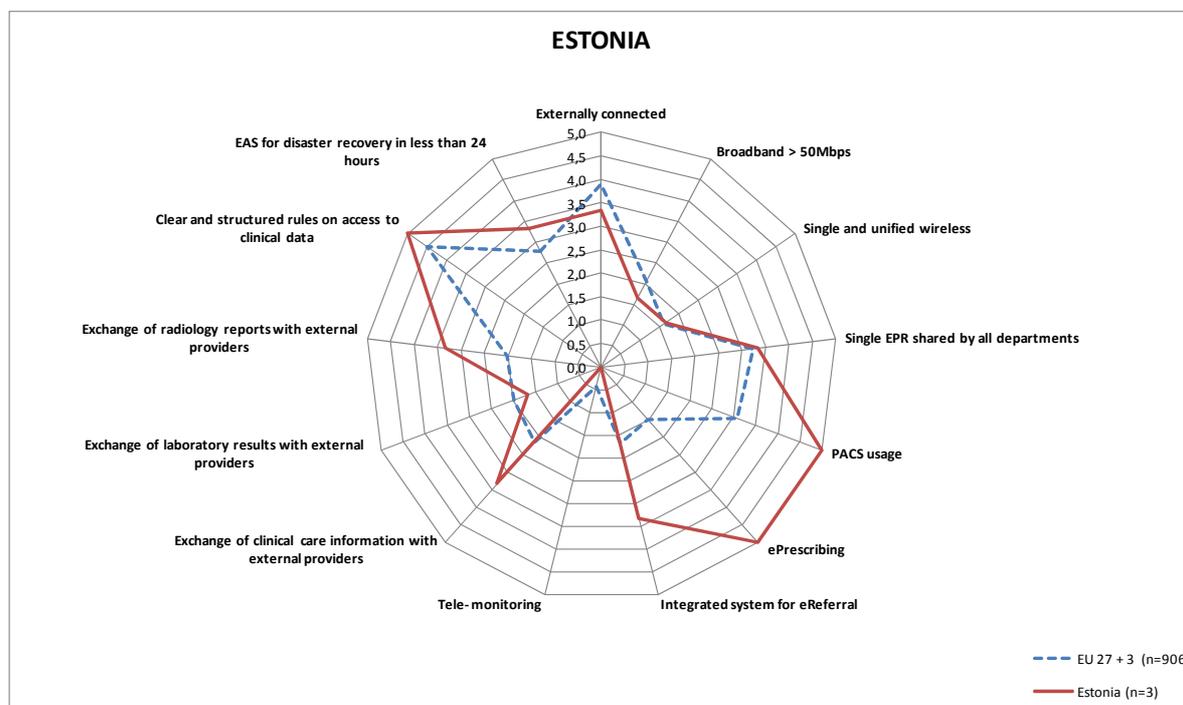
This spider diagram shows that Denmark's acute hospital eHealth profile is significantly higher than the EU+ average on all indicators. Furthermore, it shows that all the hospitals are: externally connected, all have single and unified wireless infrastructure, a single EPR shared by all departments, complete PACS usage, complete availability of ePrescribing, integrated systems for eReferral, and clear and structured rules on access to clinical data. On Internet connectivity, all Danish hospitals have broadband that is faster than 50Mbps, and 88% of them have broadband with speeds in excess of 100Mbps.

The country has long been a leader in terms of eHealth advances in many fields and has numerous interesting and innovative approaches to ICT use in hospitals as well as in fields like telemedicine. A first strategy for the development of EPR systems was launched in 1996, when decentralised, regional pilots identified the need for standards and common terminology. The National Strategy for Information Technology in Hospitals was published over a decade ago, in 1999, with the main objective of establishing electronic patients records as the core of IT systems in hospitals (Ibid., p29).

### 5.2.9 Estonia's acute hospital eHealth profile

Figure 71 shows Estonia's acute hospital eHealth profile in comparison with the EU+ average.

Figure 71 – Estonia's acute hospital eHealth profile



This spider diagram shows that Estonia's acute hospital eHealth profile is higher than the EU+ average on seven indicators. These are: Single and PACS usage, ePrescribing, an integrated system for eReferral, exchange of clinical care information with external providers, exchange of radiology reports with external providers, clear and structured rules on access to clinical data, and EAS for disaster recovery in less than 24 hours. Interestingly, all hospitals surveyed in Estonia have broadband: 67% have broadband with speeds under 50MBps and the remaining 33% have broadband with speeds above 100MBps. PACS usage, ePrescribing, and structured rules on access to clinical data, are available in all the Estonian hospitals in the survey. Estonia is close to the EU+ average on single and unified wireless infrastructure and a single EPR shared by all hospital departments. Estonia is below the EU+ average on the following three indicators: external connection, telemonitoring, and the exchange of laboratory results with external providers.

These achievements and ongoing challenges can be associated with the Estonian philosophy (Ibid., p33) that:

The realisation of the digital health record project requires not just implementation of advanced information technology across a deeply complex system. It is widely recognised that significant efforts will be required in re-organising existing organisational and service delivery structures and in establishing an innovation friendly ethos.

### 5.2.10 Finland's acute hospital eHealth profile

Figure 72 shows Finland's acute hospital eHealth profile in comparison with the EU+ average.

Figure 72 – Finland's acute hospital eHealth profile



This figure shows that Finland's acute hospital eHealth profile is higher than EU+ average on all indicators except two. These are: first, ePrescribing and, second, EAS disaster recovery in less than 24 hours, where Finnish acute hospitals are significantly below this average profile. Finland is far more mature than the EU+ average profile on all the indicators that are above EU+ profile. Four of these indicators show full availability in all the Finnish hospitals surveyed. The hospitals are all externally connected, they all use PACS, they all exchange laboratory results with external providers, and they all have clear and structured rules on access to clinical data. For broadband in Finland, Figure 4 shows that the country has broadband in all its hospitals and only 7% of the hospitals have broadband that is below 50 Mbps.

Finland has a longstanding history of strategy development and implementation of eHealth in relation to its health system. Indeed (Ibid., p34):

The Ministry of Social Affairs and Health established its first Strategy for the Utilisation of Information and Communication Technologies in Welfare and

Health in May 1996, as part of Information Society policies aimed at facilitating information transfer between organisations. ... [T]he strategy was built around the principle of citizen-centred, seamless service structures. Among the main targets were **the horizontal integration of services (social, primary and secondary care)**<sup>48</sup> and the development of shared, coordinated services delivered closer to home.

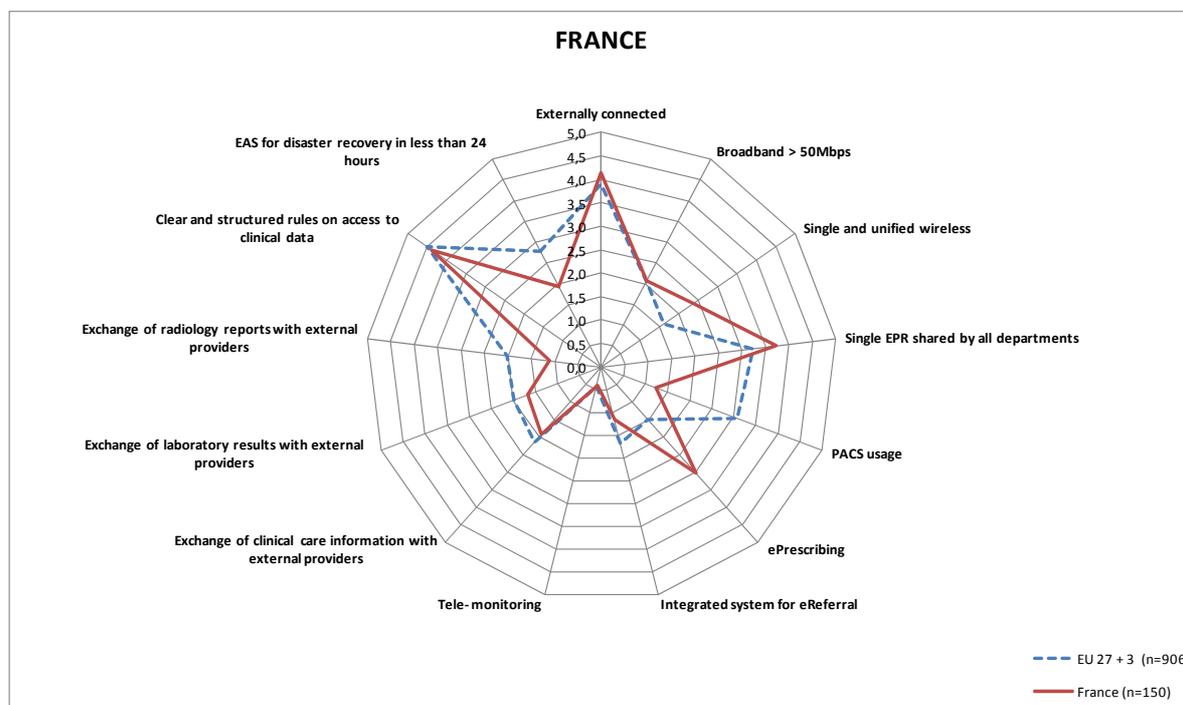
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<sup>48</sup> emphasis added.

### 5.2.11 France's acute hospital eHealth profile

Figure 73 shows France's acute hospital eHealth profile in comparison with the EU+ average.

Figure 73 – France's acute hospital eHealth profile



This figure shows that France's acute hospital eHealth profile is higher than EU+ average on four indicators: the level of external connectedness, single and unified wireless infrastructure, a single EPR shared by all departments, and ePrescribing. Furthermore, French acute hospitals are very close to the EU+ average on telemonitoring, clear and structured rules on access to clinical data, and high-speed broadband. France's distribution of Internet connection in these hospitals is very close to the EU+ average for hospitals (as Figure 4 shows). On integrated systems for eReferral, exchange of clinical care information, and exchange of laboratory results with external providers, France is only slightly behind the EU+ average. On three indicators, there is room for improvement in French acute hospitals to reach the EU+ average: PACS usage, exchange of radiology reports with external providers, and EAS for disaster recovery in less than 24 hours.

A June 2004 Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST) report, entitled New Information Technologies and Healthcare Systems, laid out a set of recommendations for French hospitals in terms of links with primary care providers,

eHealth funding, eHealth training and other issues. One of the five objectives of the ensuing comprehensive plan for the French hospital sector, Hôpital 2012, focuses on developing hospital information systems and is financed from France's regional budgets. The plan runs from 2007–2012. It replaced a previous plan, entitled Hôpital 2007 (Ibid., p37).

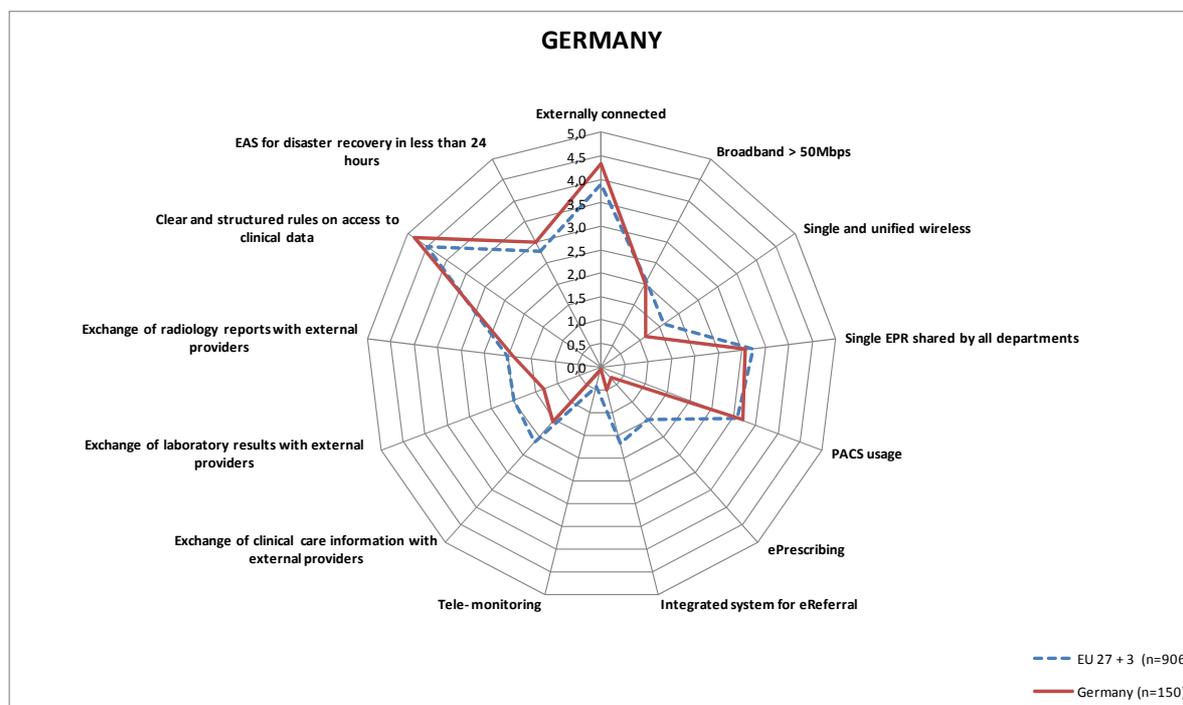
With possible implication for attempts to reach EAS recovery inside a 24-hour time-period, observations made by a member of the medical staff at the Georges Pompidou University Hospital at the Paris HIT Congress (May 2009) are insightful (CALLIOPE, 2009, p4):

An electrical failure could mean the end of my dreams as a doctor. ... For example, back in April 2007, the electricity failed at the Georges Pompidou Hospital. However, we managed to keep at least two computer systems going, those which were not integrated into the process-oriented architecture: the pharmaceutical system and the radiological system. As a result, continuity of care was maintained. This could be a good reason to keep [some] systems separate from other systems.

### 5.2.12 Germany's acute hospital eHealth profile

Figure 74 shows Germany's acute hospital eHealth profile in comparison with the EU+ average.

Figure 74 – Germany's acute hospital eHealth profile



This figure shows that Germany's acute hospital eHealth profile is higher than EU+ average on four indicators. These are the degree of: external connection, PACS usage, clear and structured rules on access on clinical data, and EAS disaster recovery in less than 24 hours. Germany's acute hospital eHealth profile is close to the EU+ average on the following three indicators: a single EPR shared by all departments, exchange of radiology reports with external providers, and high-speed broadband (where Figure 4 shows that the connection type distribution is very close to EU+ average). Germany is, however, still below the EU+ average on the following five indicators: single and unified wireless infrastructure, ePrescribing, telemonitoring, the exchange of clinical care information with external providers and the exchange of laboratory results with external providers.

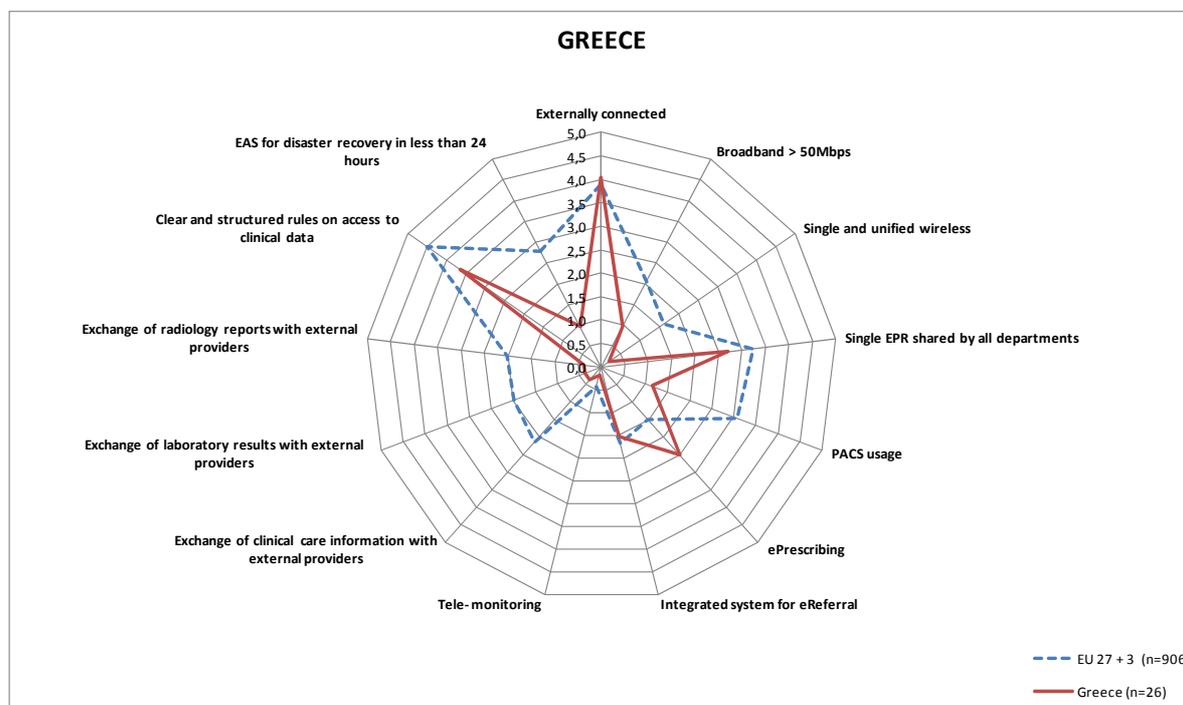
Germany's commitments in eHealth have been, and remain, the introduction and roll-out of an electronic health card ('Gesundheitskarte') (Ibid., pp40-41). The potential, nevertheless, for hospital re-structuring and re-organisation in countries such as Germany

was already clear in the early part of the last decade, and was commented on in the final report by e-Business W@tch (2006, p168).

### 5.2.13 Greece's acute hospital eHealth profile

Figure 75 shows Greece's acute hospital eHealth profile in comparison with the EU+ average.

Figure 75 – Greece's acute hospital eHealth profile



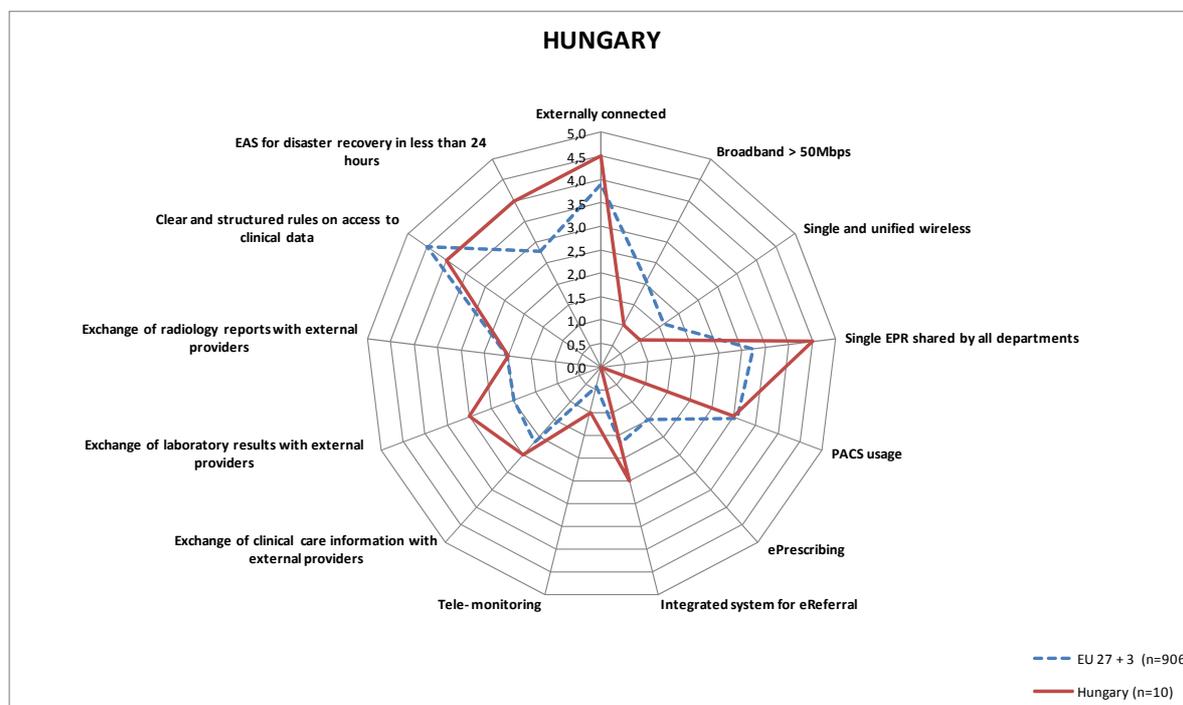
This figure indicates that Greece's acute hospital eHealth profile is higher than EU+ average on the following two indicators: external connectivity and ePrescribing. However, it is just under the EU+ average with regard to three applications: a single EPR shared by all departments, an integrated system for eReferral, and telemonitoring. On the remaining indicators, there is significant room for improvement in order to reach the EU+ average. Although there is very little high-speed broadband in the Greek acute hospitals surveyed – Figure 4 shows that there is a type of broadband available in all hospitals, although 81% of that is broadband below 50 Mbps.

Greece's national eHealth roadmap, was launched in 2006 by the Ministry of Health and Social Solidarity, as part of the National Strategy for Quality and Safety of Healthcare Services in the Knowledge Society. Associated projects included information systems covering transactions on patient charges between hospitals and insurance organisations. Health networking services included – among others – ePrescribing (Commission of the European Communities 2007, p43).

### 5.2.14 Hungary's acute hospital eHealth profile

Figure 76 shows Hungary's acute hospital eHealth profile in comparison with the EU+ average.

Figure 76 – Hungary's acute hospital eHealth profile



This figure shows that Hungary's acute hospital eHealth profile is higher than EU+ average for six indicators: external connectivity, a single EPR shared by all departments, integrated system for eReferral, the exchange of clinical care information with external providers, exchange of laboratory results with external providers, and EAS for disaster recovery in less than 24 hours. On PACS usage and the exchange of radiology reports with external providers, Hungary's acute hospital eHealth profile is close to the EU+ average. However, in terms of high-speed broadband (above 50Mbps), single and unified wireless infrastructure, ePrescribing, and clear and structured rules on access to clinical data, all are below the EU+ average. ePrescribing appears to be non-existent in the Hungarian hospitals surveyed. Finally, although high-speed broadband is below the EU+ average, all the hospitals surveyed in Hungary do have broadband.

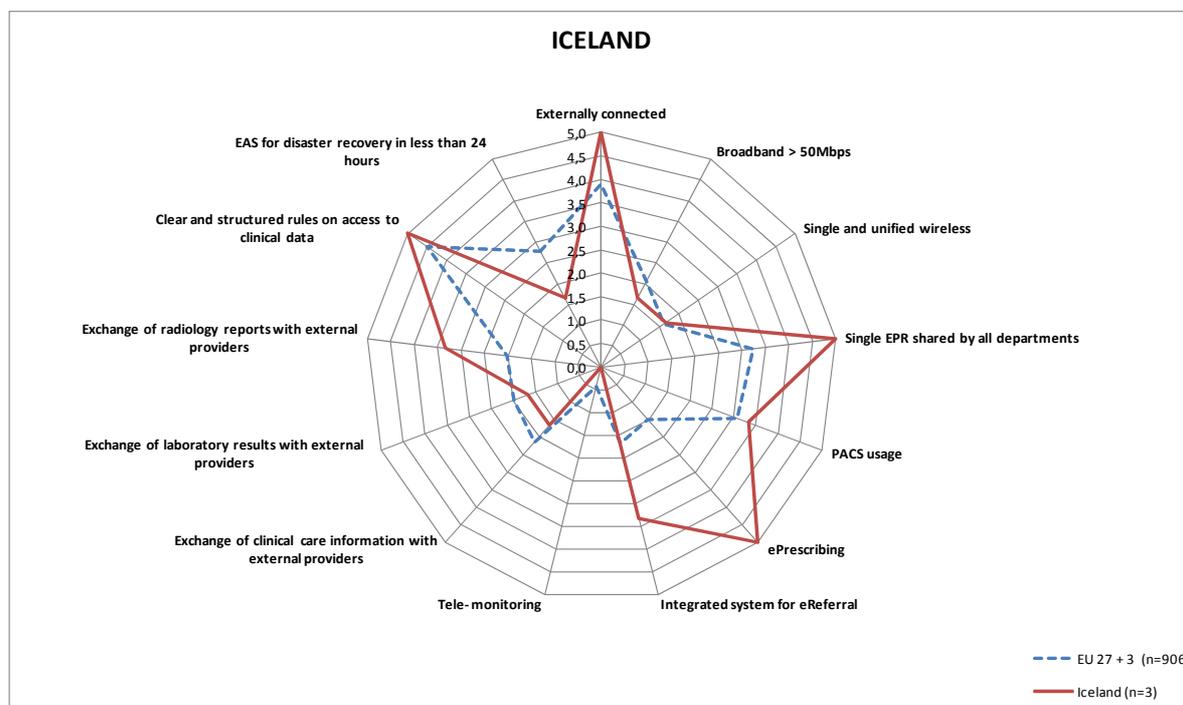
In Hungary, eHealth is a major policy initiative which underlies both the country's National Health Strategy and its Convergence Programme. Legislation announced in 2006 was envisaged as creating significant changes in drug prescription and dispensing practices

that would be enabled by an online health professional portal and transaction monitoring and analysis (Ibid., p45).

### 5.2.15 Iceland's acute hospital eHealth profile

Figure 77 shows Iceland's acute hospital eHealth profile in comparison with the EU+ average.

Figure 77 – Iceland's acute hospital eHealth profile



This spider diagram shows that Iceland's acute hospital eHealth profile is higher than EU+ average for the following seven indicators: external connectivity, a single EPR shared by all departments, PACS usage, ePrescribing, integrated system for eReferral, exchange of radiology reports with external providers, and clear and structured rules on access to clinical data. For four of these indicators, there is full availability in all the Icelandic hospitals surveyed. These are: external connectivity, a single EPR shared by all departments, ePrescribing, and structured rules on access to clinical data. Iceland is very close to the EU+ average in terms of the presence of single and unified wireless infrastructure. An overview of Iceland's eHealth priorities and strategies in 2007 indicated its longstanding commitment to such issues. In some cases, initiatives had started in the mid-1990s, and in others in the early and mid-part of the last decade (Ibid., pp85-86). An observation with regard to electronic health records highlighted (Ibid., p85) that:

The two largest hospitals use the same systems for general primary care patient information and use special systems for activities such as laboratory tests, surgery, Picture Archiving and Communication Systems (PACS) and

Radiology Information Systems (RIS). The small hospitals have not come as far; they mostly have different legacy systems for out-patient services and even older systems for in-patient information.

Iceland's acute hospitals are below the EU+ average on high-speed broadband, telemonitoring, exchange of clinical care information with external providers, exchange of laboratory results with external providers and EAS for disaster recovery in less than 24 hours. Of these five indicators, two stand out. The first is that there is no telemonitoring in the Icelandic hospitals surveyed<sup>49</sup>. The second is that there is no presence of high-speed broadband in the hospitals surveyed. As Figure 4 shows, in 67% of Iceland's acute hospitals, there is narrowband Internet connection whereas 33% have broadband with a speed between 50MBps and 100MBps.

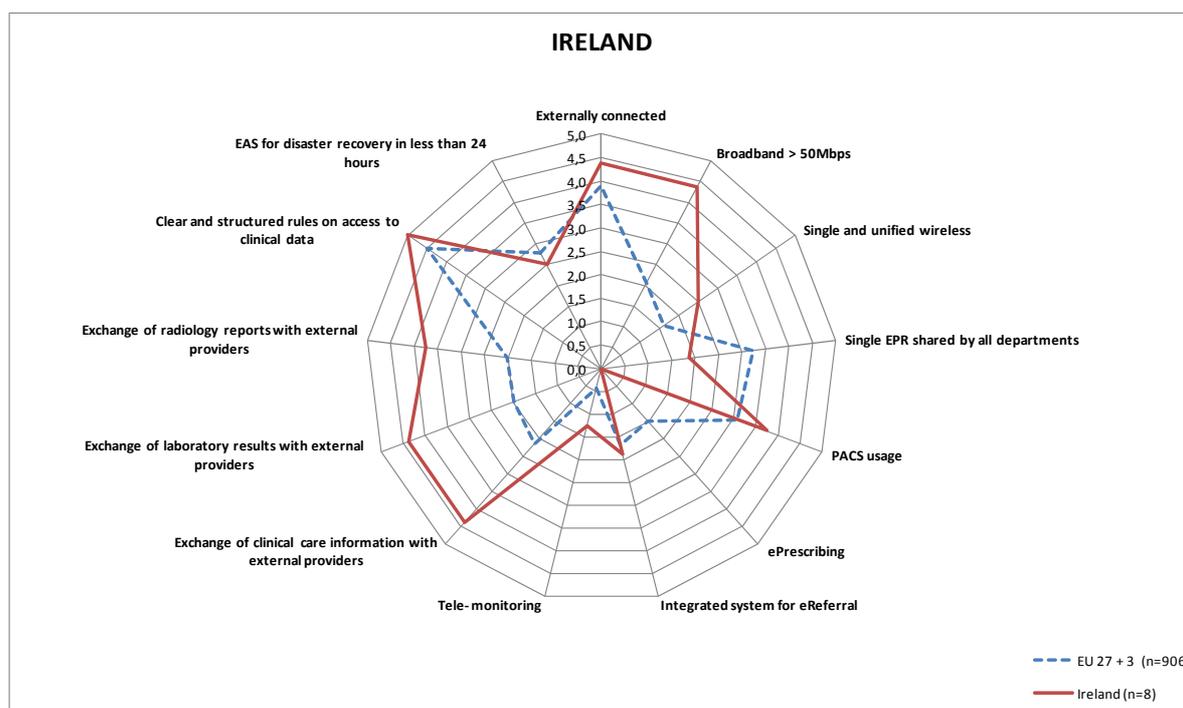
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<sup>49</sup> However, "Since 1996, telemedicine projects have been conducted across 13 locations, in remote medical consultations and in various clinical specialties, including: teleradiology, teleobstetrics, telepsychiatry, maritime telemedicine, telemedicine in surgery and telepathology." (Ibid., p85)

### 5.2.16 Ireland's acute hospital eHealth profile

Figure 78 shows Ireland's acute hospital eHealth profile in comparison with the EU+ average.

Figure 78 – Ireland's acute hospital eHealth profile



This spider diagram shows that Ireland's acute hospital eHealth profile is higher than EU+ average across ten indicators. They are composed of: external connectivity, broadband, single and unified wireless infrastructure, PACS usage, integrated system for eReferral, telemonitoring, exchange of clinical care information with external providers, exchange of laboratory results with external providers, exchange of radiology reports with external providers, and clear and structured rules on access to clinical data. A number of these applications are those identified as being included in Ireland's national general practitioner messaging project which has developed an electronic communication system between primary and secondary care. Indeed, the message types that are available electronically are comprised of laboratory results, and radiology results as well as others such as death notifications, discharge notifications, discharge summaries, accident and emergency attendance notification, and waiting list updates (Ibid., p47).

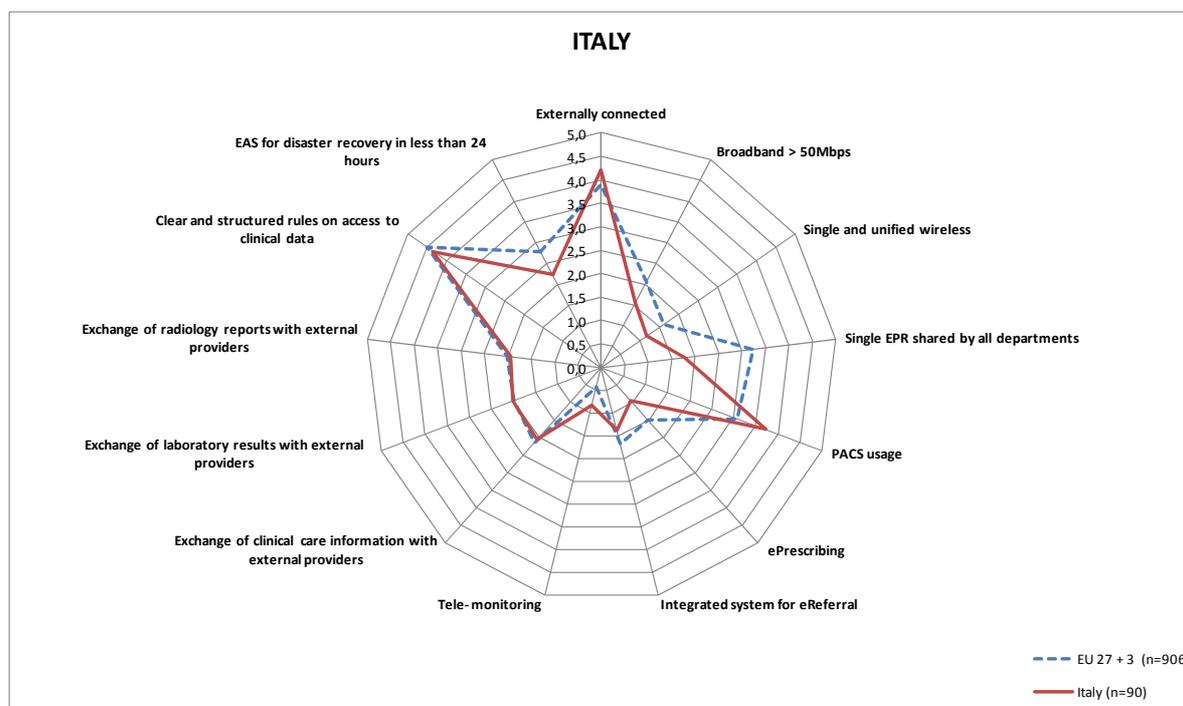
For high-speed broadband, Ireland is very much above the EU+ average. Furthermore, as Figure 4 shows, 88% of all Irish hospitals have broadband. The remaining three indicators

are below EU+ average (they are ePrescribing, an EPR shared among all hospital departments, and EAS disaster recovery in less than 24 hours). The most noteworthy of these is that there is no availability of ePrescribing in the Irish hospitals surveyed.

### 5.2.17 Italy's acute hospital eHealth profile

Figure 79 shows Italy's acute hospital eHealth profile in comparison with the EU+ average.

Figure 79 – Italy's eHealth Profile



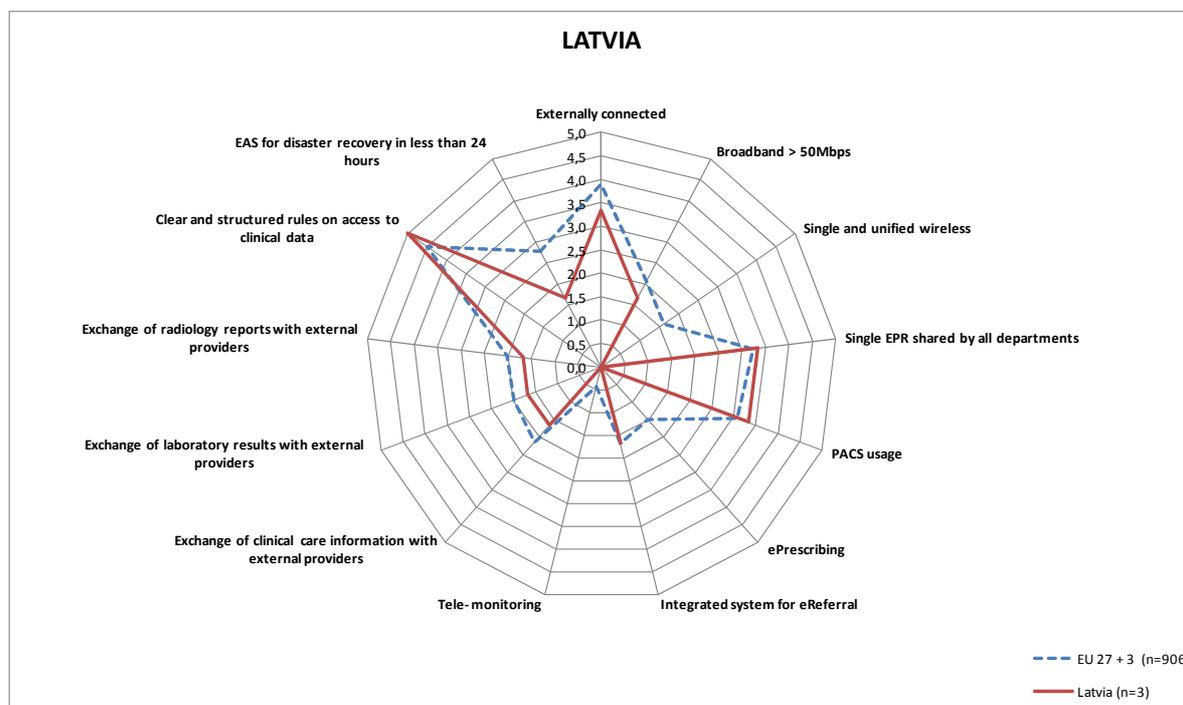
This spider diagram shows that Italy's acute hospital eHealth profile is higher than EU+ average for external connectivity, PACS usage, and telemonitoring. It is close to the EU+ average for the exchange of clinical care information with external providers, exchange of laboratory results with external providers, exchange of radiology reports with external providers, and clear and structured rules on access to clinical data. Among pilots launched by Italy's permanent eHealth Board (its Tavolo di lavoro permanente per la Sanità Elettronica) are ones on telemedicine and tele-education (Ibid., p49).

Italy's acute hospital eHealth profile is below EU+ average for the following indicators: high-speed broadband, single and unified wireless infrastructure, a single EPR shared by all departments, ePrescribing, and EAS for disaster recovery in less than 24 hours.

### 5.2.18 Latvia's acute hospital eHealth profile

Figure 80 shows Latvia's acute hospital eHealth profile in comparison with the EU+ average.

Figure 80 – Latvia's acute hospital eHealth profile



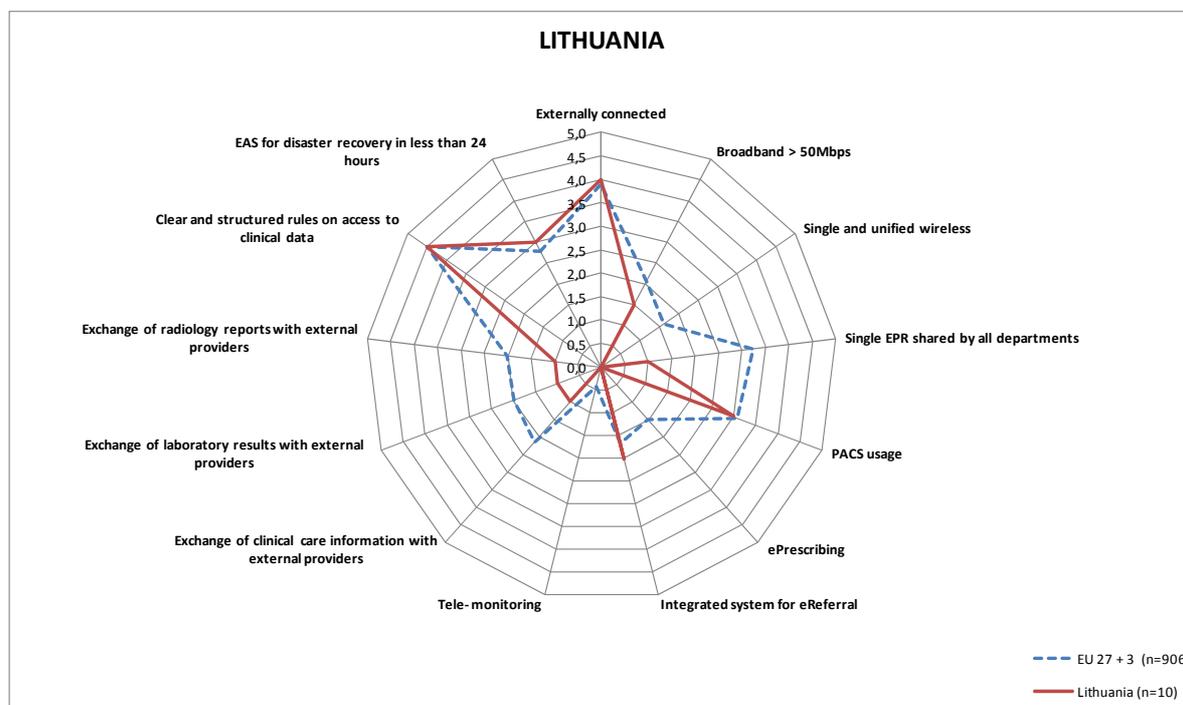
This spider diagram shows that all Latvian hospitals surveyed have broadband, but only a third have broadband that is faster than 50Mbps, as Figure 4 shows. Latvia's acute hospital eHealth profile is slightly higher than EU+ average across three indicators. These are: a single EPR shared by all departments, PACS usage, and clear and structured rules on access to clinical data. One of the eHealth in Latvia's objectives places an emphasis on an "improvement of linkage and connection between health care institutions' internal information systems as well as the improvement of electronic data exchange between state health care registries, health authorities and managers." (Ibid., p50)

Latvian hospitals are close to the EU+ average on integrated system for eReferral. However, they are under the EU+ average for the remaining indicators which include no presence for a single and unified wireless infrastructure, ePrescribing or telemonitoring.

### 5.2.19 Lithuania's acute hospital eHealth profile

Figure 81 shows Lithuania's acute hospital eHealth profile in comparison with the EU+ average.

Figure 81 – Lithuania's acute hospital eHealth profile



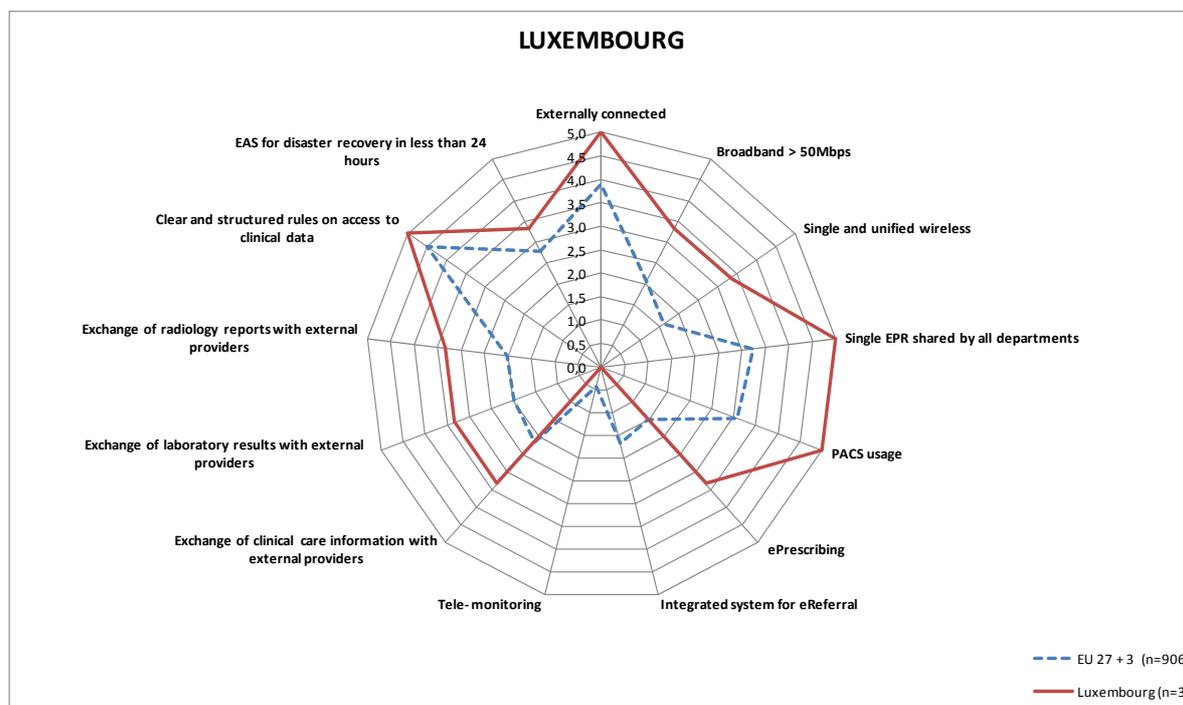
This spider diagram shows that Lithuania's acute hospital eHealth profile is slightly higher than EU+ average for integrated systems for eReferral and EAS for disaster recovery in less than 24 hours. Lithuania's acute hospital eHealth profile is very close to the EU+ average for external connectivity, PACS usage, and clear and structured rules on access to clinical data. However, for eight indicators, Lithuania's eHealth profile in its hospitals is lower than the EU+ average. These indicators are: high-speed broadband, single and unified wireless infrastructure, a single EPR shared by all departments, ePrescribing, telemonitoring, exchange of clinical care information with external provider, exchange of laboratory results with external providers, and the exchange of radiology reports with external providers.

The country's eHealth Strategy for 2005 – 2010 addresses the requirements signalled by the main organisational, professional and occupational groups involved in the Lithuanian healthcare domain. It includes a proposed model for computerisation and networking of institutions that covers – among others – and hospital information systems (Ibid., p52).

### 5.2.20 Luxembourg's acute hospital eHealth profile

Figure 82 shows Luxembourg's acute hospital eHealth profile in comparison with the EU+ average.

Figure 82 – Luxembourg's acute hospital eHealth profile



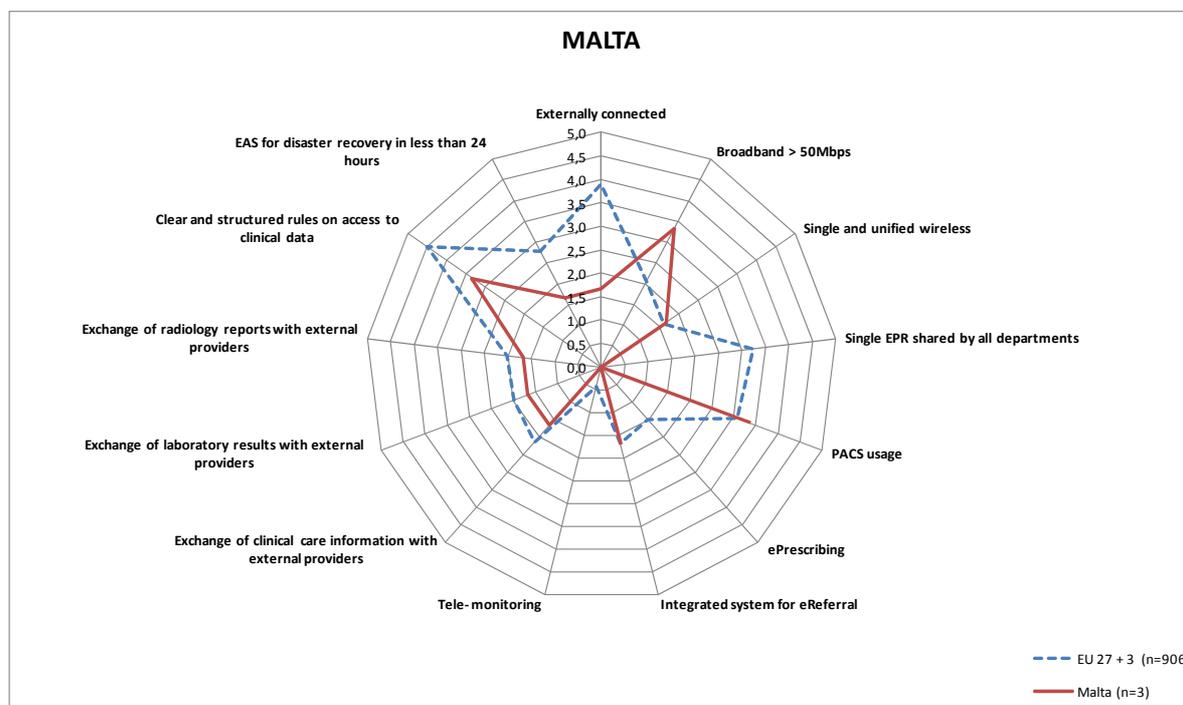
This spider diagram shows that Luxembourg's eHealth profile in its acute hospitals is significantly higher than the EU+ average on all indicators except an integrated system for eReferral and telemonitoring. Neither exist in the Luxembourg hospitals surveyed. All of Luxembourg's hospitals included in the survey are externally connected, have a single EPR shared by all departments, use PACS, and have clear and structured rules on access to clinical data. It is also interesting that all Luxembourg hospitals surveyed have broadband and that two-thirds of them have speeds above 100Mbps (as Figure 4 shows).

As early as 1995, the Ministry of Health in Luxembourg initiated and funded a project to build a secure network between Luxembourg's hospitals, its sickness funds and other stakeholders in the healthcare domain. Among its commitments, starting in 2007, Luxembourg was aiming to establish a radiological record in electronic form, containing the history of the radiological examinations of each patient. In 2006, the country undertook a systematic review of the ICT solutions available in its hospitals (Ibid., p53–55).

### 5.2.21 Malta's acute hospitals eHealth profile

Figure 83 shows Malta's acute hospitals eHealth profile in comparison with the EU+ average.

Figure 83 – Malta's acute hospitals eHealth profile



This spider diagram shows that Malta's acute hospitals eHealth profile in its hospitals is higher than the EU+ average for high-speed broadband and PACS usage. All hospitals in Malta surveyed are connected with broadband which is equally distributed over the different broadband speeds. For single and unified wireless infrastructure and integrated system for eReferral, Maltese hospitals are close to the EU+ average. The remaining indicators are all below EU+ average. There appears not to be a single EPR shared by all departments or telemonitoring in Maltese hospitals.

Malta national eHealth vision was to be published for public consultation in 2007. Since 2005, the government's main focus in the domain of ICT in health has been on the implementation of an integrated health information system for all Malta's public hospitals and health centres. Launched in 1997 the island's main hospital – St Luke's Hospital – has had services that have been provided to several of Malta's hospitals and health centres across the government's country-wide telecommunications network (Ibid., p56). While the Information Management and Technology Directorate in the country's newly established

Mater Dei hospital<sup>50</sup> manages almost a hundred different IT systems which support the delivery of clinical services to patients and the management of hospital service, its website nevertheless observes with some acuity:

Not all patient records at [the Mater Dei hospital] are kept electronically. The largest volume of patient information is still stored within 450,000 volumes of patient files, all managed by the Medical Records Department. These files occupy 5.5km of shelf space, i.e. the same as the distance from Valletta to the airport. Over 1,000 of these files are loaned out every working day to clinics and wards, and an equivalent number returned.

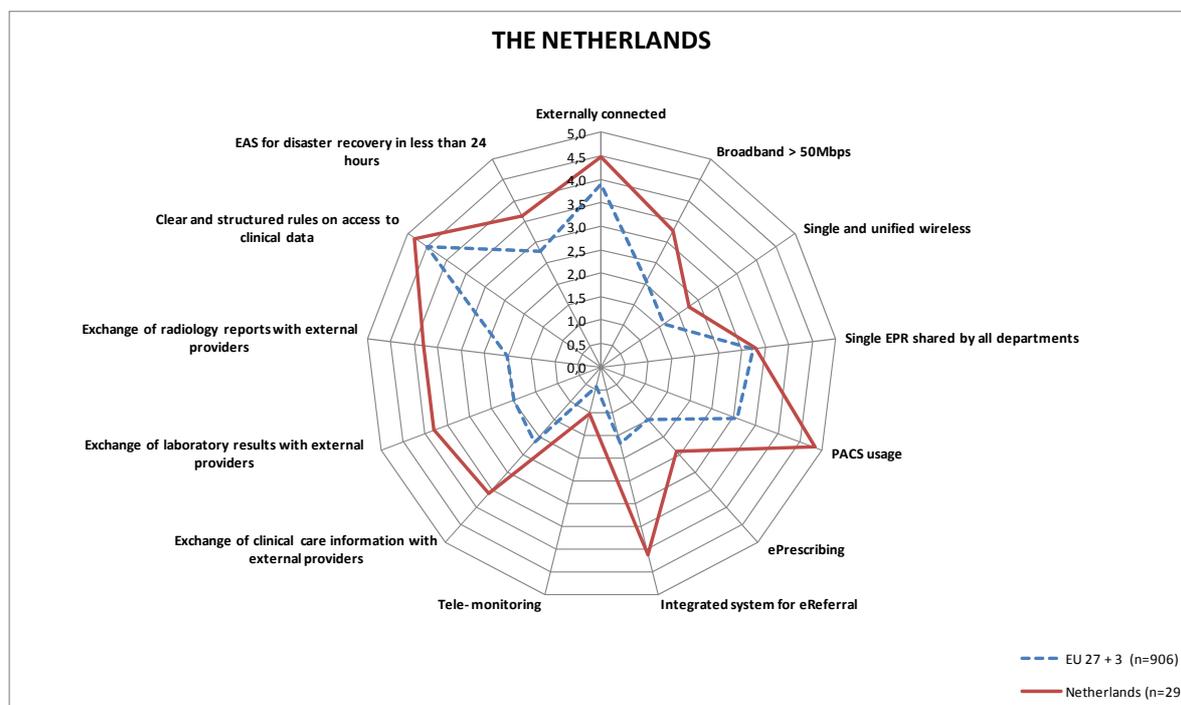
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<sup>50</sup> Mater Dei Hospital website. Accessed February 16, 2011.  
<http://www.gov.mt/newsletterarticle.asp?a=613&l=2/>.

### 5.2.22 The Netherlands' acute hospitals eHealth profile

Figure 84 shows the Netherlands' acute hospitals eHealth profile in comparison with the EU+ average.

Figure 84 – The Netherlands' acute hospitals eHealth profile



This spider diagram shows that the Netherlands' acute hospitals eHealth profile is higher than EU+ average across all the indicators. This is noticeably the case for PACS usage, an integrated system for eReferral, the exchange of clinical care information with external providers, exchange of laboratory results with external providers, and the exchange of radiology reports with external providers.

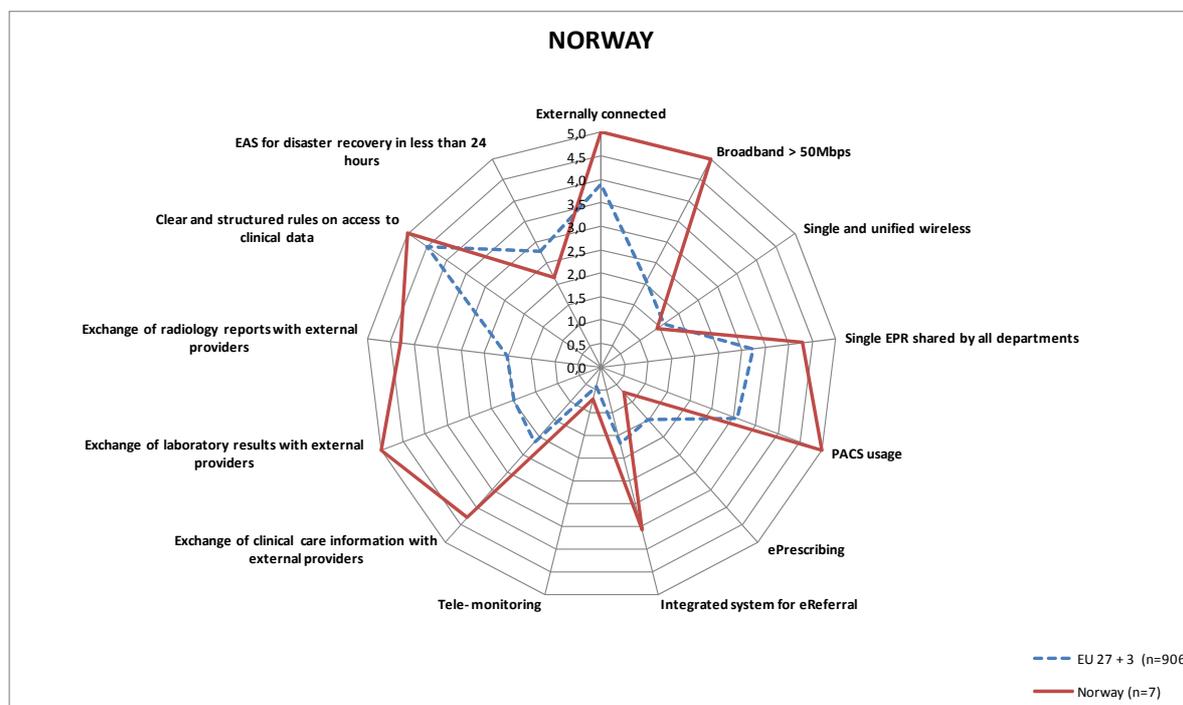
The country places considerable emphasis on its national infrastructure for healthcare called AORTA, its roll-out of an electronic health record, and careful identification of the users' of this application (Ibid., p57). The country's expectation is that the:

good use of ICT will contribute to the quality, effectiveness and accessibility of healthcare, now and in the future. In fact, to even ensure the continued existence of an efficient health care system, ICT usage is inevitable. In particular, medical staff will be better enabled to provide the required care through improved access to accurate and up-to-date data on patients.

### 5.2.23 Norway's acute hospitals eHealth profile

Figure 85 shows Norway's acute hospitals eHealth profile in comparison with the EU+ average.

Figure 85 – Norway's acute hospitals eHealth profile



This spider diagram shows that Norway's acute hospitals eHealth profile is higher than EU+ average for all the indicators except three. For a single and unified wireless infrastructure, Norway is just below the EU+ average. For ePrescribing and EAS for disaster recovery in less than 24 hours Norway's hospitals are also just below the EU+ average.

On the high-speed broadband indicator, Norway's hospitals are well above the EU+ eHealth average as all the hospitals in the survey have a 50MBps or faster connection. Seventy-one per cent of the country's hospitals surveyed have high-speed broadband with speeds in excess of 100MBps; the remaining 29% have broadband speeds between 50MBps and 100MBps.

Furthermore, all Norway's hospitals are externally connected, use PACS, exchange laboratory results with external providers and have clear and structured rules on access to clinical data.

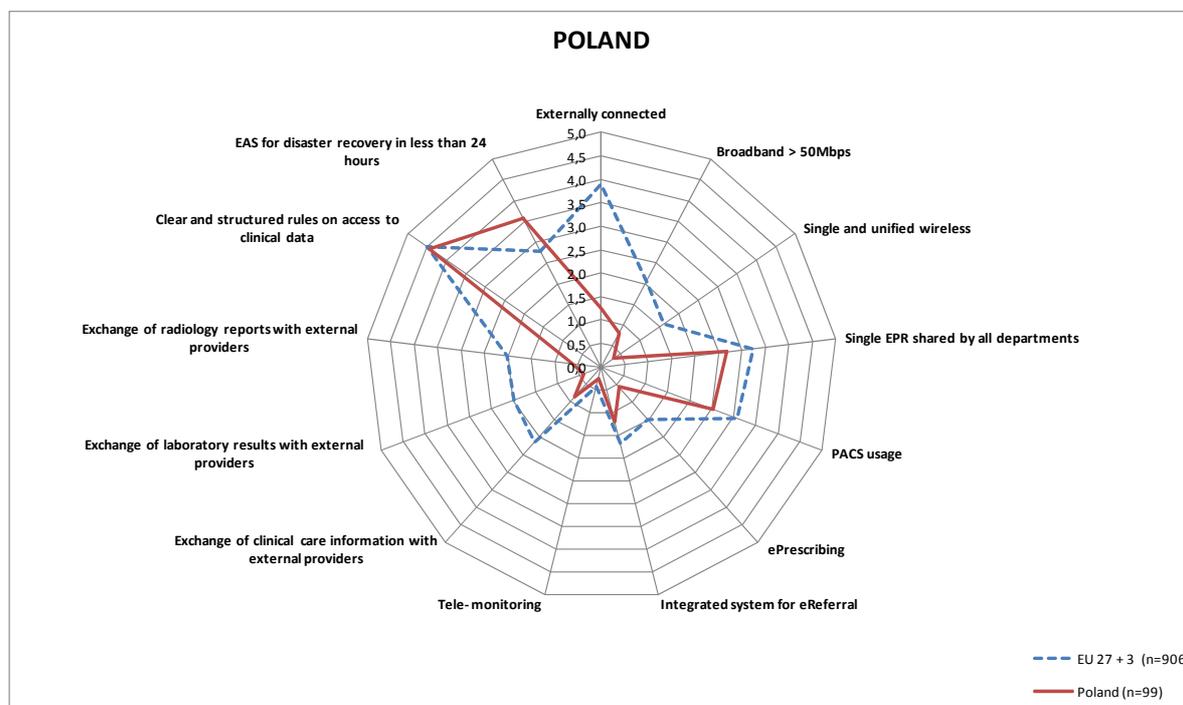
Norway's first national action plan for IT development in the health and social sectors, called 'More health for each bit', was issued almost 15 years ago by the Ministry of Health

and Social Affairs in 1997. The country's dedicated healthcare network interconnects its five regional health networks. The Norwegian Health Net organisation provides a sector network for effective cooperation between the different service sections. Norway also places considerable importance on multi-national cooperation in the field of eHealth. Cooperation with the other Nordic countries is well established at the level of national competence centres, and there Nordic cooperation at political and governmental levels with regard to eHealth has also been strengthened (Ibid., p88–90).

### 5.2.24 Poland's acute hospitals eHealth profile

Figure 86 shows Poland's acute hospitals eHealth profile in comparison with the EU+ average.

Figure 86 – Poland's acute hospitals eHealth profile



This spider diagram shows that Poland's acute hospitals eHealth profile is higher than EU+ average for EAS disaster recovery in less than 24 hours. It is also close to the EU+ average on telemonitoring and on clear and structured rules on access to clinical data. For the remaining indicators, Poland's eHealth in its hospitals is less mature than the EU+ average.

High-speed broadband is very low in the Polish hospitals surveyed. In general, the hospitals' Internet speeds are lower than the average EU+ Internet speeds (as is shown in Figure 4).

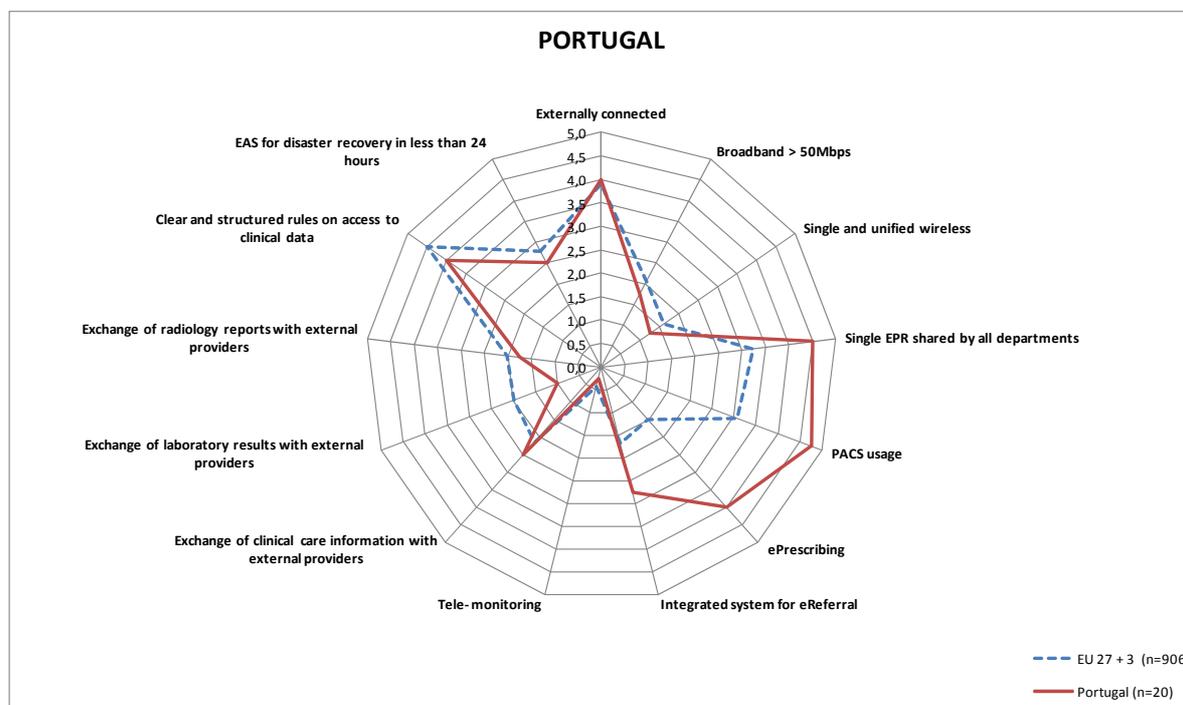
In 2007, Poland planned to build on its activities outlined in the 'Strategy for Development of Information Infrastructure in Poland – ePoland' in terms of healthcare provision. The Ministry of Health and the National Health Fund had released plans for the construction of a health information infrastructure that would enable electronic interactions between all the various parties involved in the healthcare sector (Ibid, p59–60). In relation to

telemedicine specifically, already by 2007, the country had five specialist centres in this domain, and two regional initiatives (Ibid, p60).

### 5.2.25 Portugal's acute hospitals eHealth profile

Figure 87 shows Portugal's acute hospitals eHealth profile in comparison with the EU+ average.

Figure 87 – Portugal's acute hospitals eHealth profile



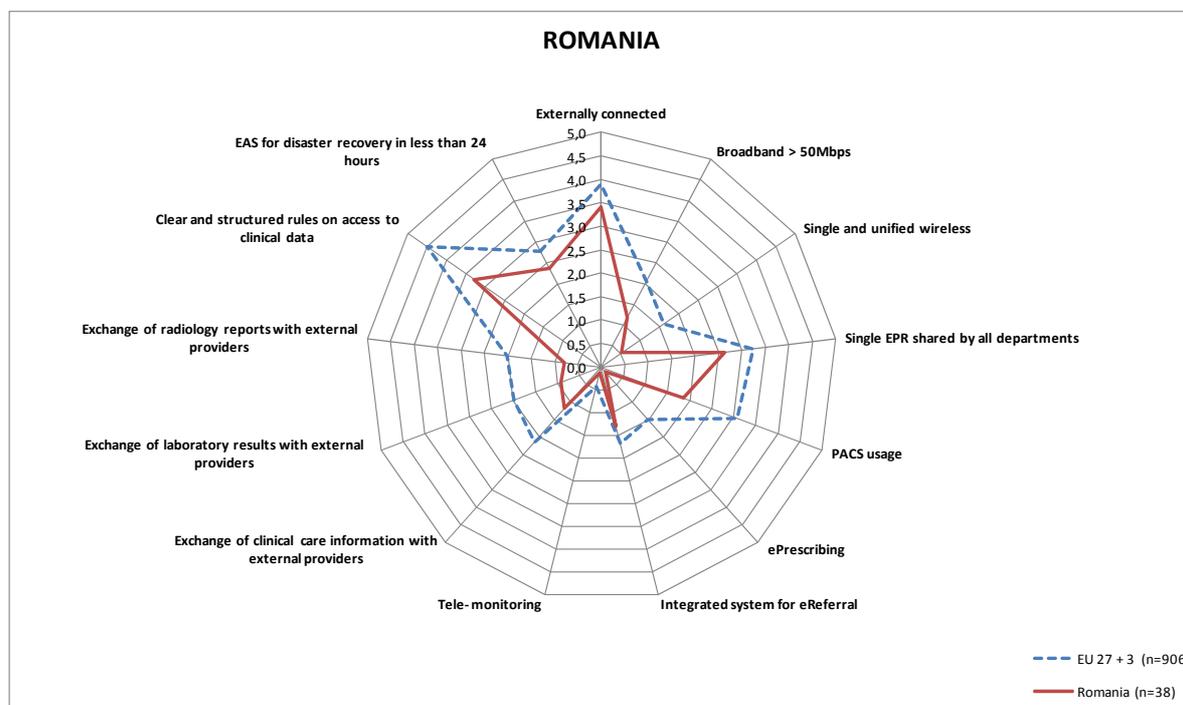
This spider diagram shows that Portugal's eHealth profile in its acute hospitals is higher than EU+ average on five indicators. These five are: the single EPR shared by all departments, PACS usage, ePrescribing, integrated system for eReferral, and the exchange of clinical care information with external providers. The indicators for external connectivity and telemonitoring in the Portuguese hospitals are close to the EU+ average. Since 2004, Portuguese hospitals have implemented clinical support applications (they include support for activities such as remote specialised outpatient scheduling, the registration of analysis results produced by other hospital applications and prescribing). Direct access is available to the connected organisations to patient information (Ibid., p61). Five years ago in Portugal, a certification process was introduced for ePrescription used by private physicians and other institutions to enable their integration into the national ePrescription workflow. ePrescriptions are sent to a central national database for the checking and payment of invoices (Ibid., p62).

The remaining indicators in the hospitals approached in the survey are below the EU+ average. These include high-speed broadband which is, nevertheless, in line with general tendencies in Internet connection speeds in Portugal.

### 5.2.26 Romania's acute hospitals eHealth profile

Figure 88 shows Romania's acute hospitals eHealth profile in comparison with the EU+ average.

Figure 88 – Romania's acute hospitals eHealth profile



This spider diagram shows that Romania's acute hospitals eHealth profile is below EU+ average across all indicators. Although Romania's acute hospitals surveyed appear to be below the EU+ average for all the applications, it should however be noted that Romania has shown – in certain fields – excellence in best practices. One example is its use of ICT in city ambulance services (European Communities 2006, p37–38).

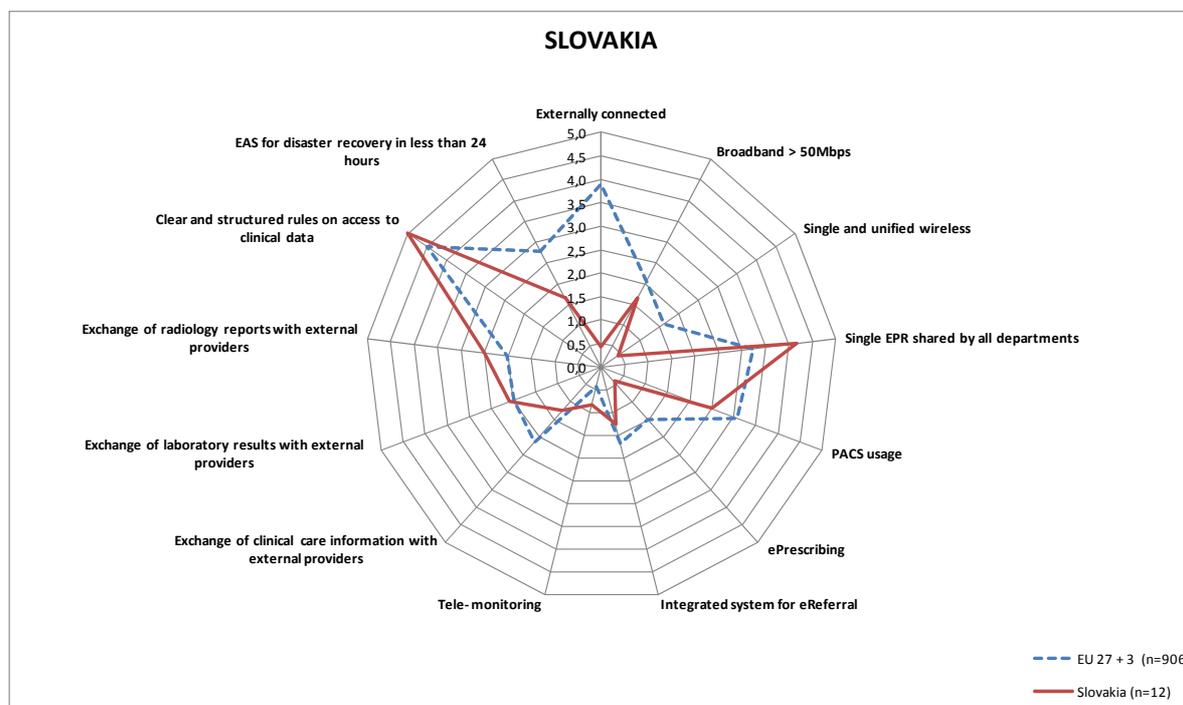
In 2007, it was observed that Romanian healthcare practice has **experience in hospital and GP information systems**<sup>51</sup>, including computerised health records and patient identification. For example, 75% of the hospitals have already introduced IT procedures in clinical or para-clinical departments. Numerous other applications were mentioned such as electronic health records integrated into laboratory, pharmacy and image processing, and telemedicine. It was remarked that all public hospitals used the same software for minimum datasets for diagnosis-related groups (Ibid., p63–64).

<sup>51</sup> emphasis added.

### 5.2.27 Slovakia's acute hospitals eHealth profile

Figure 89 shows Slovakia's acute hospitals eHealth profile in comparison with the EU+ average.

Figure 89 – Slovakia's acute hospitals eHealth profile



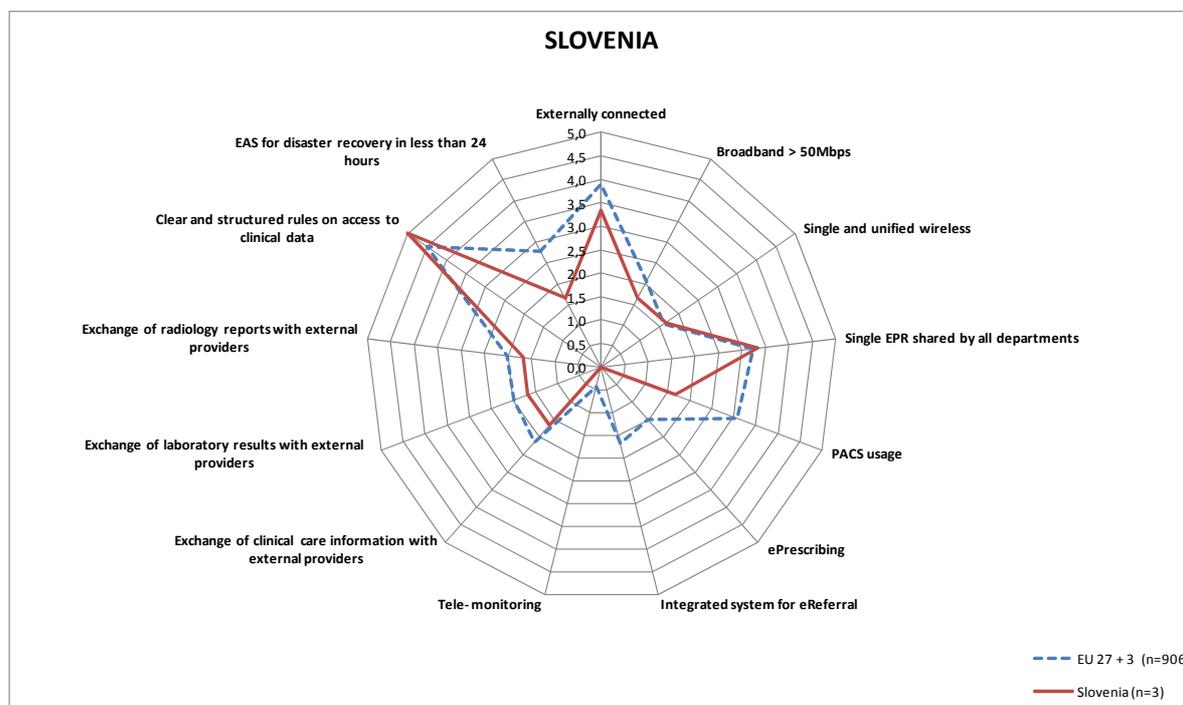
This spider diagram shows that Slovakia's acute hospitals eHealth profile is above EU+ average for a single EPR shared by all departments, telemonitoring, and clear and structured rules on access to clinical data (which is the case for all Slovakian hospitals). Furthermore, it is slightly above the EU+ average in terms of the exchange of laboratory results with external providers. For the remaining indicators Slovakia is below the average EU+ acute hospitals eHealth profile index.

The Slovakian Ministry of Health initiated a 'New Healthcare System' programme in which its eHealth vision is laid out. Many of its plans for implementation are focused on patient medication records, clear certification guidelines and standardisation (Ibid., p66).

## 5.2.28 Slovenia's acute hospitals eHealth profile

Figure 90 shows Slovenia's acute hospitals eHealth profile in comparison with the EU+ average.

Figure 90 – Slovenia's acute hospitals eHealth profile



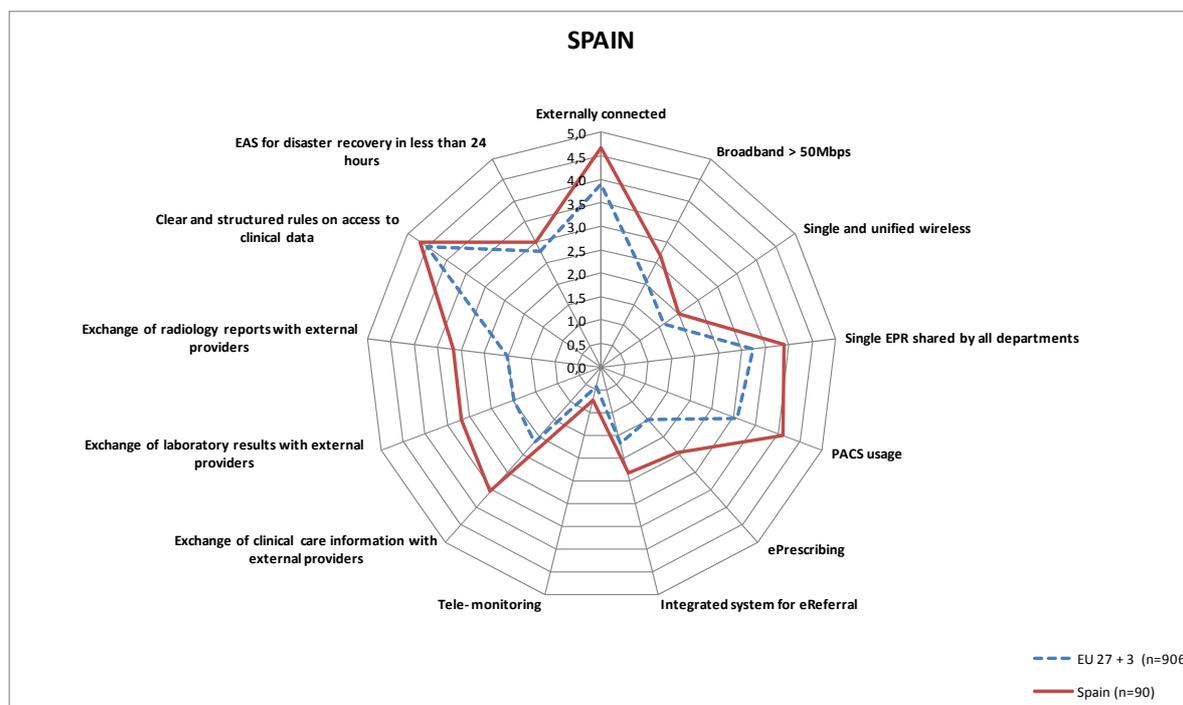
This spider diagram shows that Slovenia's acute hospitals eHealth profile is above EU+ average for structured rules on access to clinical data. It is slightly above the EU+ average for a single EPR shared by all hospital departments. This may be construed as being associated with the country's longstanding recognition as a country which has a good practice in terms of its electronic national health insurance card system (one of which's role is to simplify and improve communication between the responsible Institute, physicians, and healthcare institutions) (Ibid., p69). All the hospitals surveyed in Slovenia have broadband (as is indicated in Figure 4), however, it is not always of a high speed. Slovenia's acute hospitals eHealth profile is on a level with the EU+ average with regard to having a single and unified infrastructure.

For the remaining indicators, Slovenia is below the EU+ average: for example, among the hospitals surveyed, it shows no presence of ePrescribing, integrated system for eReferral or telemonitoring.

### 5.2.29 Spain's acute hospitals eHealth profile

Figure 91 shows Spain's acute hospitals eHealth profile in comparison with the EU+ average.

Figure 91 – Spain's acute hospitals eHealth profile



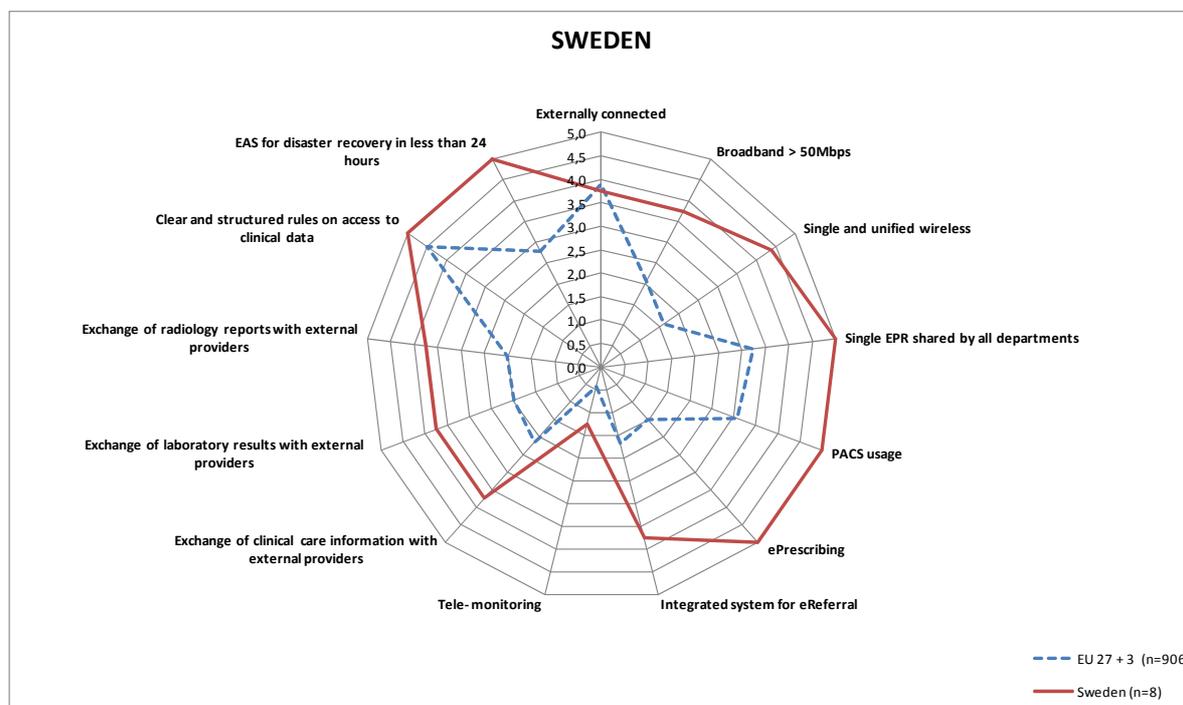
This spider diagram shows that Spain's acute hospitals eHealth profile is above EU+ average on all indicators. This is especially the case in terms of a single EPR shared by all departments, PACS usage, ePrescribing, integrated system for eReferral, and the three types of information exchange with external providers. In terms of Internet connection speed, the Spanish acute hospitals surveyed are above the EU+ average (as is indicated in Figure 4).

eHealth activities in Spain, referred to as "Health on line", have formed part of the country's "Plan Avanza" which ran throughout 2006–2010. Many of Spain's healthcare organisations and hospitals in its 17 autonomous regions are well-known for their innovative leadership in eHealth: one example is the Andalusian Diraya system (European Communities 2010, p60–65).

### 5.2.30 Sweden's acute hospitals eHealth profile

Figure 92 shows Sweden's acute hospitals eHealth profile in comparison with the EU+ average.

Figure 92 – Sweden's acute hospitals eHealth profile



This spider diagram shows that Sweden's acute hospitals eHealth profile is above the EU+ average across all the indicators, except one: external connectivity (which is slightly below EU+ average). However, the Swedish acute hospitals surveyed have full availability of a single EPR which is shared by all hospital departments, PACS usage, ePrescribing, clear and structured rules on access to clinical data, and EAS disaster recovery in less than 24 hours. Broadband is available in 87% of Swedish hospitals, and the interviewees in the remaining 13% of the hospitals did not know the speed, as is indicated in Figure 4, so the percentage may be even higher.

Sweden's longstanding commitment to eHealth at a regional level was brought together in a national eHealth strategy in 2006. As was noted in 2007, in Sweden – since 2002 – **all hospitals**<sup>52</sup> and primary care centres have been connected via a joint telecommunication

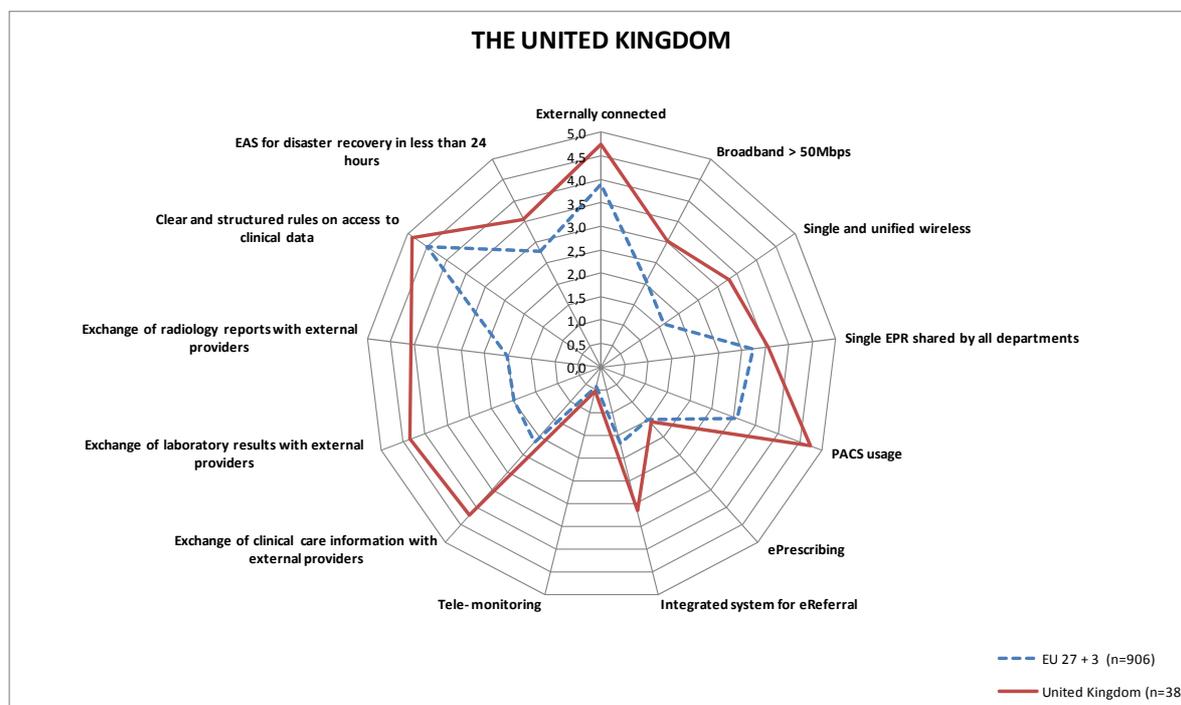
<sup>52</sup> emphasis added to several elements of this description.

network called **Sjunet**, when it **connected 80 public hospitals**, 800 primary care centres, 950 pharmacies and a number of private healthcare institutions (Ibid., p71).

### 5.2.31 United Kingdom's acute hospitals eHealth profile

Figure 93 shows the United Kingdom's acute hospitals eHealth profile in comparison with the EU+ average.

Figure 93 – The United Kingdom's acute hospitals eHealth profile



This spider diagram shows that the UK's eHealth profile is above EU+ average on all the indicators in its acute hospitals. However, the UK is only slightly above the EU+ average for ePrescribing and telemonitoring in the hospitals surveyed. High-speed broadband (100Mbps) is available in 42% of the hospitals surveyed and narrowband is below the EU+ average (as is shown in Figure 4).

This approach does not, however, indicate any differences which may in general occur in acute hospitals eHealth profile among the four home countries of the UK: England, Northern Ireland, Scotland, and Wales. In terms of the four countries' hospitals, each of the ICT systems which support their national health services can be shown to have experienced a variety of highlights and challenges (Ibid., pp74–81). At a national level, Scotland and Wales, for example, are often used as illustrations of good, regionally-strong, and incremental approaches to ICT introduction<sup>53</sup>. On the other hand, what is

<sup>53</sup> See the National Health Service (NHS) Scotland's emergency care record system described in European Communities (2010).

reputed to be one of the world's largest employers<sup>54</sup>, the National Health Service of England, has over the years been beset by numerous problems in its implementation of eHealth: the Connecting for Health agency which runs the National Programme for Information Technology, launched in 2002, is one of the world's largest public sector IT initiatives (Ibid., p74).

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<sup>54</sup> Accessed February 16, 2011 <http://www.nhs.uk/Livewell/NHS60/Pages/Didyouknow.aspx>

### 5.3 Good practice according to hospital types

This is the third section of the eHealth benchmarking III best practice analysis. Here we focus on the EU-level hospital breakdowns regarding hospital size, ownership, function, and regional connectivity. It is anticipated that complementary work is being undertaken by the IPTS (for example, on hospital organisational size, type, and reform/change management).<sup>55</sup>

The analysis undertaken in the four sub-sections which follow explores four types of hospitals. These hospitals have proven themselves to be more advanced in the implementation of eHealth within and outside the acute hospital site (in terms of *intramural* and *extramural* activities<sup>56</sup>, and therefore – in the latter case – with external healthcare actors or with patients). These include large hospitals with over 750 beds, public hospitals, university hospitals, and those hospitals which are connected to a dedicated regional network. In each of these cases, their eHealth profile position will be analysed together with a number of additional indicators where these hospitals outperform the rest.

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<sup>55</sup> <http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=4179>

<sup>56</sup> North American social science and educational literature use these two Latin terms to refer to, first, *intramural* – "operating within or involving those in a single establishment", in this case, a single hospital and, second, *extramural* "connected with but outside the normal courses or programme of a university or college" or "located outside the boundaries or walls" of the particular establishment. Accessed February 16, 2011 See: <http://www.thefreedictionary.com/intramural> and <http://www.thefreedictionary.com/extramural>

### 5.3.1 Large hospitals

The CIO survey findings have already showed that large hospitals with over 750 beds are, in many instances, more sophisticated than small hospitals particularly with regard to eHealth implementation both outside and inside the hospital organisation.

Figure 94 shows the average EU+ eHealth profile by hospital size (in which all sizes of hospital are considered) measured against the overall EU+ average (which is illustrated by the blue, dotted line).

Figure 94 - EU+ eHealth Profile by Hospital Size

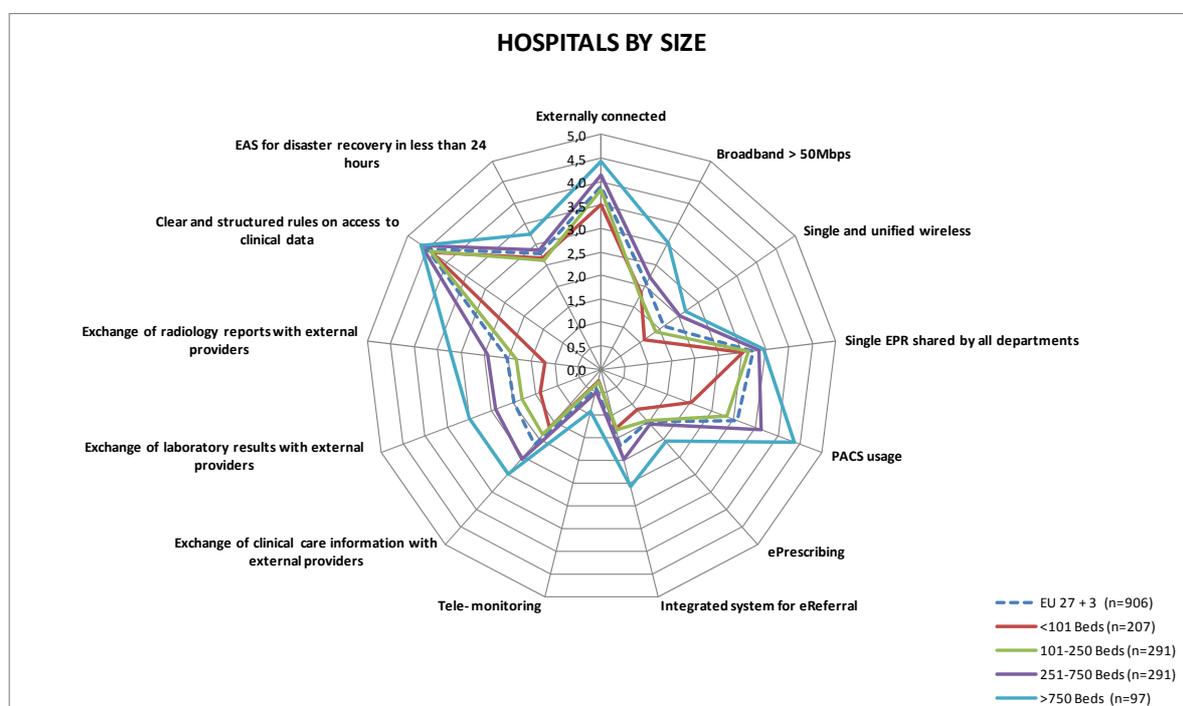


Figure 94 indicates that the larger the hospitals are, the more advanced they are in the eHealth progress made in terms of the 13 indicators selected for the eHealth profile.

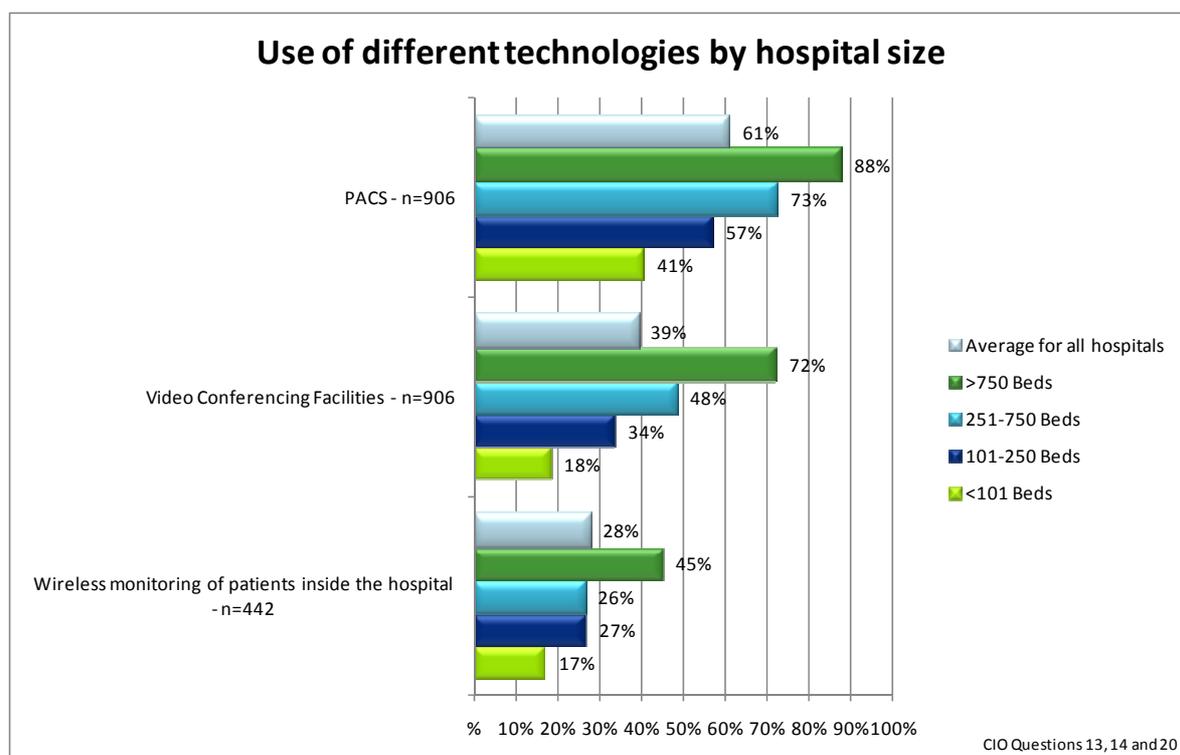
There are five specific indicators, out of the 13, that show a significantly larger difference in profile in terms of the hospital size than other indicators. The first indicator illustrates a significant difference in *high speed broadband connectivity*. on average, larger hospitals (with more than 750 beds) are much more likely to have high speed broadband than are smaller hospitals. The second indicator where the largest hospitals are disproportionately sophisticated when compared with the rest of the indicators is *ePrescribing*. The third is with regards to the availability of an integrated system for *eReferral*. The fourth is

exchange of radiology reports with external providers. The fifth is having an EAS in place for disaster recovery in less than 24 hours.

These five phenomena could be due to a number of characteristics, such as economies of scale or the higher relevance of such applications to larger hospitals. Further investigation would be required to determine which factor is the cause of the high level of profile of these indicators in EU+ large hospitals.

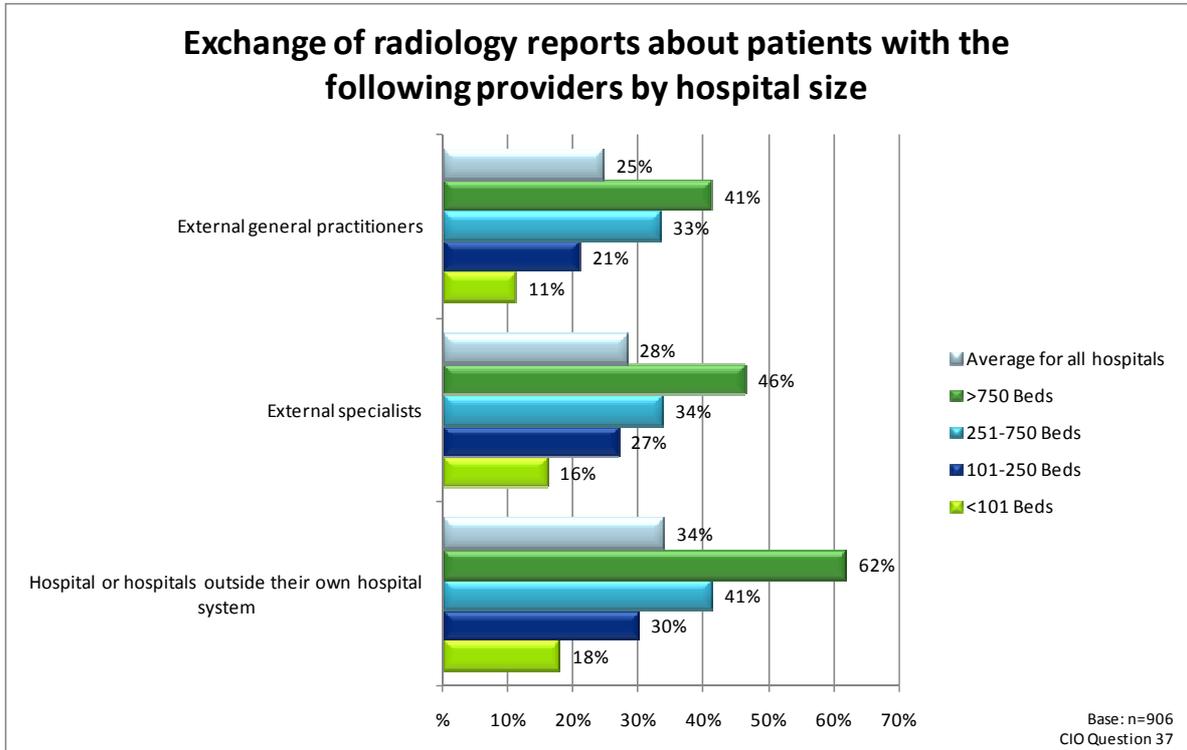
Examining further the role of ICT applications in large hospitals, Figure 95 shows that the use of technologies like PACS, video conferencing facilities, and wireless monitoring of patients inside the hospital, is more common, the larger a hospital is.

Figure 95 – Use of different technologies by hospital size



These are all applications that show a high degree of connectivity. Hence, it is perhaps not surprising not only are large hospitals more active in terms of their exchange of these applications inside the hospitals (*intramural* use) but they are also much more active in their electronic exchange activities with the external healthcare providers (*extramural* use). For instance, as Figure 96 shows, the exchange of radiology reports about patients with external providers (such as external general practitioners, external specialist and hospitals outside their own hospital system) is much more frequent in the case of large hospitals.

Figure 96 – Exchange of radiology reports about patients with the following providers



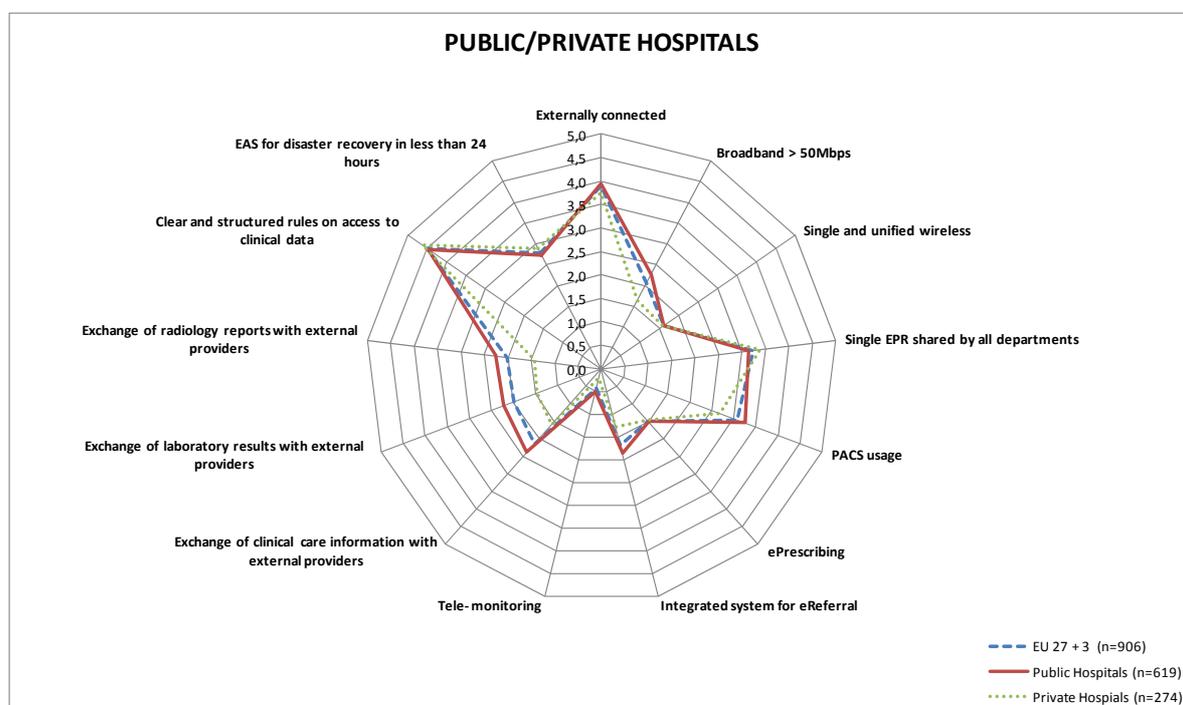
Large hospitals are both, first, more likely to undertake external electronic exchanges with health care providers outside the hospital and, second, more likely to offer extramural services – such as telemonitoring – to patients in their homes. The data from the eHealth Benchmarking III survey show that, the larger the hospital, the more likely it is to offer telemonitoring (large hospitals are twice as likely to do this as the EU+ average). They also allow external medical staff and patients to make electronic appointments directly into the hospital system.

### 5.3.2 Public hospitals

The eHealth Benchmarking III survey analysis has shown that public hospitals are in many instances more sophisticated than private hospitals regarding their eHealth activities outside and inside the hospital organisation. However, this is not necessarily the case for all 13 of the indicators.

Figure 97 shows the average EU+ eHealth profile. It compares both private and public hospitals in terms of the 13 advanced eHealth indicators that the study team have selected to display as spider diagrams.

Figure 97 - EU+ eHealth Profile by Public/Private Hospitals



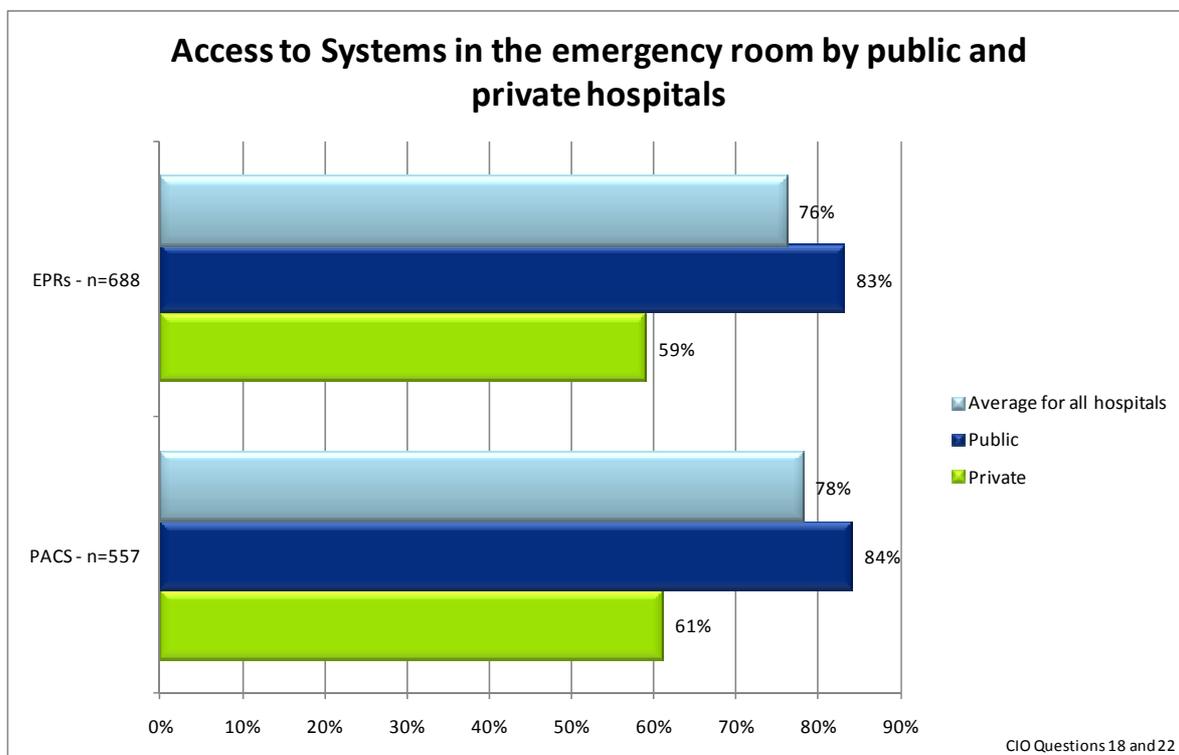
The diagram shows that private and public hospitals are close to being equally mature on five out of the 13 indicators:

- Externally connected,
- Single and unified wireless infrastructure,
- ePrescribing,
- Clear and structured rules on access to clinical data,
- EAS for disaster recovery in less than 24 hours.

However, with regard to high speed broadband connectivity, private hospitals indicate less profile than public hospitals. This is also the case for PACS usage, integrated systems for eReferral, telemonitoring, and the exchange of various forms of data – such as clinical care information, laboratory results, and radiology reports – with external providers.

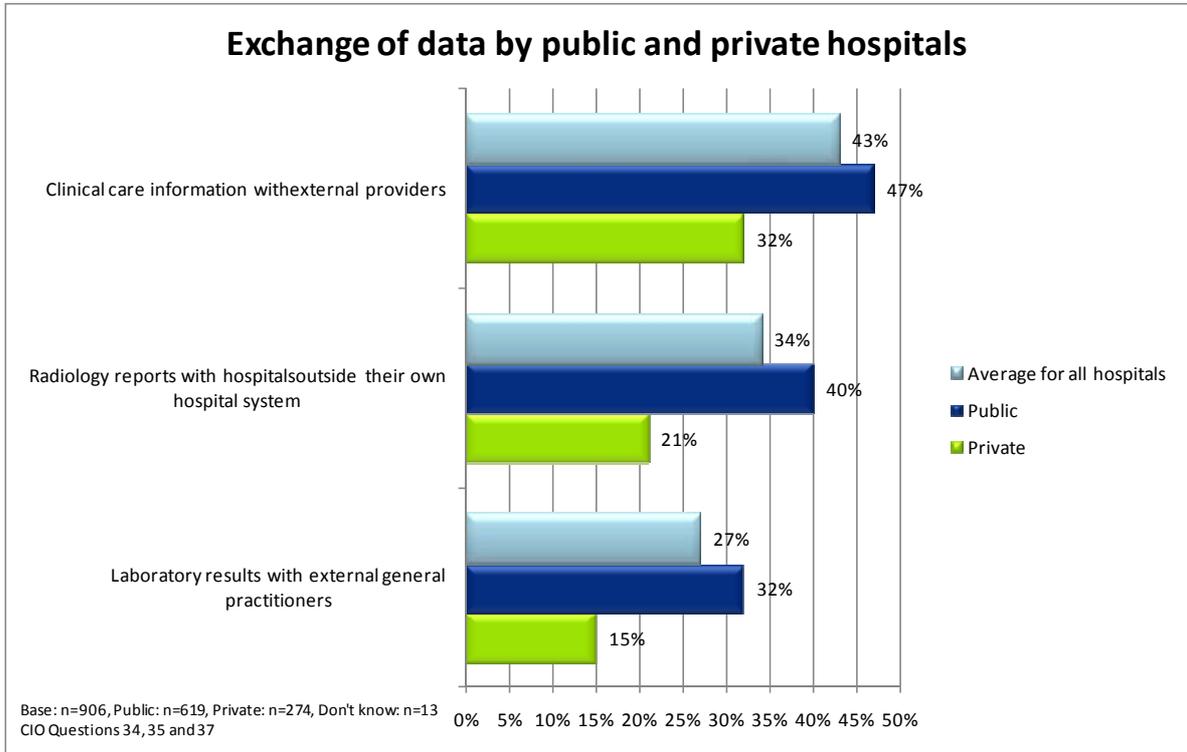
In private hospitals, a single EPR shared by all hospital departments is slightly more common than in public hospitals. Interestingly, for example, however, Figure 98 shows that public hospitals are much more likely to have access to EPR systems and PACS in emergency rooms than are private hospitals.

Figure 98 – Access to systems in emergency rooms by public and private hospitals



Furthermore, as Figure 99 shows, public hospitals are far more likely to exchange data with external providers such as clinical care information and radiology reports with hospitals outside their own hospital system and laboratory results with external General practitioners.

Figure 99 – Exchange of data by public and private hospitals



These findings also show that public hospitals are much more likely to have video conferencing facilities than are private hospitals. Only four out of ten public hospitals offer wireless Internet access to inpatients. The rate is higher in private hospitals, where six out of ten hospitals offer it. This may be due to the often more sophisticated and luxurious, material surroundings in private hospitals which imply that their patients expect generally more comfort and service (which could include access to the latest technologies and mobile communications).

### 5.3.3 University hospitals

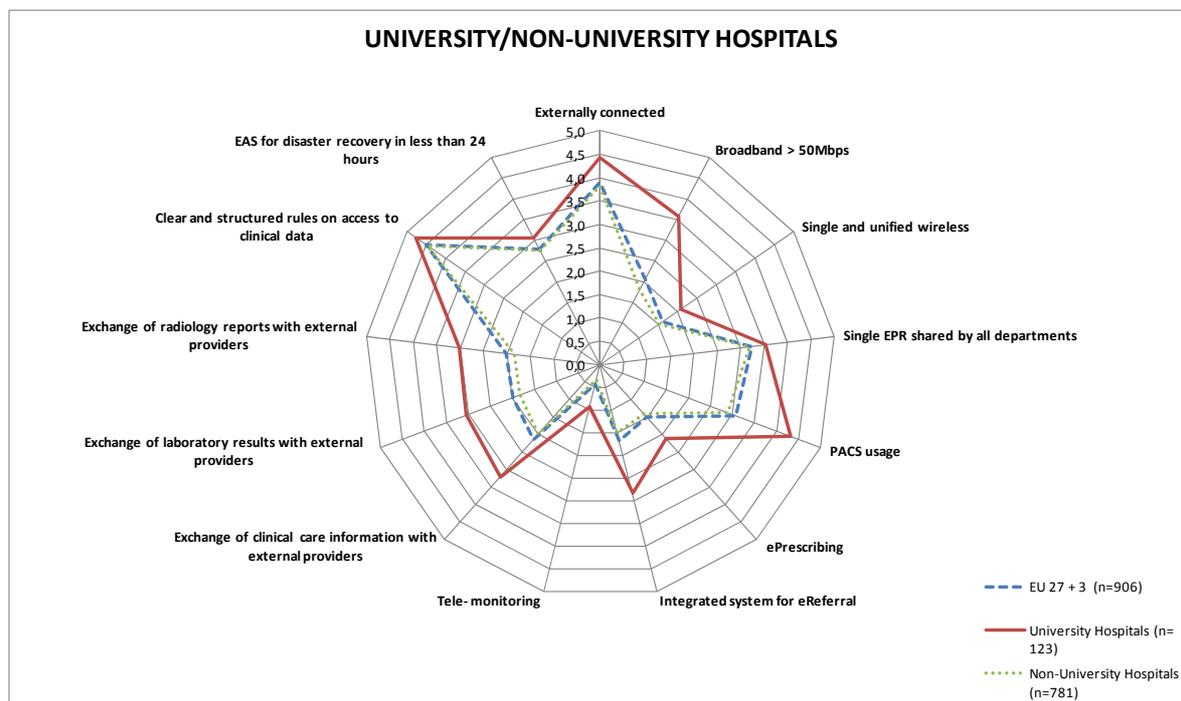
The eHealth Benchmarking III survey findings have shown, in many instances, how university hospitals are more sophisticated than non-university hospitals regarding eHealth activities outside and inside the hospital organisation.

These differences might, in general, be related to the fact that university hospitals:

- Undertake more research and are more open to new technologies and developments.
- Are, by definition, teaching hospitals, and thus must teach medical students and doctors involved in continuing education, about the newest and most up-to-date techniques and technologies (Tokuda et al. 2010).
- Are typically publicly funded, and are non-profit, which means that they can invest more in new technologies.
- Because of their larger size, they may:
  - achieve economies of scale when investing in such systems.
  - be able to justify easier investment (since the cost in person hours and resources of transporting files physically may be much higher as the physical size of the hospitals is greater).
  - may experience a larger administrative burden (which may to some extent be alleviated by these ICT systems).

Figure 100 shows the average EU+ eHealth profile applied to both university and non-university hospitals.

Figure 100 – EU+ eHealth Profile by University/Non-university hospitals



This spider diagram shows that the non-university hospitals are very close to the EU+ average. This is to be expected, given that there are six times more non-university hospitals than university hospitals, that is, they might be expected to be nearer to the “typical” (or “average”) hospital.

On all indicators, therefore, the university hospitals which were surveyed outperform non-university hospitals. University hospitals might be expected to be among those that do a greater amount of research, a greater amount of teaching, and undertake more experimental forms of surgery. Hence, they could – as a result – be subject to a higher degree of patient referrals, and be better connected, undertake more communication with external institutions, and generally exchange more data with other institutions.

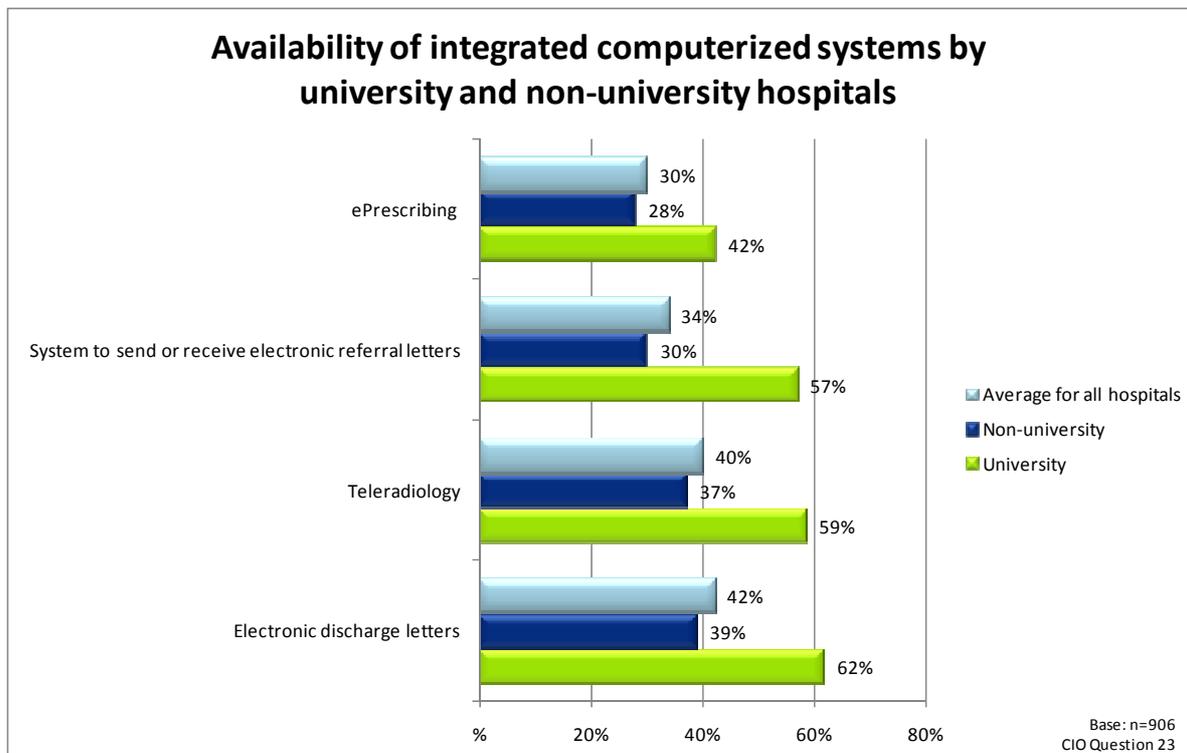
There are seven indicators of the 13 where the difference between university and non-university hospitals is particularly large. These are:

- High speed broadband,
- PACS,
- ePrescribing,
- eReferral,

- Exchange of clinical care information with external providers,
- Exchange of laboratory results with external providers,
- Exchange of radiology reports with external providers.

Figure 101 shows that university hospitals have a much higher availability than do non-university hospitals of such advanced computerised systems as ePrescribing, tele-radiology, systems to send or receive electronic referral letters, and electronic discharge letters.

Figure 101 - Availability of integrated computerised systems by university and non-university hospitals



Finally, university hospitals seem to have also a larger number of online chronic disease management programmes in place. This is evident as four of the 30 university hospitals where a medical director was interviewed have chronic disease management programmes against only eighteen of the 250 non-university hospitals offer it. Furthermore, in connection with chronic disease management programmes, three of the 30 university hospitals offer tele-monitoring services to outpatients at home against only seven of the 250 non-university hospitals. An additional example is that of the three university hospitals, two offer this service for chronic renal diseases whereas only one of the seven

non-university hospitals offer the service for the same disease. This could related to their orientation towards more innovation and more experimentation when compared to the non-university and the average EU+ acute hospital.

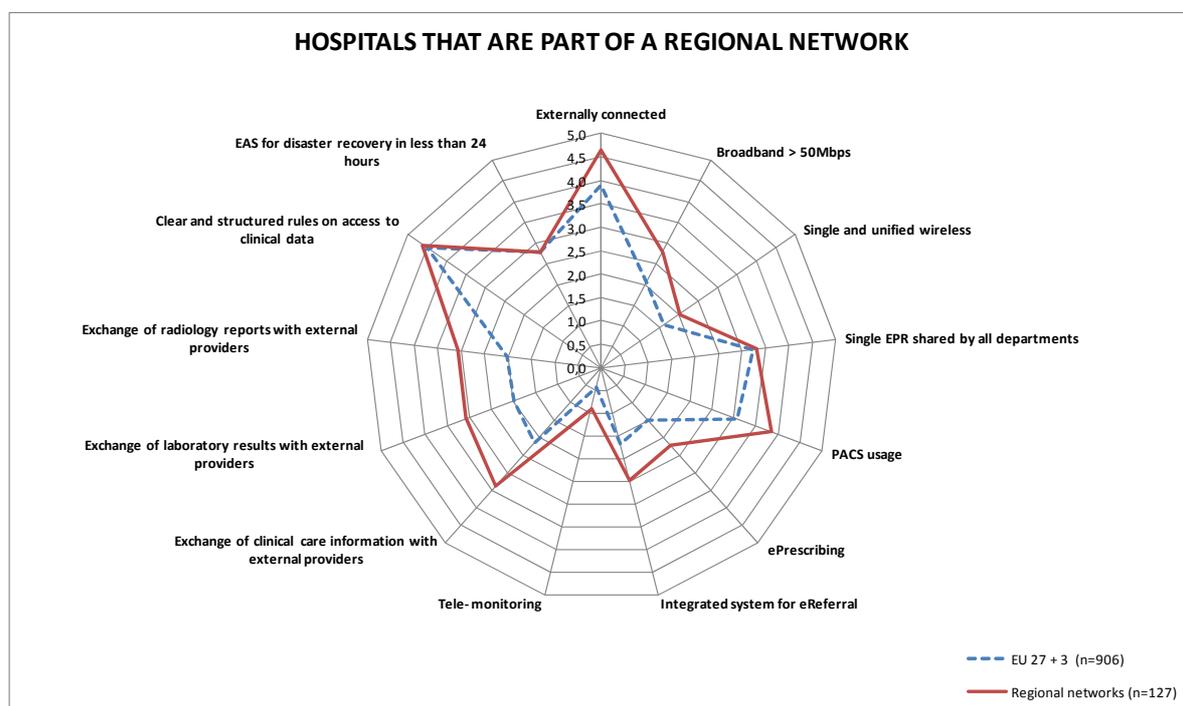
### 5.3.4 Hospitals that are part of a regional network

The eHealth Benchmarking III survey findings have shown, in many instances, how hospitals that are part of a regional network are more sophisticated than stand-alone hospitals regarding their eHealth activities both inside and outside the hospital organisation. A higher level of network connectivity is associated with a higher eHealth profile in the these acute hospitals.

Dedicated, regional networks have been promoted by many EU Member States: on the one hand, they provide a secure, robust, infrastructure; they enable the sharing and maintaining of interoperability challenges in a coordinated manner; and, on the other hand, they can also generate a cost-effective manner for sharing systems across different healthcare levels in the same region or even nation.

These type of networks are particularly typical of the Nordic countries and countries such as the UK.

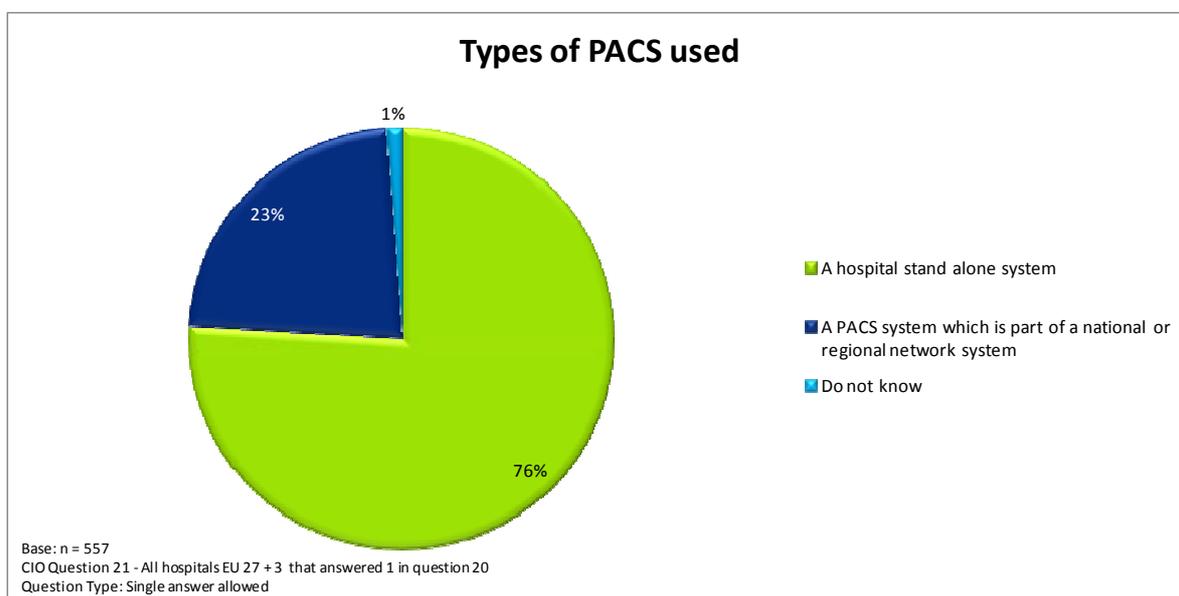
Figure 102 – eHealth Profile for Hospitals that are a part of a Regional Network



The survey findings indicate that there is a link between regional network connectivity and uptake of certain technologies: the more connected a hospital, the higher the uptake. It points to the fact that regional network connectivity is a best practice.

Figure 103 shows, that 23% of all hospitals have a PACS that is part of a national or regional network system. Many hospitals have invested in a system that is part of a larger external network: this indicates that there are significant advantages to be drawn from being connected to such a network. The benefits obtained from having a PACS may be larger if there is a network to connect to: thus, the availability of such a network may make it more attractive for hospitals to invest in such systems. PACSs form part of regional or national networks in nearly three-quarters of hospitals in the UK and in seven out of eight Swedish ones.

Figure 103 – Type of PACS



As Figure 104 shows, hospitals that are a part of a regional network are generally more advanced in their use of various technologies. This figure illustrates that, whereas 61% of all hospitals surveyed use PACS, 77% of those hospitals form part of a regional (or national) network system that is using PACS. It also shows that, whereas on average just 39% of all hospitals surveyed have video conferencing facilities (VCF), 61% of the hospitals that are a part of regional networks have such facilities. Similarly, whereas 30% of all hospitals surveyed have ePrescription, 44% of hospitals that are a part of a regional network have it.

These figures clearly support the hypothesis that there is a positive correlation between the use of the various technologies and hospitals being part of a regional network. Thus,

strengthening and enlarging regional networks may increase the adoption and use of such technologies in general.

Figure 104 – Use of different technologies – hospitals part of a regional network vs average for all hospitals

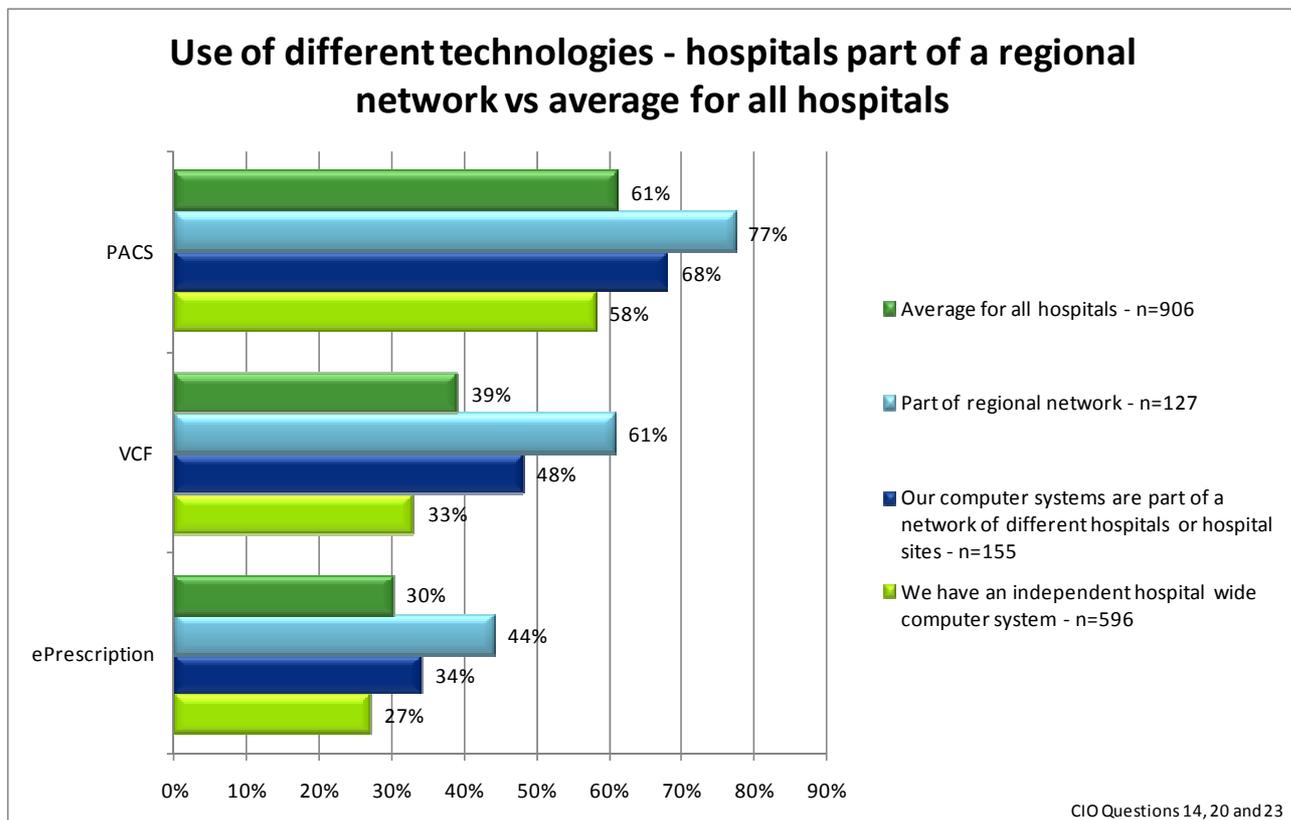
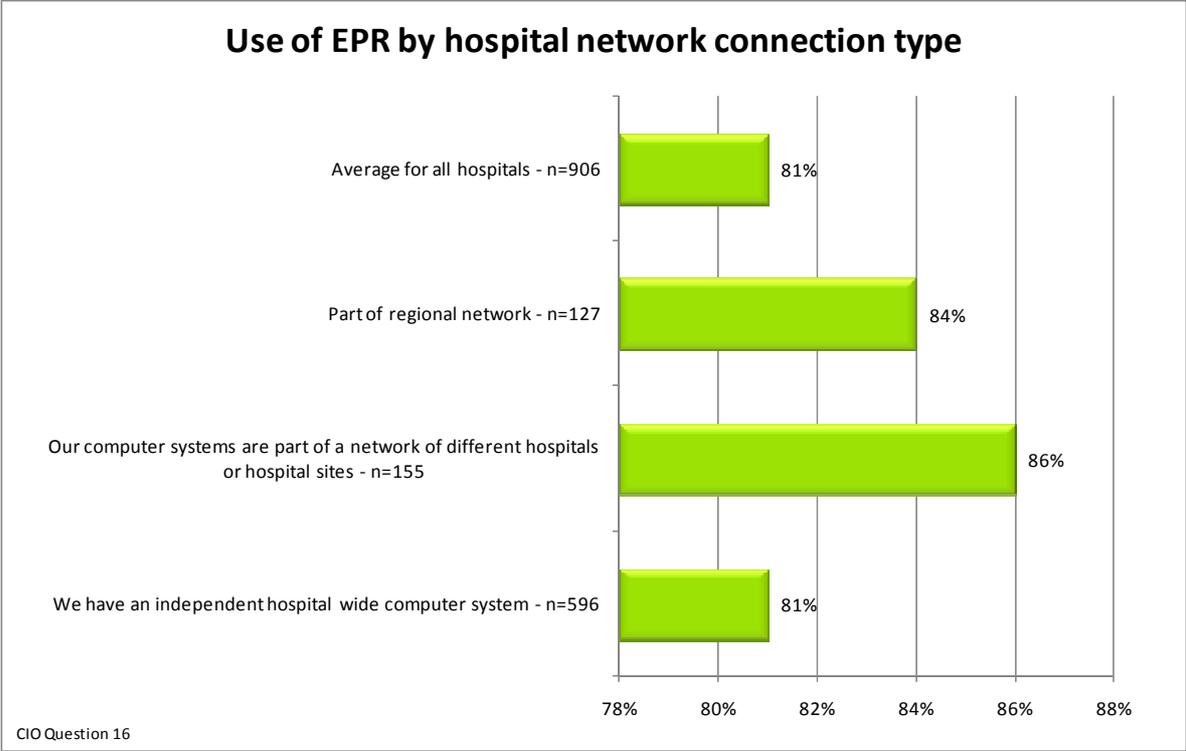


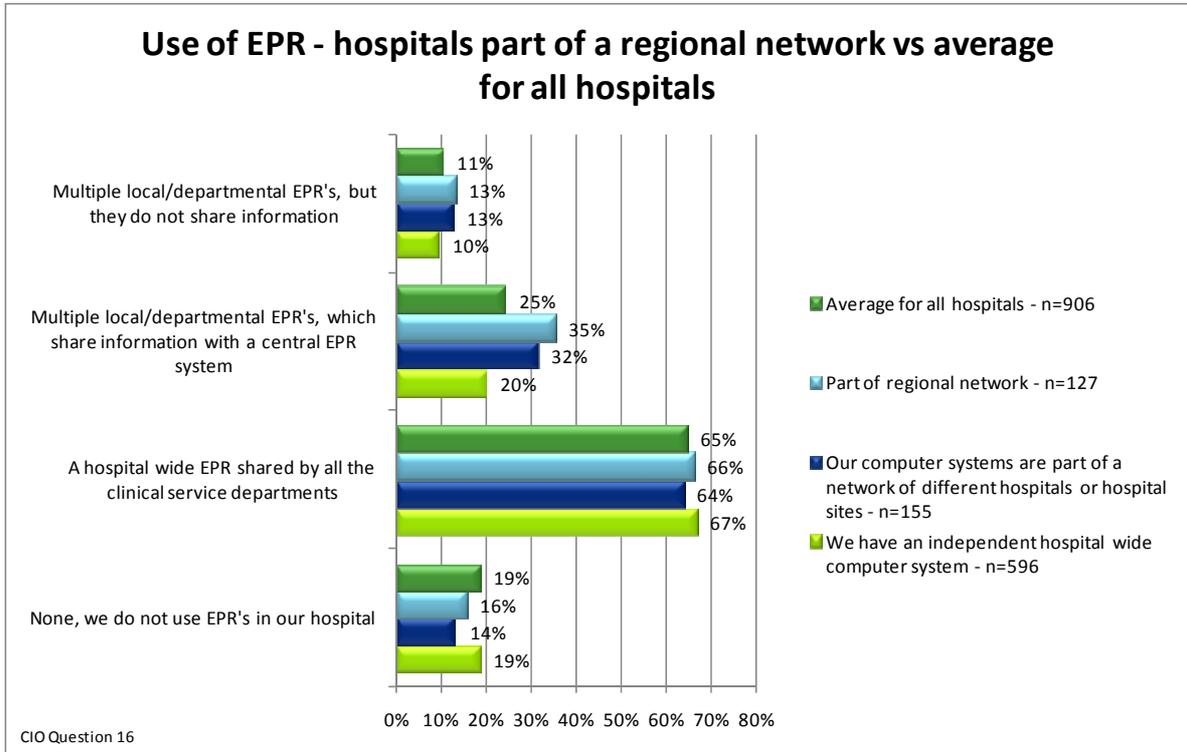
Figure 105 provides further evidence that being part of a regional network has a positive effect on the adoption and use of various clinical, hospital applications and technologies. The figure shows that the hospitals that share EPR systems the most are hospitals for which the computer system is part of a network of different hospitals or hospital sites. The second group of hospitals which share data and communications most is those which are part of a national and regional network.

Figure 105 – Use of common EPR systems sharing information centrally by hospital network connection types



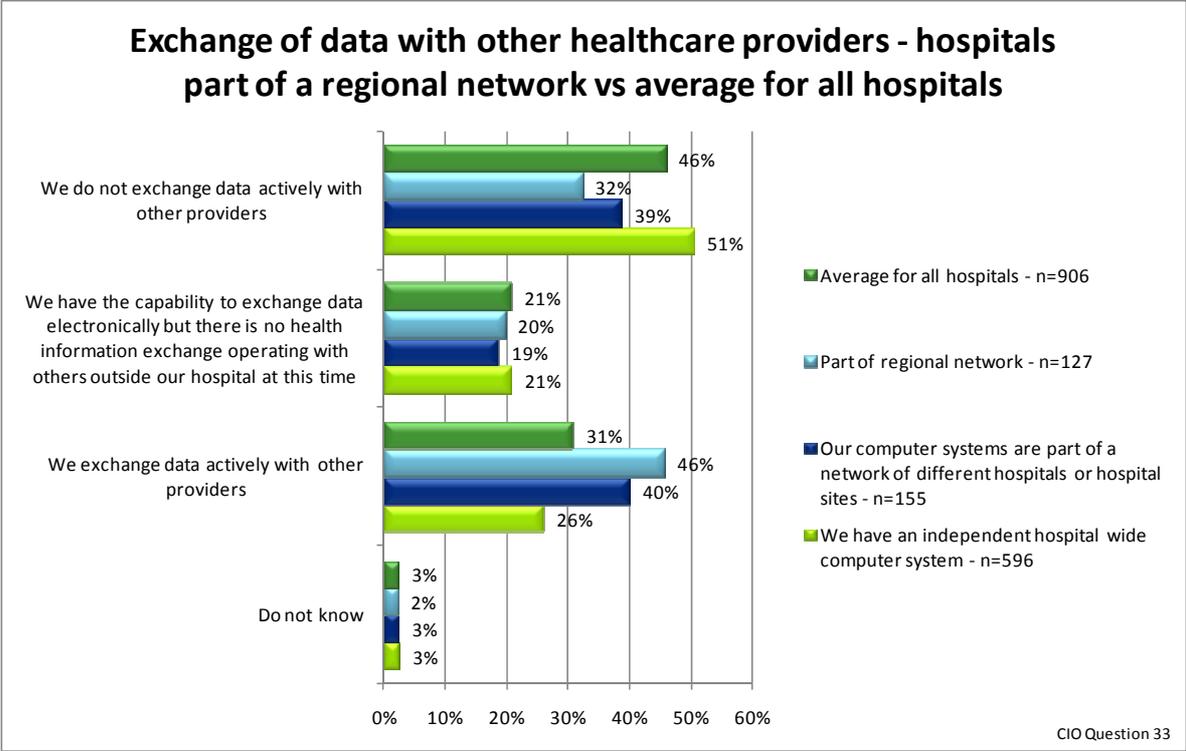
Furthermore, Figure 106 shows that the higher the level of connectivity, the more likely hospitals are to have multiple local/departamental EPR systems which share information with a central EPR system.

Figure 106 – Use of EPR systems – hospitals part of a regional network vs average for all hospitals



Finally, as shown in Figure 107, hospitals which belong to a dedicated regional network are also much more likely to exchange medical data with all type of external providers when compared to hospitals that are not connected to these networks or in comparison to the average EU acute hospital.

Figure 107 – Exchange of data with other healthcare providers – hospitals part of a regional network vs average for all hospitals



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## 6 Comparisons with similar Survey Exercises

This chapter contains two main elements:

- A retrospective comparison to show good progress made on eHealth in European hospitals when compared to previous studies.
- A comparison with a few indicators from the 2010 American Hospital Association (AHA) Annual Survey Information Technology Supplement Health Forum.

These two topics are discussed in sections 6.1 and 6.2 respectively.

### 6.1 Progress to date as compared to previous studies

For the first time, this 2010 survey includes all the EU27 Member States as well as three additional countries (Croatia, Iceland and Norway). It also comprises all sizes and types of hospital within the acute hospital field.

This section focuses on comparing the results from this study with the results from the 2004 Hospital Information Network Europe (HINE) survey (the year in which more countries were surveyed by HINE), and the 2006 e-Business W@tch Hospitals activities study.

These two previous surveys are the most comprehensive EU-related sources of empirical information about ICT use in hospitals. They form useful points of comparison with the 2010 eHealth Benchmarking III survey findings. All three surveys are similar, in the sense that they have targeted CIOs as their principal respondents and have used a CATI-based survey methodology. Some, but not all, of the indicators of the surveys are common to all three. The e-Business W@tch, and this 2010, surveys are similar in so far as they both target all hospital sizes.

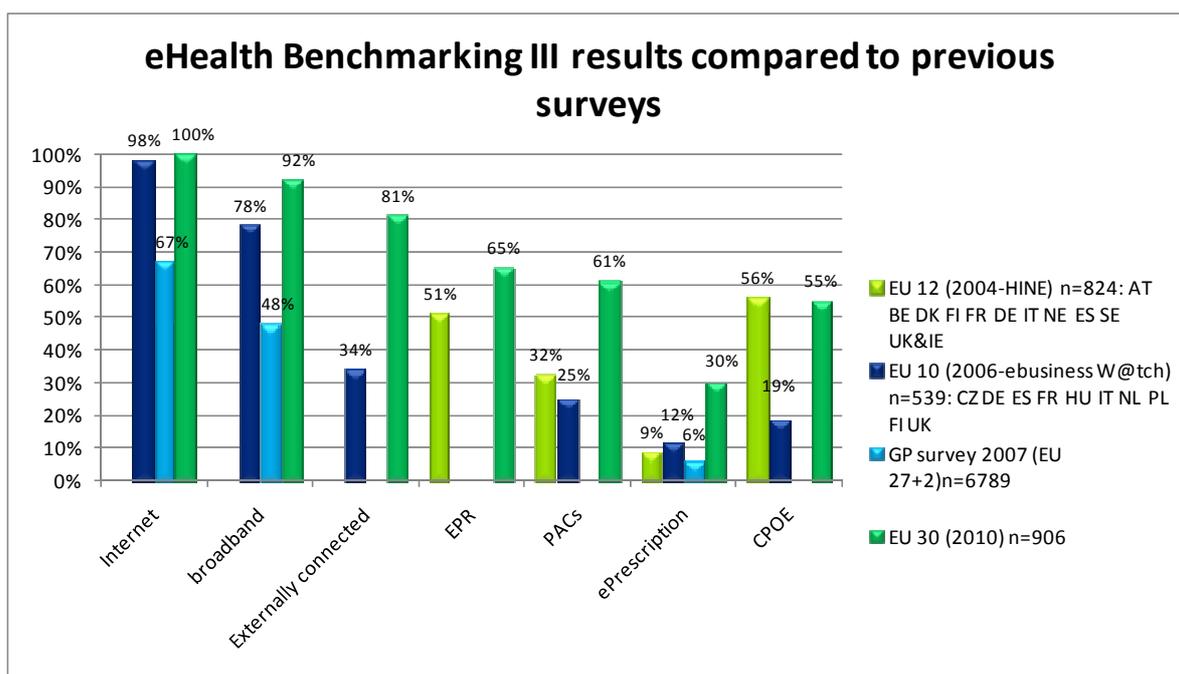
As a general observation, the series of HINE surveys was commissioned with support from nine leading ICT companies. Meeting the business interests of these companies, HINE targeted hospitals with more than 100 beds. Thus, the 2004 HINE survey contrasts with both the 2006 e-Business W@tch survey, and this 2010 survey, in two major ways. First, the 2004 HINE survey does not offer a representative sample in terms of classes of hospital size. Second, HINE overestimated ICT use across hospitals of all sizes (HINE focused more on large hospitals).

Hence, some reservations should be borne in mind when attempting to compare the three surveys. The surveys, which were undertaken in 2004, 2006 and 2010, did not ask

precisely the same questions nor did they use exactly the same sample frames and country coverage. The HINE and the e-BusinessW@tch surveys included only twelve and ten European countries respectively. They focused primarily on the former EU15 Member States.

Due to the differences in the sample selection and the formulation of various questions used in the various surveys, the statistics which emerge are not directly comparable. However, they can provide an indication of the general development of ICT use in EU acute hospitals. As a result, the analysis which is derived here should be considered as being for indicative purpose only. Figure 108 illustrates the indicators can be considered for indicative comparison with the findings that have emerged from the eHealth Benchmarking III survey.

Figure 108 – e-Business W@tch and HINE comparison



Three major messages result from this initial comparison. They refer to good progress in relation to three aspects: broadband and the Internet; hospitals' deployment of eHealth in comparison to that of general practitioners; and the introduction of clinical applications generally.

The first highlight is the **good eHealth progress that can be observed in EU acute hospitals since 2004** for all of the similar indicators that were investigated. There has been sound improvement in both connectivity and in the implementation of medical computerised

systems. This is particularly relevant when it is considered that the two previous surveys included mainly former EU 15 Member States (whereas this 2010 survey included all 27 of the EU Member States, and a further three European countries).

For example, 98% of the hospitals in Europe reported having Internet access in 2006. Currently the level is 100%. On broadband, there has also been a good improvement: 78% of hospitals had it in the 2006 e-BusinessW@tch survey whereas today its penetration is at 92%. In 2006, only 34% of the hospitals surveyed offered the possibility of remote access to the hospital's computer network whereas this in 2010 that has increased to 80%.

The second highlight is the **comparison with the previous connectivity of general practitioners**. European hospitals seem to be **more connected to ICT than general practitioners**. According to the 2007 survey of general practitioners' ICT use which took place in the 27 Member States, only 48% had a broadband connection (European Commission and empirica 2008, p6). Hospitals are more connected to the Internet and to broadband than general practitioners, and ePrescribing is about five times more available than in the case of general practitioners.

The third highlight is the situation that relates to **a variety of clinical applications' availability and use in EU acute hospitals**, especially EPR systems, ePrescribing, PACS and CPOE. Hospital-wide use of EPR systems have increased from the 2004 HINE survey (when they were used in 50%) to over 60% of hospitals. Similarly, while only 8.6% of hospitals reported that they were using integrated electronic prescribing in HINE, two years later in e-BusinessW@tch, the figure was 10%. In 2010, that figure has tripled to 30%. PACSs are much more prevalent in 2010 was the case in either 2004 and 2006. CPOE software is more commonly available, particularly in comparison to 2004.

The overall message is of good progress made in terms of eHealth availability in EU acute hospitals. These results, and the advances observed, are particularly relevant when the spread in the number of countries investigated – including the considerable increase in New Member States – is considered.

In conclusion, any future focus with specific regard to hospitals could be on monitoring the improvement in performance in the advanced types of eHealth indicators such as the 13 indicators which have been included in the study's acute hospital eHealth profile. For instance, broadband would no longer be considered an application on which to

concentrate since it has now reached saturation point. Any future emphasis could be on the quality – and speed – of the broadband available: to ensure a minimum quality of service acute hospitals might need to use high-speed networks for remote eHealth imaging services.

## 6.2 Progress in the EU as compared to the AHA 2010 survey

This section contains a number of indicative comparisons between the EU and the US on selected eHealth indicators. The two surveys share the fact that both were targeted at CIO respondents.

The US data has been provided to the study team by the US Department of Health and Human Services from its 2010 Hospital IT instrument survey that was conducted by the AHA. A thorough comparative exercise is, however, limited as only a few indicators are comparable.

The two surveys were conducted using different tools over differing periods of time<sup>57</sup>. They include different phrasing of questions and a varied base of indicators. Methodologically, therefore, the comparisons of the survey findings are only indicative since different survey methodologies were used in each of these two surveys.

The relevant data is compared indicatively at three levels:

- First, a number of applications which have been fully integrated hospital-wide.
- Second, the level of external medical exchanges with hospitals outside their systems wireless communications.
- Third, the level of patient's access to medical information electronically.

Table 3 offers insights into the first dimension of the data, the number of applications which have been integrated hospital-side. American hospitals are slightly more advanced in the deployment of some clinical applications. However, European hospitals are definitely more advanced in terms of CPOE in whatever way this is measured. The availability of telemedicine/telemonitoring in hospitals on both sides of the Atlantic is still relatively low.

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<sup>57</sup> In the USA, an online questionnaire involved six months of fieldwork. It resulted in over 4,600 CIO responses. The EU eHealth Benchmarking III survey used a telephone-based CATI exercise, which lasted for two months, and resulted in 1,186 interviews (906 of which were with CIOs).

Table 3 – US/EU comparison for availability of eHealth medical applications in acute hospitals

USA* indicators	Fully Implemented across all units USA	USA sample	EU** indicators	Availability of ... in the EU (%)	EU sample
Results Viewing Laboratory reports	79%	n=4,585	electronic transmission of results of clinical tests and laboratory tests	x70%	n=906
Results Viewing Radiology images	77%	n=4,634	PACS	x61%	n=906
Discharge summaries	50%	n=4,626	Integrated system to send electronic discharge letters	42%	n=906
Computerised Provider Order Entry (CPOE) (laboratory tests)	21%***	n=4,593	existence of a computer-based system for electronic service order-placing	x55%	n=906
Telemedicine	11%	n=4,598	telemonitoring	x8%	n=906

**Notes**

\*Question 1 in the USA Hospital Instrument survey 2010: Does your hospital have a computerised system which allows for...? Possible responses(only one choice possible): (1)Fully Implemented Across ALL Units (2)Fully Implemented in at least one Unit (3) Beginning to Implement In at least one Unit (4) Have Resources to Implement in the next year (5) Do Not have Resources but Considering Implementing (6) Not in Place and Not Considering Implementing-Fully implemented meant it has completely replaced paper record for the function and this is the breakdown that has been considered for comparison with the EU level indicators. However the EU survey did not refer to complete replacement but only to integration of the computerised systems in the hospitals.

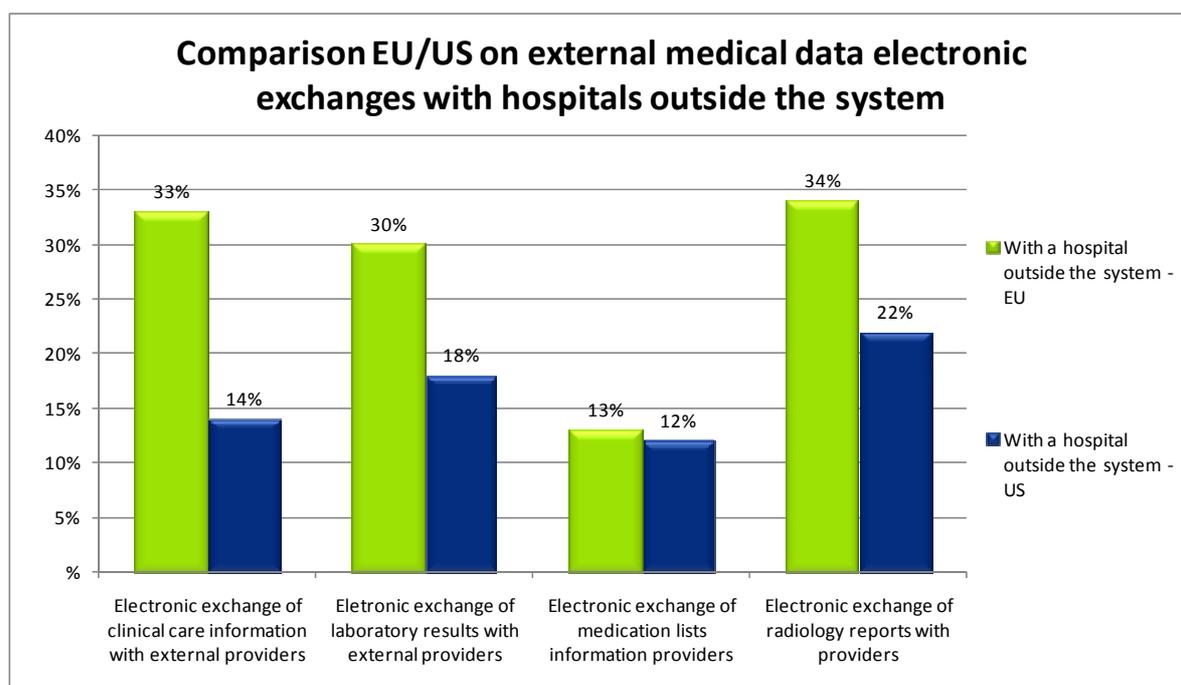
\*\*EU results from questions: 20, 23, 26, 27 and 30.

\*\*\*When the responses with regard to a CPOE for laboratory results implemented in at least one unit are considered, this percentage increases from 21% to 34%. The study team finds the latter percentage to be potentially more accurate in comparison with the EU figure.

On the second dimension of the data, the US and EU comparison focuses on the exchange of different types of medical data with external providers. eMature hospitals (or hospitals that are more mature in terms of their ICT availability) are characterised by the enabling of wireless communication access to a variety of applications and services throughout the hospital departments, wards or rooms. These data can be compared directly since the two items were included by using a similar format and wording in both questionnaires. The results show that European hospitals are more likely to undertake external medical data exchanges with all types of medical data that were surveyed than the US hospitals. For three separate applications (clinical care information, laboratory results and radiology results), the level is higher than 30 percent in Europe whereas it is around 20 per cent in American hospitals. For medication information exchanges, both the EU and US hospitals

stand at a low level of hospitals (13%) that exchange medication lists' information with providers that are external to their system (in another hospital, for example).

*Figure 109 – USA/EU comparison on external data exchanges with external hospitals: Does your hospital electronically exchange any of the following patient data with any of the providers listed below?*



Finally, a third dimension has been considered for comparison: this is whether the hospital provides patients with an electronic copy of their health information. The analysis shows that the USA is currently more advanced in providing access of medical records electronically to patients. Out of the 34% of US hospitals that replied positively to this question (n=1,579), 9.5 % of CIO respondents said that they provide patients with their health records. Nineteen per cent of them do so through an online portal (see Figure 111). In the EU, only 3% of CIO respondents provide some type of online access to some of the medical data in the EPR (see Figure 112).

Methodologically, however, it is important to note that the questions posed in the surveys on either side of the Atlantic are somewhat different. The US question focused on the provision of electronic copies of the patient medical record to the patient, whereas the EU question concentrated on the provision of online access to the record.

Figure 110 – USA Question providing patients with an electronic copy of their health information

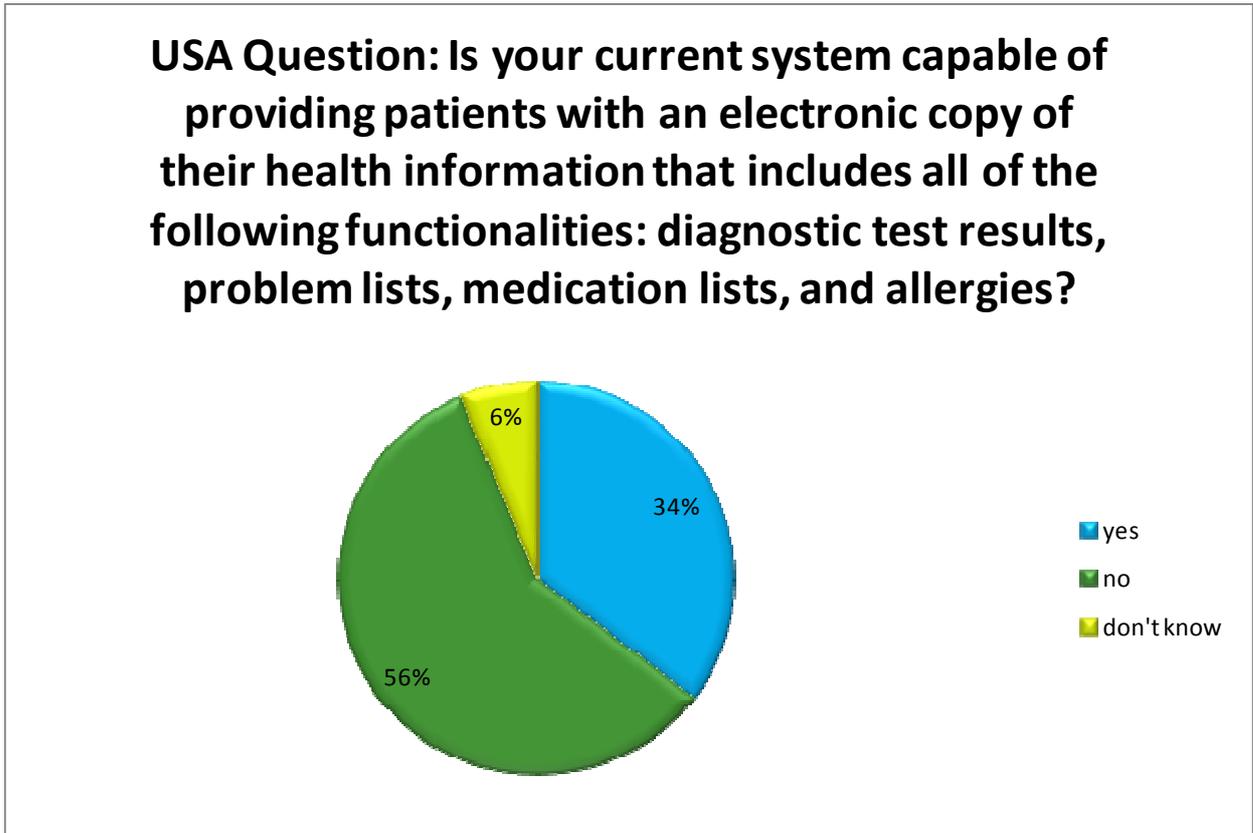


Figure 111 – Through what mechanism(s) are you currently providing this electronic information?

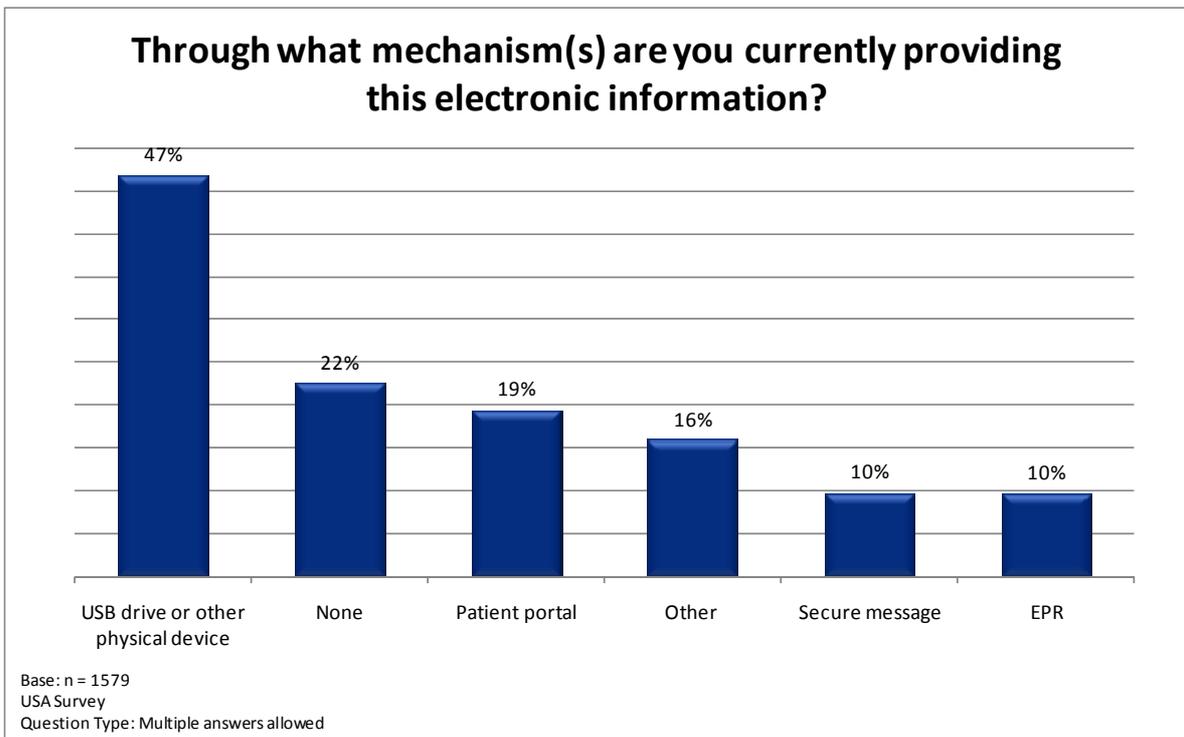
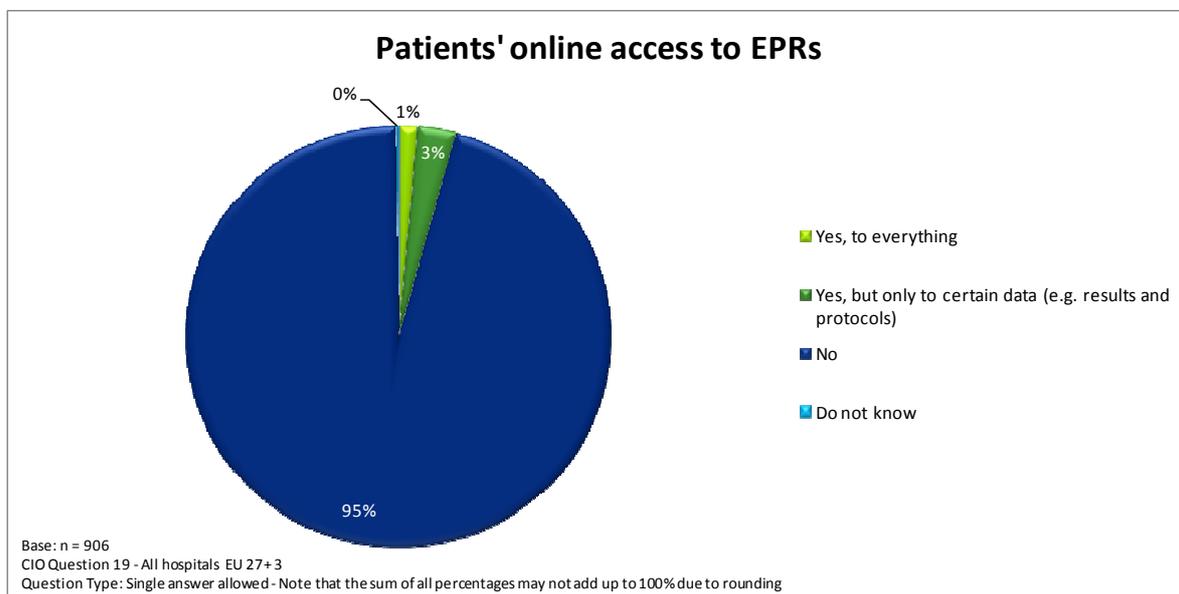


Figure 112 – Patients' online access to EPR systems



In conclusion, the analysis shows that the USA is currently slightly more advanced in the availability of some clinical applications and in the provision of access of medical records electronically to patients. European hospitals are, however, more advanced in terms of the way in which they undertake external data exchanges with hospitals outside their immediate system.

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## 7 Lessons learned for future benchmarking

This chapter brings together the findings from the two sets of survey data on acute hospitals in Europe (from CIOs and Medical Directors). It also draws on observations made during the validation phase of the survey. As a result, it outlines a number of potential lessons learned for the future of benchmarking.

The eHealth benchmarking III survey findings open up a number of new possibilities to European policy-makers and health authorities. They include the opportunity to:

- Understand the strengths of European acute hospitals in terms of ICT.
- Consider what foundations (building blocks) need to be laid down to ensure future connectedness, interoperability and external data exchange in terms of different eHealth applications such as EPR systems, ePrescribing and telemedicine.
- Understand how health professionals in acute hospitals use ICT and what are the barriers and incentives to that use.
- Examine how further work can be undertaken to expand eHealth implementation and use in European hospitals and in other organisational settings.
- Develop a wider European focus on constructive stakeholder engagement (whether of health players, payers, or people) and pro-active involvement of all participants in institutional, social, and technical innovations in the health and eHealth fields i.e., consider the use of socio-technical and/or participatory approaches to change management.

This first eHealth survey of ICT implementation and use in acute hospital in 30 European countries has resulted in a wealth of information about the availability of ICT in this sector. It has expanded considerably the previous data available which dates from the middle of the last decade<sup>58</sup>. The survey has also enabled a provisional examination of its findings with those which are currently emerging from the US. It is feasible that the survey findings could also be compared and contrasted with a wider range of OECD countries or with countries globally (from data published by the WHO).

The CIO survey findings provide the current state-of-play with regard to eHealth implementation in acute hospitals. They refer specifically to ICT infrastructure, clinical

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<sup>58</sup> These earlier findings were limited to a far smaller number of Member States and did not target the EEA or current candidate countries.

electronic applications, integration with external healthcare organisations and issues related to security and data protection. The findings which pertain to acute hospitals' Medical Directors focus on their priorities for ICT investments, the key barriers and impacts observed in relation to EPR systems and telemonitoring, and some possible interpretations that relate to actual use of systems.

As a result, there are two sets of lessons learned. The first list is of key policy-related messages. They relate largely to health systems and services, and policy related to technologies (see section 7.2). The second refers to potential methodological approaches that could be taken into consideration when the next round of eHealth benchmarking measurements are undertaken (they refer to surveys, other forms of study and their various methodologies) (see section 7.3). Before each set of lessons learned is explored in detail, a table presents the main findings. These two tables are Table 4 and Table 5.

#### 7.1 Validation workshop and its outcomes

As a last stage of this survey, a validation workshop was held on January 18, 2011 in order to gain feedback on the accuracy of the survey findings. This validation exercise concentrated on aspects relating to telemonitoring, the continuing weaknesses and/or barriers to ICT implementation as well as the use of ICT in European hospitals and the use of ICT by medical staff, other personnel and other stakeholders.

Following the validation workshop, an initial analysis of the survey findings was expanded to include a number of observations about the survey's strengths, potential enhancement or enlargement and its institutional or organisational implications. The list was also categorised and classified according to a more concise number of observations.

Validation workshop attendees suggested the possibility of structuring a questionnaire survey around the use of various key applications by health professionals, with a focus – in the following order – on EPR systems, ePrescribing, and telemedicine/telemonitoring. It was even proposed that the sample of respondents needed could extend as high as 40,000<sup>59</sup>.

Commentary from the group of experts present at the workshop identified a number of additional questions that could be raised as part of future benchmarking exercises. The

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<sup>59</sup> This comment was made by the industry group representative to the *ad hoc* experts' group (formerly known as the i2010 sub-group on eHealth).

types of questions to be posed could be expanded to a far wider range of services, different types of health professional (a range of medical, health and care staff) and an examination of the implications of diverse applications for different categories of care for patients. In any case, for many of the questions proposed no specific category of respondent was suggested by the workshop attendees.

Many of the questions proposed are open questions (rather than closed questions). While many of the questions raised are of considerable interest, they would prove difficult to pose as closed questions in a questionnaire format. Many of the items that relate to change management might also provide unclear responses even when raised in an interview setting. Other forms of study might need to be considered to as to undertake a more effective handling of these research issues.

Where it has been feasible, these questions have been added to the lessons learned (see section 7.2).

## 7.2 Policy lessons learned

The survey findings offer a clear picture of the state-of-play in terms of the digitisation of hospitals. They focus on a number of EU policy priority issues. They refer in some cases to implementation, and in others to use. They permit an understanding of how hospitals deploy and implement ICT, how their staff use it, and what are the main incentives – and barriers – to that use.

### 7.2.1 Potential policy directions

A number of key messages emerge from an analysis of the CIO and Medical Director findings. They are particularly relevant for EU policy purposes. They are organised into five categories. These are the: fit with policy documents; hospital infrastructure and connectivity; availability and use of electronic medical applications in hospitals; electronic patient data exchanges; and a bridge with a new methodological approach.

No specific observations are made here with regard to data protection and security aspects.

Table 4 – Policy-related observations

<b><u>Table of policy-related observations</u></b>
<b><u>Potential policy actions</u></b>
Create a fit with various policy documents
Identify, remove, and reduce any gaps inherent in terms of policy directions
<b><u>Hospital ICT infrastructure</u></b>
Investigate whether more ultra-fast broadband (above 100Mbps) is needed in hospitals
Towards a ubiquitous hospital – is more wireless needed?
<b><u>Availability and use of electronic medical applications in hospitals</u></b>
EPR systems are deployed but are not broadly used
Apply appropriate incentives for health professional to use EPR systems
Focus on patients' access to EPR systems
Interoperability is still an issue – concentrate on it
Pay attention to low telemedicine deployment and intention to invest
<b><u>Electronic patient data exchanges</u></b>
Low levels of European data exchanges – involve more hospitals in a pan-European approach
<b><u>A bridge towards a new methodological approach</u></b>
An overall census of European hospitals could prove useful
Involve a wide range of hospitals
Focus on the clinical experience of medical staff in terms of ICT support to increase quality of care
Pay attention to patients' needs in terms of the support that ICT offer
Ask a wide range of questions with regard to the use of legacy systems and use of future systems.

### 7.2.1.1 Create a fit with various policy documents

1. Good progress made with regard to the eHealth Action Plan 2004 but focus is still needed on specific applications

Sound progress has been made with regard to the issues and actions outlined seven years ago in the eHealth action plan (COM(2004)356 final). There has been measurable advancement since the last hospital surveys undertaken by commercial organisations and by the EC in 2004 and 2006 (such as HINE and e-Business W@tch). Some indicators, such as broadband penetration, have now virtually reached saturation point (at 92% of all acute hospitals). (The extent to which higher broadband rates are required in hospitals appears, according to feedback during the validation process, to be an ongoing topic of discussion.)

Despite the generally good progress, advancement in certain specific areas has been much slower. A specific example is the extent to which EPR systems are being used in conjunction with other applications. ePrescription, especially in terms of connectivity to external pharmacies outside the hospital (see question 24 of the CIO survey), and eDispensing<sup>60</sup> remain applications whose use could be expanded. Another is telemedicine and telemonitoring whose implementation and use remain low. Other insufficiently explored applications include eBooking and eReferral.

Decisions about the expected rate of progress, and the next steps for policy commitment, need to be borne in mind in the context of any new action plan or road map under consideration by the European Commission and the Member States in conjunction with the eHealth Governance Initiative.

2. Identify, remove, and reduce any gaps inherent in terms of policy directions

The eHealth benchmarking III survey findings can be read within a wider policy and institutional context. There is still a need to counterbalance certain policy gaps that are still evident in the EU despite good progress.

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<sup>60</sup> These kinds of activity could be associated with potential revisions in European policy approach with regard to drugs sales and marketing. See, for example, accessed February 23, 2011 <http://www.europarl.europa.eu/en/pressroom/content/20110215IPR13734/html/Fake-medicines-Parliament-approves-new-rules-to-protect-patients-better/>.

The extent to which the implementation and use of applications in relation to the degree to which certain policy documents refer to them should be seriously considered – that is, are the aims of the policy documents being achieved, what initiatives need to be strengthened, and/or what indicators or benchmarking exercises will need to be introduced to monitor their progress. Examples include the proposed cross-border directive on patient rights (European Parliament 2011); the Lead Market Initiative (COM(2007)860 final); the Recommendation on the interoperability of EPR systems (COM(2008)3282 final); and the telemedicine Communication (COM(2008)689 final).

A last example relates to inequality in health and healthcare terms throughout the EU. Gaps relate to health as well as eHealth. They include the need, for example, to: fight healthcare inequities<sup>61</sup> whether in isolated, rural areas or in impoverished inner urban/city areas (COM(2009)567 final). This could lead, for example, to a focus on the relationships that could be built up between small and non-university hospitals with large, research-oriented or university hospitals (and to do so through appropriate support by eHealth). As a result, acute hospitals, and their personnel, would not be separated or alienated from other forms of hospitals nor secondary care from primary care. Various divides would need to be explored and counterbalanced. They could include: north-south treatment divides; old-new Member State treatment divides; and hospitals' or a doctors' digital divides<sup>62</sup>. It would be feasible to concentrate on the possibilities for leapfrogging on the part of systems and services in regions which have until now been lagging behind, professions or occupations which have not shown keen exploration of ICT.

#### 7.2.1.2 Hospital ICT infrastructure

1. Investigate whether more ultra-fast broadband is needed in hospitals

Next generation networks remain a key issue for the EC in the Digital Agenda for Europe (COM (2010)245 final/2): the agenda covers both fast and ultra-fast broadband, and having hospitals deploy these new networks may become an increasingly relevant policy priority too.

Medical network infrastructures allow hospitals to implement applications such as electronic data transmission for emergency units, electronic imaging exchange,

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<sup>61</sup> DETERMINE. Accessed February 16, 2011. <http://www.health-inequalities.eu/>.

<sup>62</sup> Eurobarometer measurements often explore different forms of digital divide.

telemonitoring, and videoconferencing. Hospitals need to ensure adequate internet capacity for next generation services which would include particularly the video and imaging applications inherent in telemedicine.

The eHealth benchmarking III survey has shown that 92% of EU hospitals have broadband. Fifty per cent of them have speeds of higher than 50MBps (see question 10 in the CIO questionnaire). A considerable number already have speeds of higher than 100MBps.

No evidence emerged from the literature survey undertaken by the study team of any particular need for fast or very fast broadband in hospitals. However, both the speed of the channel and the number of channels that can handle parallel transmissions might need to be considered. It might be appropriate to undertake further investigation on this, and related, issues. This is especially because it is currently not clear what impacts these observations may have with regard to the use of certain applications, such as telemonitoring, or other electronic services either by health professionals and/or by citizens/patients and their carers and families.

## 2. Towards a ubiquitous hospital – is more wireless needed?

Ubiquity in computing terms implies the state of being able to have access to ICT facilities everywhere at once. Ubiquity is becoming an increasingly important notion in terms of hospitals (Le et al. 2010). Wireless and mobile computing in hospital environments is becoming an important part of healthcare's ICT toolbox (Holzinger et al. 2005). The major potential benefit of wireless and mobile computing is to enable caregivers to access clinical data and applications anywhere and anytime, but also potentially patients themselves. Doctors in acute hospitals need an efficient means to enter and retrieve data: they need to spend less time looking for an available desktop to log in and enter information into the system. Up-to-date record-keeping of the health status of out-patients (and even ordinary citizens) may also be facilitated by wireless and mobile equipment.

The eHealth benchmarking III survey has shown that only one-third of European acute hospitals have a hospital-wide wireless infrastructure. Wireless Internet access in any location of the hospital remains low (see questions 11 and 12 of the CIO survey). Again, it is currently not clear what impacts these observations may have with regard to the use of telemonitoring (or other electronic services) either by health professionals and/or by

citizens/patients and their carers and families nor what the legal, regulatory, or clinical restrictions might be on such uses.

Wireless access to EPR systems and PACS is also low.

#### 7.2.1.3 Availability and use of electronic medical applications in hospitals

##### 1. EPR systems are deployed but are not broadly used

There is a need to focus on EPR integration and improved functionality. Capturing and accessing clinical data from patients electronically in a hospital is critical to achieving many potential benefits offered by ICT. These include greater patient safety and, through the efficiency and improvements that emerge from more effective decision support, improved decision-making. Electronic records of many sorts make it easier to schedule appointments for patients, to keep track of their follow-ups, and to ensure that general practitioners are informed of the results of their patients' referrals.

Yet, the eHealth benchmarking III survey has shown that – despite a substantial proportion of hospitals being ready with common EPR systems in place (65%) – the take-up of applications such as electronic physician order entry, ePrescribing, and electronic referrals is much less widespread in the hospitals.

The survey findings also indicate that, while implementing electronic health records in an interoperable way has become a key priority for hospitals, EPR systems hold a much greater potential to improve efficiency and effectiveness of healthcare providers both inside and outside the hospital. A comprehensive and sophisticated implementation of EPR systems could lead to the clinical transformation of hospitals.

#### **Potential additional question in relation to EPR systems:**

How does dematerialisation affect hospitals (an example would include reductions in the use of paper)? In what form of media are records kept? How are the records used in clinical settings? How are EPR systems used? Are there shifts towards increasing patient communication, and more recording of data in the records, which aim to involve patients more

*Additional possible questions with regard to clinical staff.* Is the use of EPR systems totally voluntary? What kinds of forms of resistance are shown on the part of staff?

## 2. Apply appropriate incentives for health professionals to use EPR systems

When asked about the key barriers to implement EPR systems, Medical Directors mention that doctors do not have enough incentives to use them (see question 5 – Medical Directors' questionnaire). Some countries, such as the USA, have put various economic incentives in place to foster this implementation. Denmark is a key European example of such an approach.

Clearly, however, it is important to match incentives appropriately to the relevant health system, health service, and hospital system that operates in the specific country (see OECD 2010, p12). Economic incentives may be appropriate in circumstances where clinicians and health professionals act as independent consultants or are self-employed. Such inducements may be less influential when health professionals are salaried. In such cases, the adoption of EPR systems by clinicians and health professionals may be motivated more by a perceived improvement in the quality of care provided to their patients. Last but not least, the way in which hospitals interact with other organisations that provide healthcare within the health system might influence the kinds of incentives it is possible to offer.

A dedicated analysis of healthcare professionals' motivation to use EPR systems could be a timely and useful approach in terms of an assessment of the European context. This activity could itself be part of a hospital survey undertaken possibly at a more regional level.

## 3. Focus on patients' access to EPR systems

In order to achieve the proposed Digital Agenda for Europe (2015) Key Action 13 pilot action target (COM(2010)245 final/2), patients' access to EPR systems needs to be a domain of high focus.

The eHealth benchmarking III survey has shown that only 4% of hospitals provide online access to all or parts of their patients' EPR to the patients themselves (see question 19 of the CIO survey). Patients often need to carry around in a hospital many of their laboratory results, and medical history tests in non-digital formats.

The Digital Agenda for Europe has announced that pilot actions will be undertaken until 2015 to investigate equipping Europeans with secure online access to their medical health data – see Key Action 13. Of course, the eventual route to this ambitious target could be through mobile access to the data, personal ownership of health data, or in conjunction

with other organisations, such as primary care institutions or care institutions in general. Nevertheless, ensuring patients' access to their EPR systems – when they are obliged to spend time in hospital – would still be an appropriate component of the health system.

Hence, this Digital Agenda for Europe Key Action 13 ambition would be an important domain in which to set an indicator to watch closely in the near future. Rigorous monitoring of these pilot initiatives over the next five-year period will be necessary if EU citizens are to be reassured that they can get secure access to more of their online medical patient records, data or information.

#### 4. Interoperability is still an issue – concentrate on it

The eHealth benchmarking III survey has shown that both CIOs and Medical Directors find that interoperability is still a key barrier to the implementation of EPR systems (see question 6 – Medical Directors' questionnaire and 17.1– CIO questionnaire)<sup>63</sup>.

Interoperability remains a key policy priority for the EC in several areas including eHealth (COM(2008)3282 final). Attention continues to be paid to the various different levels of interoperability that are required – for instance, in the proposed eHealth Governance Initiative – including those related to governance, legal and regulatory conditions, standardisation, as well as organisational, technical and semantic.

This survey evidence indicates that interoperability still needs to continue to be a key area of focus. Medical Directors indicated that they found that the main barrier encountered during implementation is that the EPR systems in their departments were not interoperable and/or could not be integrated with new solutions. Concentration on interoperability as a challenge could eventually facilitate a full implementation of EPR systems so as to allow for electronic medical data exchanges within and between Europe's hospitals.

#### 5. Pay attention to low telemonitoring deployment and intention to invest

The eHealth benchmarking III survey has shown that only 8% of acute hospitals offer telemonitoring of outpatients (see, for example, question 30 of the CIO survey). This percentage will have to increase substantially in the future to ensure that the 2020 Digital Agenda for Europe target of achieving widespread deployment of telemedicine services is achieved – see key Action 13 (COM(2010)245 final/2).

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<sup>63</sup> See also the next section of analysis on electronic patient exchanges.

This would imply a renewed focus and follow-up to the Communication on telemedicine for the benefit of patients, healthcare systems and the aging society (COM(2008)689 final); attention to the necessary legal clarity and its implications particularly for safety and security, monitoring and surveillance; and, last but not least, a thorough investigation of the appropriate investment, commissioning, and procuring of systems. Attention also needs to be paid to the structural and institutional relations between primary, secondary, and tertiary care institutions, the home, and what can be called the home hospital.

***Additional potential questions in relation to telemedicine:*** Is telemedicine actually used by medical staff? What degree of resistance to it is shown by staff? Is there resistance by patients? What are the incentives (including financial incentives) to encourage the take-up of telemedicine by clinicians? What are the financial impacts of using telemedicine? What are the legal and/or liability challenges that result? Do clinicians experience a perceived (or actual) loss of power and influence as a result of telemedicine use? What institutional changes result from the use of telemedicine according to health professionals?

***Additional potential questions in relation to Investment:*** On what future applications do hospitals plan to invest (whether the decision is made by CIOs or Medical Directors or responsible medical staff)? What investments are being made with the intention to shift hospitals towards a next stage of organisational development? What willingness is there to upgrade the available technology so as to ensure a greater level of uptake?

#### 7.2.1.4 Electronic patient data exchanges

1. Low levels of European data exchanges – involve more hospitals in a pan-European approach

Sharing – providing and/or receiving – electronic clinical data among hospitals, general practitioners in the community, and other community health care providers is an essential component of tracking ICT take-up in Europe's hospitals and the implication that it has for improving healthcare. How this happens at a European level as well as on a country-by-country and a hospital-by-hospital basis is of crucial importance.

This external data exchange remains very low within and between hospitals, and especially within countries and between countries. It is possible that this low level of usage can be

explained by such continuing barriers as insufficient interoperability, and inhibiting structural, organisational, financial and/or reimbursement, and other behavioural or motivational mechanisms<sup>64</sup>. Hospital organisations and their personnel should ideally be keenly involved in this revitalisation process.

***Additional possible questions on exchange of data between hospitals:***

To what extent are data exchanged between hospitals? How are the data structured?

How much are the data re-used?

7.2.1.5 A bridge towards a new methodological approach

1. An overall census of European hospitals could prove useful

The desk research, advice from the steering committee, and the feedback from the focus group appear to indicate that there is currently no overall census data available on the number and types of European hospitals. Some Member States have such censuses, and others not. Although each Member State's health system is in a state of constant flux, it could be useful to the authorities concerned if there were an authentic, guaranteed provision of such data whether or not these data were available on a commercial or a non-commercial basis. This census data could, nevertheless, bear in mind the relationship of hospitals with other health-related institutions, primary and tertiary care and the increasingly home-based character of much healthcare.

2. Involve a wide range of hospitals

While large, public, university hospitals and regional networks in Europe use ICT in a sophisticated manner – there is a need to involve other forms of hospitals.

The eHealth benchmarking III survey has shown clearly that large, public, and university hospitals currently have access to more advanced forms of eHealth implementation. Hospitals which belong to a regional network are in a similar position. This places pressure on, and poses challenges to, smaller, isolated, and private hospitals. Countries,

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<sup>64</sup> Exploratory research questions might investigate whether there are demonstrable needs for this; whether hospitals are too self-reliant or self-contained to see the utility of such an approach; and/or whether staff are unaware of the benefits that could provisionally be offered by ICT because of the existing organisational barriers between healthcare services.

regions, and health authorities need to ensure that digital disparities do not emerge that could further increase the disparity in the quality of care to patients and in the efficiency of the public health systems.

3. Focus on the clinical experience of medical staff in terms of ICT support to increase quality of care

Medical Directors are potentially more concerned about the organisational and interoperability aspects of ICT (see the responses to the Medical Directors' questionnaire). The impacts of medical staff's use of ICT appear to focus on: efficiency gains, and the capacity to see more patients, but there is as yet no apparent impact in terms of the quality of care. A considerable challenge might lie in whether there is any form of consensus with regard to what quality of care might be considered to be.

Some potential barriers to the use of telemedicine could be explored in greater detail: security issues, privacy concerns, and ICT knowledge. Future studies could explore the relevant reimbursement mechanisms needed to encourage telemedicine use.

4. Pay attention to patients' needs in terms of the support that ICT can offer

A counterbalancing study and/or large-scale survey of patients' experience of care both inside and out of hospitals in relation to ICT should also be undertaken. It would be appropriate if it were to reflect some aspects of supply and demand and also experience of the quality of care.

5. Ask a wide range of questions with regard to use of legacy systems and future use of systems

A range of questions that generally relate to the changing use of ICT applications in hospitals and other parts of the healthcare system could be posed in future studies or surveys.

***Miscellaneous additional potential questions:***

***Legacy systems:*** What use is made of legacy systems?

What kinds of more advanced systems or less advanced systems are used?

***Future ICT applications:*** What kinds of applications would clinical staff be most likely to take up in the future?

***Organisational change and change management.***

How much time does it take to transfer and deploy eHealth?<sup>65,66</sup>

*Piloting of applications as opposed to real-life use:* What degree of use of ICT is still at a pilot stage? How much use is authentic, well-established use? On what kind of funding are the institutions dependent? What are their business models?

*ICT use and transformation of work:* How is ICT used in the clinical setting? How is ICT transforming clinical tasks, responsibilities, and ways of working? How does this apply to clinicians? How does it apply to other health professionals?

### 7.3 Methodology lessons learned

In addition to the set of key policy messages, there are also a number of emerging methodological lessons learned that can be highlighted. The pilot character of the survey is reinforced by the arguments put forward. It is, however, possible that such surveys may be repeated within the lifetime of the Digital Agenda for Europe (COM(2010)245 final/2).

Three key sets of observations emerge. They relate to:

- What and who to survey,
- How to survey,
- What other forms of investigation are possible.

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<sup>65</sup> Research undertaken in the eHealth field implies a time-period of up to twenty years spent on the deployment and deployment of eHealth before cost benefits are perceived. See European Communities 2006.

<sup>66</sup> Anecdotal evidence provided at the validation workshop implies that various (commercial) surveys undertaken with CIOs during the 2004–2010 timeline indicate increases in the deployment of radiology and in CPOE, but not huge increases in use.

Table 5 – Methodology-related observations

<u>Table of methodology-related observations</u>
<u>What and who to survey</u>
Repeat certain indicators
Complement the survey findings with findings from other levels of healthcare
Create a more in-depth and accurate understanding of EPR systems
Focus on advances in telemonitoring and/or the barriers to its use
Consider undertaking a wider range of studies and surveys
<u>How to survey</u>
Enlarge the span of the survey
Explore divergences across countries/regions
Involve hospitals in the collection of data
Involve different job specialities in the collection of data (examples include cardiologists, radiologists, emergency staff and nurses)
Involve patients in the collection of data
Consider the use of online surveys rather than CATI surveys
Improve the survey research by extending the fieldwork time
<u>What other forms of investigations are possible</u>
Qualitative research can help understand barriers and impacts
Encourage change to happen through using an appropriate learning model

### 7.3.1 What and who to survey

#### 1. Repeat certain indicators

One of the survey's strengths is the potential offered by the indicators that it has tested. Many questions resulted in good and interesting indicators that should be subject to further piloting in future years. The survey has resulted in a large number of indicators which have been applied for the first time at EU level about eHealth policy in acute hospitals. Many of these indicators are associated with applications and approaches that are still far from saturation point, and therefore could be repeated in subsequent or future surveys undertaken in this domain.

#### 2. Complement the survey findings with findings from other levels of healthcare

It is important to recognise how the results of this eHealth benchmarking III survey of acute hospitals can complement survey results at other levels, such as in primary care or in care institutions, especially for specific application such as telemonitoring. Such complementary findings would provide a more complete picture of ICT deployment in the healthcare sector. This kind of comparative surveying would enable the making of progress on eHealth benchmarking in relation to a range of eHealth services and systems. It would be crucial to explore key policy indicators that are common across all sub-sectors, can be applied to the availability of various clinical applications and illustrate external electronic medical data exchanges with other healthcare providers.

#### 3. Create a more in-depth and accurate understanding of EPR systems

The complexity of measuring what is recorded in an EPR would require a specific questionnaire module. This kind of module has been developed in the USA by the AHA. It includes a total of 36 questions dedicated to registering the various, different levels of EPR use. Conducting such a survey would permit more rigorous international comparisons of the use of EPR systems.

#### 4. Focus on advances in telemonitoring and/or the barriers to its use

Given the importance of telemonitoring on the current European policy agenda, a more targeted and in-depth analysis of the spread of telemonitoring, the impact that it is having, and what the barriers are to its use could be appropriate – in hospitals as well as other health-related institutions. Conducting such a survey might build on currently

available data from the WHO (2010). The eHealth benchmarking III survey was not able to identify, for example, the relevant barriers to telemedicine use. As identified in section 7.2.1.3, however, it may be that other forms of study or research would be more fitting in terms of studying the use of telemedicine and telemonitoring.

#### 5. Consider undertaking a wider range of studies and surveys

Further surveys could be launched which would focus more on enabling mechanisms, barriers, lessons learned, general trends, take-up and how to increase use of ICT.

Given the importance of health to the economy and social well-being of the EU, a number of additional surveys and studies might be considered. They could include:

- a (second) survey on the use of ICT use by general practitioners,
- a survey of hospitals to explore lessons learned.

### 7.3.2 How to survey

#### 1. Enlarge the span of the survey

Future surveys could be more comprehensive and larger (covering up to 40,000 respondents, for example)<sup>67</sup>. Locally or regionally-available, shared tools might enable effective data entry on the part of the respondents. The surveys to be undertaken could involve a set of national surveys which would take place not only throughout the EU Member States but also throughout the entire European region (for instance, in the context of the WHO Europe).

#### 2. Explore divergences across countries/regions

It is apparent that there are divergences in the levels of adoption and use of eHealth within countries and at regional levels. The eHealth Benchmarking III survey focused on the EU level. The country level context has its limitations<sup>68</sup>. However, it could be increasingly important to undertake benchmarking in the following ways: to explore regional differences; to explore findings related to large hospitals as compared to smaller ones; to investigate developed versus less developed and/or more rural areas or, conversely, poor

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<sup>67</sup> Comment made by the industry group representative to the *ad hoc* experts' group (formerly known as the i2010 sub-group on eHealth).

<sup>68</sup> These limitations are explored in terms of other possible forms of investigation (see methodology lesson learned no. 8 in relation to small universes).

urban areas. Such exploration would be particularly important in order to ensure that any health inequities occurring on the European continent do not become entrenched or made worse.

### 3. Involve hospitals in the collection of data

Hospitals could clearly develop their own benchmarking mechanisms which would take place either within and/or outside their own specific country. The involvement of hospitals themselves in such surveys might encourage a higher level of response than can be achieved when using a CATI survey (especially if different managerial profiles, and wide ranges of job or health specialities are to be targeted). This involvement was the case in the recent survey approach used by the USA AHA.

It is also hypothesised that many hospitals will be keen to understand general levels of ICT performance in particular types of hospital in specific countries, as a form of business intelligence. They might, on the one hand, be keen to obtain general data and/or to understand the position of their own hospital vis-à-vis potential competitors in the marketplace. It is feasible that some hospitals might show themselves to be unwilling to disclose certain information publically and/or might not offer completely frank responses.

There is also a growing interest on the part of hospitals and those who manage them to assess the overall quality of their institutions in a wider context rather than simply in relation to ICT (Groene et al. 2010) <sup>69,70</sup>.

#### *Additional potential questions in relation to barriers*

**Barriers:** What factors inhibit a greater usage of ICT (applications could include the use of CPOE and ePrescribing)? What are Medical Directors' reasons for implementing (or not) various eHealth applications?

### 4. Involve different job specialties in the collection of data (examples include cardiologists, radiologists, emergency staff and nurses)

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<sup>69</sup> See the 2006–2007 co-financed MARQuIS project. MARQuIS Project website. Accessed February 16, 2011. <http://www.simpatie.org/marquis/Main>.

<sup>70</sup> See the 2009–2013 co-financed DUQuE project, DUQuE Project website. Accessed February 16, 2011. <http://www.duque.eu/>.

Given the large array of occupational profiles and specialties in the hospital system that use ICT, surveys could be developed that target specific job profiles (so as to understand more effectively their uses of ICT).

In the 1980s and 1990s, fundamental case studies were undertaken which examined how ICT affected hospital job design and developments (particularly of nurses). However, this preoccupation appears to have diminished. Little evidence has been found of existing international or national surveys that target different job specialties in eHealth surveys. This might be due to the fact that, as this eHealth Benchmarking survey has shown, intensive and integrated ICT use is still in a deployment phase in hospitals.

*Additional potential questions on use:*

Can the ways in which CIOs and medical staff use ICT  
be compared in a more systematic way?

5. Involve patients in the collection of data

Patients or potential patients are becoming increasingly interested in obtaining information about hospitals. This can relate both to the quality of the eHealth support that a hospital can offer, but more often about the quality of the care provided by particular hospitals in their immediate locale, nation, or wider afield. Some Member States have been providing this information to their citizens for many years: Denmark provides a well-known example<sup>71</sup>. Yet other players are newer to such an approach. A 2010 investigation of the quality of hospital information portals in providing useful information to patients has been the Health Consumer Powerhouse (Cordasev et al. 2010).

6. Consider the use of online surveys rather than CATI surveys

The eHealth benchmarking III survey took CIOs an average of 30 minutes to complete. This is a substantial length of time to devote to a survey for interviewees who hold managerial posts in hospitals. Equally, finding the requisite time is likely to pose considerable challenges to health professionals who represent different professional specialities and

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<sup>71</sup> Sundhedsqualitet website. Accessed February 16, 2011. <http://www.sundhedskvalitet.dk/>.

roles. Desk research has indicated that an increasing number of countries are doing online surveys (examples include Finland and the USA).

An online survey can provide a more adequate approach to long questionnaires: their replies can be rotated among different target groups. Online surveys also offer respondents more opportunity to reply to the survey during time-periods that are perhaps less busy, making completion of the questionnaire more convenient for them. It is therefore possible that holding online surveys can increase the rate of response to a survey. Online surveys may also decrease the costs of undertaking surveys. Since all European hospitals possess the internet, and 92% of them have access to broadband, the use of online surveys may be an appropriate approach to take in the future.

In addition, regular, online monitoring of progress and gap analysis could be encouraged<sup>72</sup>.

#### 7. Improve the survey reach by extending the fieldwork time

In the USA, the AHA has developed an online tool which was available to survey respondents throughout a full six months of fieldwork. This time-period is close to three times the amount of time that the eHealth benchmarking III survey team had available to it to undertake this CATI exercise. Given the time scarcity of managers in hospital, allowing for a longer fieldwork period might improve the response rate in any future edition of the survey. For a CATI survey, a six-month period of fieldwork would be rather unusual. However, time extension would be particularly feasible if the survey type were to be an online survey.

#### 8. Reflect on the methodological implications of having small universes in small (less populous) countries (that is, <100 observations)

As explained in chapter 2 of this report on the methodological approach that underpinned the eHealth benchmarking III survey, the universe of hospitals is very small in some countries. Although the statistical recommendation for such situations is to interview the entire universe this is not always feasible due to time and budget restrictions as well as the fact that not everybody may be willing or have time to participate in a survey. This

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<sup>72</sup> Although not explicitly mentioned during the validation workshop, possible activities might be based around online methods and approaches such as collaborative networks and crowd sourcing, use of Web 2.0 and Web 3.0.

made it somewhat difficult to produce sound statistical inferences in some countries where there are a restricted number of observations. This limitation has been clearly reflected in the study team's analysis of this survey. It is, however, an issue which needs to be considered if and when observers wish to compare progress in large and small countries.

### 7.3.3 What other forms of investigation are possible

#### 1. Qualitative research can help understand barriers and impacts

Medical staff are facing a number of clinical and organisational challenges. The Medical Directors' survey findings indicated interesting results. To further qualify these findings, in-depth interviews would need to be undertaken, and techniques other than a CATI survey should be used. In particular, all of the questions that are related to impacts of EPR systems and telemonitoring need complementary qualitative data collection to help understand and interpret current findings in a comprehensive way. In addition, attention should be paid to how medical staff consider the use of electronic tools/devices which might help support the treatment and care of persons with (multiple) chronic diseases, who need integrated care, and who would expect to experience a lifetime of Active and Healthy Ageing. A qualitative approach of this sort could lead to the creation of a more effective set of studies and/or surveys of the attitudes and, in particular, the actual use of ICT by health professionals.

#### 2. Encourage change to happen through using an appropriate learning model

Benchmarking can have wider implications than simply the accumulation of statistical results. A broader concept of learning how to benchmark and benchlearn might be considered, as well as creating a mutual interaction and positive feedback loop between the two methods. This could involve the development of education about eHealth benchmarking and scoreboarding and what it means for hospital and health work processes, organisational and institutional management, the local area, region, country, and Europe as a whole. Both quantitative and qualitative models and methods could be brought together in such an approach. They could involve all members of the integrated health team (including patients, family members, and carers, and all healthcare job specialities); mutual support between benchmarking and benchlearning eHealth

implementation and use, and a fit with health benchmarking and benchlearning could be ensured.

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## 8 Annexes

This set of annexes includes a set of abbreviations and acronyms; a glossary of terms and definitions; the questionnaire module used with CIOs; the questionnaire module used with Medical Directors; various methodological and statistical observations; an information note on the survey; the agenda of the January 18, 2011 validation workshop held in association with the survey; and a reference list.

## 8.1 Annex 1: Abbreviations and acronyms

Word	Meaning
AHA	American Hospital Association
CATI	Computer-assisted telephone interviewing
CIO	Chief Information Officer
CIP ICT PSP	Competitiveness and Innovation Programme Information and Communication Technologies Policy Support Programme
COPD	Chronic obstructive pulmonary disease
CPOE	Computerised physician order entry
DAE	Digital Agenda for Europe
DG INFSO	Directorate-General for Information Society and Media
DICOM	Digital Imaging and Communication in Medicine
EAS	Enterprise Archiving Strategy
EC	European Commission
EEA	European Economic Area
EPR	Electronic Patient Record
EPR systems	Electronic Patient Record system
EU	European Union
EU+	The 27 Member States of the EU as well as Croatia, Iceland and Norway
FPC	Finite population correction
GP	General Practitioner
HCC	US Department of Health and Human Services
ICT	Information and Communication Technology
IPTS	Institute for Prospective Technology Studies
IT	Information Technology
JRC	Joint Research Centre
MD	Medical Director
NHS	National Health Service
NUTS	Nomenclature of Units for Territorial Statistics
OECD	Organisation for Economic Co-operation and Development
PACS	Picture Archiving and Communication System
UK	United Kingdom
US	United States
USA	United States of America
VCF	Video Conferencing Facilities
WHO	World Health Organisation

## 8.2 Annex 2: Glossary of terms and definitions

This annex contains the definitions that were used in this study to design and support the survey questions, to train the Ipsos questionnaire survey team, and to clarify the understanding of any questions by the survey respondents. The definitions are laid out in alphabetic order. The annex can also serve as a glossary of terms for other readers of the report.

### **Acute hospital**

*Explanation:* According to e-Business W@tch the notion of 'acute' 'refers to the fact that the hospitals are predominantly serving patients in immediate need of health care, as opposed to long-term care' (2006, p23). Similarly, a more common description of acute hospitals may suggest: '... those intended for short-term medical and/or surgical treatment and care. The related medical speciality is called acute medicine.' Acute hospitals may cover those in both the secondary and tertiary health sectors.

*Background:* The Information Services Division of the National Health Services Scotland, for example, indicates that: 'Acute hospitals provide a wide range of specialist care and treatment for patients. Typically, services offered in the NHS Acute sector are diverse. They include: consultation with specialist clinicians (consultants, nurses, dieticians, physiotherapists and a wide range of other professionals); emergency treatment following accidents; routine, complex and life saving surgery; specialist diagnostic procedures; and close observation and short-term care of patients with worrying health symptoms.'<sup>73</sup> According to the System of Health Accounts (SHA) definition, 'a hospital comprises licensed establishments primarily engaged in providing medical, diagnostic, and treatment services that include physician, nursing, and other health services to inpatients and the specialised accommodation services required by inpatients.' (e-Business W@tch, p24) The definition is quoted as being available in Eurostat (2002) documentation.

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<sup>73</sup> NHS National Services Scotland, Information Systems Division, s.v. "acute hospital care," last modified December 14, 2010, <http://www.isdscotland.org/isd/3400.html>.

### **Adverse events reporting system**

*Explanation:* This is an (electronic) reporting system for reporting adverse events that take place. These events could happen at a hospital, department, or ward level. Such a system sometimes enables the inclusion of reporting near-misses (or events that almost happened)<sup>74</sup>. Adverse reporting events are pertinent to clinical care.

### **Disaster recovery**

*Explanation:* Disaster recovery implies the ability to recover mission-critical computer systems as required to support the business's continuity – in this case, “the business” is the hospital. This is terminology that was originally elaborated by the SHARE organisation<sup>75</sup>.

### **Discharge letter**

*Explanation:* This is a letter in which the medical status and the treatment given to the patient and instructions for further treatment and medication is given to the GP on the discharge of the patient from the hospital.

*Background:* Different health systems may have different time-lengths under which a GP expects to receive such a letter about the patient's status from the discharging hospital (in NHS England, for example, this is 72 hours (Gould 2008). Researchers have sought to explore the efficiency of the discharge letter process (Dugas et al. 2008).

### **eBooking**

*Explanation:* This is an electronic booking system which enables appointments to be booked with clinicians and other health professionals. A range of medical personnel may be allowed to do the bookings but so may others (such as patients/citizens). There is a diversity of approaches throughout Europe in the ways in which different users take

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<sup>74</sup> Adverse events in health care (archived European Commission website) originally accessed February 16, 2011

[http://ec.europa.eu/health/ph\\_information/dissemination/hsis/hsis\\_15\\_en.htm](http://ec.europa.eu/health/ph_information/dissemination/hsis/hsis_15_en.htm) (definition no longer available)

<sup>75</sup> This terminology was originally elaborated by the SHARE organisation. SHARE group website. "SHARE > Technology – Connections – Results." Accessed February 16, 2011.

<http://www.share.org/>.

responsibility for making eBookings.<sup>76</sup>

## **eDispensing**

*Explanation:* According to the epSOS large-scale pilot, eDispensing or eDispensation is referred to as: "the act of electronically retrieving a prescription and administering medicine to the patient as indicated in the corresponding ePrescription. Once the medicine is administered, the dispenser sends an electronic report on the dispensed medicine(s)."<sup>77</sup>

## **Electronic (or online) chronic disease management programmes for outpatients and chronic disease management programme**

*Background to chronic condition management programmes or schemes:*

Chronic diseases are diseases of long duration and generally slow progression<sup>78</sup>.

Self-management techniques for chronic diseases or conditions are becoming more and more popular. They are particularly used in relation to the treatment and handling of chronic diseases by patients themselves.

Certain aspects of online support can facilitate the self-management of chronic diseases by patients. Chronic condition management solutions can be facilitated by the use of computers or telecommunications.

Online programmes are often used with patients who are affected by chronic diseases, such as diabetes, heart disease, and cancer. Patients can learn how to maintain their conditions stably at home. They can be helped to reduce risk and acute care episodes. Improving a patient's knowledge of chronic diseases and helping them to avoid acute care episodes can make a positive difference to the whole health system<sup>79</sup>.

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<sup>76</sup> This is an adaptation of concepts used by the National Health Service England. The original definition refers more specifically to the service's own system.

<sup>77</sup> epSOS large-scale pilot glossary. Accessed February 16, 2011  
<http://www.epsos.eu/glossary.html/>.

<sup>78</sup> World Health Organisation. "Health topics: Chronic diseases." Accessed February 16, 2011.  
[http://www.who.int/topics/chronic\\_diseases/en/](http://www.who.int/topics/chronic_diseases/en/).

<sup>79</sup> Microsoft Corporation. "Chronic condition management solutions." Accessed February 16, 2011.  
[http://www.microsoft.com/industry/government/solutions/health\\_chronic\\_conditions/default.aspx](http://www.microsoft.com/industry/government/solutions/health_chronic_conditions/default.aspx).

## Electronic medical record

*Explanation:* The 2009 Gartner definition of an electronic medical record can help with the definition of an electronic patient record. The electronic medical record is a computer-based patient record system which contains patient-centric, electronically-maintained information about an individual's health status and care. Gartner uses the notion of an electronic patient record system which is "limited to a single care delivery organisation" (for example, to a single hospital) (2009).

## Electronic Patient Record

*Explanation:* These are electronic health records for patients. More (or less) sophisticated systems which are accessible to other institutions, besides the hospital, exist. A simple history of a patient's access to hospital services is not sufficient to be considered as an electronic patient record system.

*Definition:* "electronic health record" means a comprehensive medical record or similar documentation of the past and present physical and mental state of health of an individual in electronic form, and providing for ready availability of these data for medical treatment and other closely related purposes" (COM(2008)3282 final, p13).

An electronic health record (also known as an electronic patient record or a computerised patient record) is an evolving concept defined as a systematic collection of electronic health information about individual patients or a population.

## Enterprise Archive Strategy

*Explanation:* Enterprise archive strategy means 'a comprehensive information archiving strategy aligned with [an organisation's] goals and performance needs'. In the context of this survey, it refers to the specific hospital concerned.<sup>80</sup>

## ePrescribing (see also ePrescription)

*Explanation:* ePrescribing 'involves the use of application software and Web connectivity tools that enable physician offices to send prescriptions to pharmacies via online fax,

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<sup>80</sup> IBM [International Business Machines Corporation]. "IBM – Information Lifecycle Management Services – Enterprise Archive – North America." Accessed February 16, 2011. <http://www-935.ibm.com/services/us/index.wss/offering/its/a1030346>.

directly to pharmacy systems or to a printer' (Runyon et al. 2005).

*Definition:* "ePrescription" means a medicinal prescription, as defined by Article 1(19) of Directive 2001/83/EC, issued and transmitted electronically' (COM(2008) 3282 final, p13).'

## **Interoperability**

*Background:* Interoperability is often used in relation to electronic health record systems. Interoperability quite simply means the ability of one or more computers or other electronic devices to communicate with each other. Terms that are often used to express a notion of interoperability include 'integrated' or 'connected'(European Communities 2006).

*Definition:* The "interoperability of electronic health record systems" means the ability of two or more electronic health record systems to exchange both computer interpretable data and human interpretable information and knowledge.' (COM(2008)3282 final, p13)

### *Definition of levels:*

At the technical level implies that technical standards and architectures are being used, or that there are common platforms. This term is an adaptation of a definition of technical level (COM(2008)3282 final) which indicates that it means to: 'promote the use of technical standards and architectures, and the establishment of common interoperability platforms'.

At the semantic level implies the use of international terminologies and classifications for clinical, medical, or statistical purposes. It is adapted from the EC's 2008 Recommendation's definition of the semantic levels as meaning to: 'coordinate efforts geared towards semantic activities by agreeing on common priorities and specific applications. ... Wherever possible, consider the suitability of international terminologies, such as Systematized Nomenclature of Medicine–Clinical Terms (SNOMED–CT) and terminologies and nomenclatures used for pharmacovigilance and clinical trials (see: <http://www.ihtsdo.org/>) and classifications such as WHO International Classification of Diseases (ICD), see: <http://www.who.int/classifications/icd/en/>.' (COM(2008)3282 final, p10)

In COM(2008)3282 final, 'the organisational level' refers to the level of the Member State (country). There, it means to: 'agree on an organisational framework for interoperability

that recognises the autonomy of each Member State in relation to the development of the relevant eHealth infrastructure and services. It should create a common domain, accompanied by the necessary interfaces, that enables the national domains to interact' (p10). However, in this questionnaire survey, throughout – but also, in particular, in relation to Q18 – the organisational level is that of the actual organisation (or hospital) itself, i.e., the hospital's different units or departments.

### **Personal health record**

*Background:* A personal health record (PHR) is typically a health record that is initiated and maintained by an individual. An ideal personal health record would provide a complete and accurate summary of the health and medical history of an individual by gathering data from many sources and making this information accessible online to anyone who has the necessary electronic credentials to view the information.

*Definition:* A PHR is an Internet-based patient-owned and patient-controlled set of tools that allow people to access and coordinate their lifelong health information and make appropriate parts of it available to those who need it. The PHR infrastructure includes components and functions that allow patients to collect and share their health information via a web platform. PHR applications are any functions within a PHR system that allow patients to manage their own health and the health of others (dependents) through education and monitoring, as well as enable the exchange of data regarding their health (Gartner 2009). As early as 2005 (Bunyon et al. 2005), these records were defined as 'an electronic application through which individuals can access, add to, manage and share their health information and that of others for whom they are authorized, in a private, secure and confidential environment'.

### **Picture Archiving and Communication System**

*Explanation:* A Picture Archiving and Communication System (PACS) enables images such as x-rays and scans to be stored electronically and viewed on screens, creating a near filmless process and improved diagnosis methods. Doctors and other health professionals can access and compare images at the touch of a button<sup>81</sup>.

### **Telemonitoring services**

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<sup>81</sup> See England, National Health Service, *Connecting for Health* Accessed February 16, 2011 <http://www.connectingforhealth.nhs.uk/systemsandservices/pacs>

Five different forms of telemonitoring services are explained: they include telecare, tele-homecare, tele-home monitoring, telemedicine, and telemonitoring.

### **Telecare**

*Definition:* Telecare is 'the provision of social care from a distance supported by means of telecommunications and computerised systems' (empirica & WRC [Work Research Centre]. 2008).

### **Telehomecare**

*Background:* Home care services using ICT can contribute to the management of chronic diseases from the home.

*Definition:* 'Tele-homecare may be defined as the application of information and communication technologies to the management and delivery of home health care services'<sup>82</sup> Telehomecare is offered to a patient in the home.

### **Tele-home monitoring**

*Description:* 'Home telemonitoring represents a patient management approach combining various information technologies for monitoring patients at distance.' (Paré et al. 2007)

### **Telemedicine**

*Background and definitions:* 'Telemedicine is the provision of healthcare services at a distance' (COM(2008) 689 final, p3). 'Telemedicine is the provision of healthcare services, through use of ICT, in situations where the health professional and the patient (or two health professionals) are not in the same location. It involves secure transmission of medical data and information, through text, sound, images or other forms needed for the prevention, diagnosis, treatment and follow-up of patients' (COM(2008) 689 final, p4).

### **Telemonitoring**

*Background:* Telemonitoring is a telemedicine service aimed at monitoring the health status of patients at a distance. Data can be collected either automatically through personal health monitoring devices or through active patient collaboration (e.g., by

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<sup>82</sup> Health Canada. 1998. "Tele-Homecare Consultation Workshop." Health Canada: Ottawa. Accessed February 16, 2011. <http://www.hc-sc.gc.ca/hcs-sss/pubs/ehealth-esante/1998-tele-workatel/index-eng.php>.

entering weight or daily blood sugar level measurements into a web-based tool). Data, once processed and shared with relevant health professionals, may be used to optimise the patient's monitoring and treatment protocols. (COM(2008) 689 final, p4)

### **Videoconferencing facilities**

*Background:* A videoconference or video conference (also known as a video teleconference) is a set of interactive telecommunication technologies which allow two or more locations to interact *via* two-way video and audio transmissions simultaneously. It is currently often used among professionals and people from different occupations located in different places, such as medical professionals. An undated Tandberg publication gives ten examples of the ways in which healthcare institutions use videoconferencing facilities.<sup>83</sup> State-of-the-art European initiatives like the DANTE project increasingly advocate videoconferencing use between hospitals<sup>84</sup>.

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<sup>83</sup> Tandberg. '10 Ways Healthcare Facilities are Using Video Conferencing to Improve Patient Outcomes, Increase Revenues, and Reduce Expense'. Accessed March 29, 2011.

<http://www.tandberg.com/collateral/socks/Exec-Brief-Health.pdf> (page no longer available)

<sup>84</sup> DANTE [Delivery of Advanced Network Technology to Europe]. 2009. "Advanced telemedicine system links four European hospitals using GÉANT and local research networks." Press release. June 10, 2009. Accessed February 16, 2011.

<http://www.dante.net/server.php?show=ConWebDoc.3145&navId=1&PHPSESSID=165e0a4ac2a4414c146dfbf331381c4>.

8.3 Annex 3: Questionnaire module used with CIOs



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Benchmarking deployment of

eHealth services III

European Commission

AV

Questionnaire n° 09-037148-01

20.04.2010

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COUNTRY CODE				
REGION				
HOSPITAL NUMBER				

Good morning/Good afternoon,

This is \_\_\_\_\_ calling from Ipsos, a professional public opinion research company.

We are conducting an important survey for the European Commission about deployment of ICT applications in hospitals in European countries. Can you please put me through the person who is responsible for information, communication and technical applications inside your hospital? It can be the ICT manager, the Chief Information Officer or the Operation manager for example,

*→ Once in contact with the CIO, explain again the survey purpose+ send the letter if necessary. If no contact, possible ask reception for the name of the Medical Director for future recall.*



4. Is this hospital a university hospital?

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes
- 2  No
- 3  Don't know **(DO NOT READ)**

**IF CODE 2 or 3 IN Q4: ASK Q5**

5. Is this hospital a non-university teaching hospital?

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes
- 2  No
- 3  Don't know **(DO NOT READ)**

6. How many beds are there in this hospital?

**ONLY ONE ANSWER POSSIBLE**

- 1  Fewer than 101 beds
- 2  Between 101 and 250 beds
- 3  Between 251 and 750 beds
- 4  More than 750 beds
- 5  Don't know **(DO NOT READ)**

7. Do you have a computer system in your hospital?

**ONLY ONE ANSWER POSSIBLE**

- 1  We do not have any computer system but only personal computers that are not part of a hospital-wide system
- 2  We have an independent hospital-wide computer system
- 3  Our computer systems are part of a network of different hospitals or hospital sites
- 4  Our computers systems are part of a regional or national network
- 5  Don't know (**DO NOT READ**)

**IF CODE 2, 3 or 4 IN Q7: ASK Q8 and Q9**

8: Is your hospital computer system externally connected...?

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes, through an extranet i.e. using a secure Internet connection over the Internet
- 2  Yes, through an value added network or proprietary infrastructure
- 3  Your computer system is not connected
- 4  Don't know (**DO NOT READ**)

9: How are applications integrated in your hospital computer system? By integrated I mean that there is data exchange between two systems, either through messaging or by using the same database.

**ONLY ONE ANSWER POSSIBLE**

- 1  Completely or nearly fully integrated (>60% of applications)
- 2  Partially integrated (26–60% of applications)
- 3  Not very integrated (0–25% of applications)
- 4  Not integrated at all

**TO ALL**

10. What type of Internet connection does your hospital have?

**MULTIPLE POSSIBLE ANSWERS**

- 1  Narrowband (Dial-up/PSTN) ISDN (128 kbit/smax)
- 2  Broadband (below 50 MBps )
- 3  Broadband (from 50 MBps to 100MBps )
- 4  Broadband (above 100 MBps )
- 5  No Internet connection **(DO NOT READ)**
- 6  Don't know **(DO NOT READ)**

**IF CODE 2, 3 OR 4 IN Q10: ASK Q11**

11. How does your hospital support wireless communications?

**ONLY ONE ANSWER POSSIBLE**

- 1  There is a single, unified wireless infrastructure capable of supporting most of the applications
- 2  There are individual wireless networks for discrete applications
- 3  There is no wireless infrastructure
- 4  Don't know **(DO NOT READ)**

**IF CODE 1 OR 2 IN Q11: ASK Q12 and Q13**

12. Does your hospital provide wireless Internet access to any of the following?

**MULTIPLE POSSIBLE ANSWERS**

- 1  Medical workstations inside the hospital
- 2  Ambulances
- 3  Inpatients inside the hospital
- 4  Outpatients or visitors inside the hospital
- 5  None **(DO NOT READ)**
- 6  Don't know **(DO NOT READ)**

13. Does your hospital provide wireless monitoring of patients inside the hospital?

- 1  Yes
- 2  No
- 3  Don't know **(DO NOT READ)**

**TO ALL**

14. Does your hospital have videoconferencing facilities?

- 1  Yes
- 2  No
- 3  Don't know **(DO NOT READ)**

**IF CODE 1 IN Q14: ASK Q15**

15. For what medically-oriented purposes does your hospital use videoconferencing?

*Interviewer:* **HERE WE ONLY REFER to more dedicated and formal videoconferencing facilities.** We are talking about doing consultations between medical colleagues. We are **not** talking about an informal and a formal discussion e.g., among colleagues or a more senior staff and student(s) by Skype. We are not talking about tele-monitoring (which comes later). Nor are we are not talking about CIO-CIO contacts for managerial or administrative purposes.

**MULTIPLE POSSIBLE ANSWERS**

- 1  For consultations between units inside the hospital
- 2  For consultations between internal medical staff and external healthcare providers (with or without the patient being present)
- 3  For consultations between the patient (either at home or outside the hospital) and hospital medical or nursing staff (for clinical purposes)
- 4  For research purposes
- 5  For education / teaching/ training purposes
- 6  Don't know (**DO NOT READ**)

**TO ALL**

16. Which type of electronic patient records (EPR) does your hospital mainly use? *By EPR I mean a computer-based patient record system which contains patient-centric, electronically-maintained information about an individual's health status and care.*

**MULTIPLE POSSIBLE ANSWERS**

- 1  A hospital-wide EPR shared by all the clinical service departments
- 2  Multiple local/departmental EPR systems, which share information with a central EPR system
- 3  Multiple local/departmental EPR systems, but they do not share information
- 4  None, we do not use EPR systems in our hospital

**IF CODE 1 or 2 IN Q16: ASK Q17.1**

17.1 Do you encounter interoperability problems between the different departmental electronic patients records systems? *By interoperability problems I mean that the systems are not connected and fail to talk to each other.*

**MULTIPLE POSSIBLE ANSWERS**

- 1  Yes, at the technical level. *By technical level, I mean at the level of technical standards, architectures, or platforms.*
- 2  Yes, at the semantic level. *By semantic level, I mean in terms of the use of terminologies and classifications for clinical, medical, or statistical purposes.*
- 3  Yes, at the organisational level. *By organisational level, I mean here between the different organisations or departments.*
- 4  Never
- 5  Don't know **(DO NOT READ)**

**IF CODE 3 IN Q16: ASK Q17.2**

17.2 Do you plan to move to a central EPR system over the next three years in which most of the independent departmental EPR systems will be sharing information?

- 1  Yes
- 2  NO
- 3  Don't know **(DO NOT READ)**

**IF CODE 1 or 2 IN Q16: ASK Q18**

18. In which of the following locations can the electronic patient records be accessed?  
(interviewers: if the system is under implementation in some location but not fully operational include the code)

**MULTIPLE POSSIBLE ANSWERS**

- 1  Bedside (accessible right next to the patient)
- 2  On each ward
- 3  In the emergency room
- 4  In the operating room
- 5  In the ambulance
- 6  In the radiology department
- 7  In the outpatient department/in a consulting room
- 8  Anywhere inside the hospital (through a wireless network)
- 9  Outside the hospital by own hospital staff, (on the move, at home...)
- 10  Outside the hospital by external healthcare providers, (primary care, other hospitals, GPs...)
- 11  Don't know (DO NOT READ)

**TO ALL**

19. Do patients have online access to their electronic patient records?

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes, to everything
- 2  Yes, but only to certain data (e.g. results and protocols)
- 3  No
- 4  Don't know (**DO NOT READ**)

20. Does the hospital use a Picture Archiving and Communication System (PACS)? *By PACS I mean a system which enables images such as x-rays and scans to be stored electronically and viewed on screens, creating a near filmless process.*

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes
- 2  No
- 3  Don't know (**DO NOT READ**)

**IF CODE 1 IN Q20: ASK Q21 and Q22**

21. Which type of PACS does your hospital have?

**ONLY ONE ANSWER POSSIBLE**

- 1  A hospital stand alone system
- 2  A PACS system which is part of a national or regional network system
- 3  Don't know (**DO NOT READ**)

22. In which of the following locations can the PACS be accessed?

**MULTIPLE POSSIBLE ANSWERS**

- 1  Bedside (accessible right next to the patient)
- 2  On each ward
- 3  In the emergency room
- 4  In the operating room
- 5  In the ambulance
- 6  In the radiology department
- 7  In the outpatient department/in a consulting room
- 8  Anywhere inside the hospital (through a wireless network)
- 9  Outside the hospital by own hospital staff, (on the move, at home...)
- 10  Outside the hospital by external healthcare providers, (primary care, other hospitals, GPs...)
- 11  Don't know (DO NOT READ)

**TO ALL**

23. Which of the following computerised systems has the hospital integrated?

**MULTIPLE POSSIBLE ANSWERS**

- 1  An integrated system for billing management- *By billing management I mean a system that produces automated electronic bills and invoices hospital-wide.*
- 2  An integrated system to send or receive electronic referral letters- *By referral letter I mean a letter sent from the medical director (whether a general practitioner or a specialist) referring a patient to another medical director for treatment in which major medical problems, major findings from previous medical exams are given.*
- 3  An integrated system to send electronic discharge letters- *By discharge letter I mean a letter in which the medical status and the treatment given to the patient and instructions for further treatment and medication is given to the general practitioner on the discharge of the patient from the hospital.*
- 4  An integrated system for tele-radiology- *By tele-radiology system I mean a system that sends and views radiological images from one location to another for the purposes of interpretation and/or consultation by a radiologist from outside the hospital.*
- 5  A computerised system for ePrescribing- *By ePrescribing I mean a system that enables the prescriber to send an accurate, error-free and understandable prescription electronically directly to a pharmacy.*
- 6  None **(DO NOT READ)**
- 7  Don't know **(DO NOT READ)**

**IF CODE 5 IN Q23: ASK Q24**

24. To which type of pharmacies is the computerised system for ePrescribing connected?

**MULTIPLE POSSIBLE ANSWERS**

- 1  A pharmacy inside the hospital
- 2  A pharmacy outside the hospital
- 3  Don't know (**DO NOT READ**)

**TO ALL**

25. Has the hospital integrated an adverse health events reporting system? *By an adverse health events reporting system I mean an electronic reporting system for reporting adverse health events that take place. These health events could happen at a hospital, department, or ward level and also include the reporting of near-misses.*

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes
- 2  No
- 3  Don't know (**DO NOT READ**)

26. Does the hospital have a computer-based system for electronic transmission of results of clinical tests? (e.g. laboratory results)?

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes
- 2  No
- 3  Don't know (**DO NOT READ**)

27. Does the hospital have a computer-based system for electronic service order-placing? (e.g. test/diagnostic results)?

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes
- 2  No
- 3  Don't know (**DO NOT READ**)

28. Does the hospital use an electronic appointment booking system?

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes
- 2  No
- 3  Don't know (**DO NOT READ**)

**IF CODE 1 IN Q28: ASK Q29**

29. Who can make electronic appointments directly in the system?

**MULTIPLE POSSIBLE ANSWERS**

- 1  Internal medical staff only
- 2  Internal medical and nursing or administrative staff
- 3  External medical staff (e.g. general practitioners, medical doctors from outside the hospital)
- 4  Patients
- 5  Don't know (**DO NOT READ**)

**TO ALL**

30. Does your hospital offer tele-homecare/tele-monitoring services to outpatients (at home)? *By tele-homecare services, I mean the provision of social care from a distance - to a patient in his/her home - supported by means of telecommunications and computerised systems. Alternatively, by tele-monitoring services, I mean a telemedicine service aimed at monitoring the health status of patients at a distance.*

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes
- 2  No
- 3  Don't know **(DO NOT READ)**

**IF CODE 1 IN Q30: ASK Q31 and Q32**

31. How is the tele-homecare or tele-monitoring implemented?

**MULTIPLE ANSWER POSSIBLE**

- 1  Automated device to device
- 2  Videoconferencing with the patient
- 3  Text introduced in web-based platform or email
- 4  Other
- 5  Don't know **(DO NOT READ)**

32. Does your hospital offer chronic disease management capabilities online to patients for any of the following diseases? Please include pilot programmes of the applications. *By chronic diseases, I mean diseases of long duration and generally slow progression. Home care services using ICT can contribute to the management of chronic diseases.*

**MULTIPLE POSSIBLE ANSWERS**

- 1  Asthma
- 2  Diabetes
- 3  Cancer
- 4  Chronic obstructive pulmonary disease
- 5  Chronic renal diseases
- 6  Heart diseases
- 7  We do not offer them
- 8  Don't know (**DO NOT READ**)

**TO ALL**

33. Does your hospital exchange electronic patient-level information with external provider of healthcare outside the hospital? (e.g., clinical data or medical results)

**ONLY ONE ANSWER POSSIBLE**

- 1  We exchange data actively with other providers
- 2  We have the capability to exchange data electronically but there is no health information exchange operating with others outside our hospital at this time
- 3  We do not exchange data actively with other providers
- 4  Don't know (**DO NOT READ**)

34. Does your hospital exchange electronically **clinical care information about patients (for instance, clinical history or results from medical tests)** with any of the following providers?

**MULTIPLE POSSIBLE ANSWERS**

- 1  With a hospital or hospitals outside your own hospital system
- 2  External general practitioners
- 3  External specialists
- 4  Health care providers in other EU countries
- 5  Health care providers outside the EU countries
- 6  None
- 7  Don't know **(DO NOT READ)**

35. Does your hospital exchange electronically **laboratory results information about patients** with any of the following providers?

**MULTIPLE POSSIBLE ANSWERS**

- 1  With a hospital or hospitals outside your own hospital system
- 2  External general practitioners
- 3  External specialists
- 4  Health care providers in other EU countries
- 5  Health care providers outside the EU countries
- 6  None
- 7  Don't know **(DO NOT READ)**

36. Does your hospital exchange electronically **medication lists information about patients** with any of the following providers?

**MULTIPLE POSSIBLE ANSWERS**

- 1  With a hospital or hospitals outside your own hospital system
- 2  External general practitioners
- 3  External specialists
- 4  Health care providers in other EU countries
- 5  Health care providers outside the EU countries
- 6  None
- 7  Don't know **(DO NOT READ)**

37. Does your hospital exchange electronically **radiology reports about patients** with any of the following providers?

**MULTIPLE POSSIBLE ANSWERS**

- 1  With a hospital or hospitals outside your own hospital system
- 2  External general practitioners
- 3  External specialists
- 4  Health care providers in other EU countries
- 5  Health care providers outside the EU countries
- 6  None
- 7  Don't know **(DO NOT READ)**

**TO ALL**

38. Is there any regulation in use that guarantees the security and privacy of electronic patient medical data?

**MULTIPLE POSSIBLE ANSWERS**

- 1  Yes, at national level
- 2  yes, at regional level
- 3  Yes, at hospital level
- 4  OTHER (SPONTANEOUS – DO NOT READ)
- 5  No, there is no regulation
- 6  Don't know (**DO NOT READ**)

39. Which of the following security measures are taken to protect the patient data stored and transmitted by the hospital's IT system?

**MULTIPLE POSSIBLE ANSWERS**

- 1  Encryption of all stored data
- 2  Encryption of all transmitted data
- 3  Workstations with access only through health professional cards
- 4  Workstations with access only through fingerprint information
- 5  Workstations with access only through a password
- 6  Data entry certified with digital signature
- 7  Other
- 8  Don't know (**DO NOT READ**)

40. Does access to patient information log off automatically when not used anymore?

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes
- 2  No
- 3  Don't know **(DO NOT READ)**

41. Are there clear structured rules on accessing (reading-writing) patients' electronic medical data?

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes
- 2  No
- 3  Don't know **(DO NOT READ)**

42. Is access to electronic patient records logged?

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes
- 2  No
- 3  Don't know **(DO NOT READ)**

**IF CODE 1 IN Q42: ASK Q43**

43. Is the logfile monitored and audited?

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes on a regular basis
- 2  Yes occasionally or on request
- 3  No
- 4  Don't know **(DO NOT READ)**

**TO ALL**

44. Does your hospital have an enterprise archive strategy for long term storage and disaster recovery? *By enterprise archive strategy, I mean a comprehensive information archiving strategy that is aligned with your hospital's goals and performance needs. Disaster recovery implies the ability to recover mission-critical computer systems as required to support the hospital's continuity.*

**ONLY ONE ANSWER POSSIBLE**

- 1  Yes
- 2  No
- 3  Don't know **(DO NOT READ)**

**IF CODE 1 IN Q44: ASK Q45 and Q46**

45. Is the enterprise archive strategy driven by...

**MULTIPLE POSSIBLE ANSWERS**

- 1  National healthcare IT programme
- 2  Regional healthcare IT programme
- 3  Hospital's own strategy
- 4  Don't know **(DO NOT READ)**

46. Please estimate how quickly your organisation can restore critical clinical information system operations if a disaster causes the complete loss of data at your hospital's primary data centre.

*Interviewer: By restoration of clinical information systems, we mean those applications that are considered "mission critical", level 1".*

**ONLY ONE ANSWER POSSIBLE**

- 1  Immediate (we have a fully redundant data centre)
- 2  Less than 24 hours
- 3  Less than 2 days
- 4  Less than 1 week
- 5  Less than 1 month
- 6  More than 1 month

CLOSE INTERVIEW + ASK TO BE PUT THROUGH THE MEDICAL DIRECTOR (OR GET AT LEAST THE NAME FOR FURTHER RECALL)

**INTERVIEWER:**

TARGET RESPONDENT IS THE LEADING MEDICAL DOCTOR OF THE HOSPITAL, I.E. THE MEDICAL DIRECTOR, THE CHIEF MEDICAL DOCTOR, THE HEAD OF THE MEDICAL DEPARTEMENT OR EQUIVALENT. THIS PERSON SHOULD HAVE KNOWLEDGE OF ALL DEPARTMENTS OF THE HOSPITAL, I.E. LEADING MEDICAL DOCTOR OF ONE DEPARTMENT OF THE HOSPITAL IS NOT ELIGIBLE.

8.4 Annex 4: Questionnaire module used with Medical Directors

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Benchmarking deployment of

eHealth services III

European Commission

**Module to Medical Director**

AV

Questionnaire n° 09-037148-01

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COUNTRY CODE				
REGION				
HOSPITAL NUMBER				

Good morning/Good afternoon,

This is \_\_\_\_\_ calling from Ipsos, a professional public opinion research company.

We are conducting an important survey on behalf of the European Commission about deployment of ICT applications in hospitals in European countries. In particular, we are interested in collecting medical directors' views about the implementation of eHealth applications in their hospitals. May I ask you 5 minutes of your precious time to answer to a few questions?

## DEPLOYMENT OF EHEALTH APPLICATIONS

1. I am going to read you a list of applications. Please tell me for each of them whether they are already in use in your hospital by the medical staff.

		Yes	No	DK
1	Electronic patient record system common to most of the departments	1	2	3
2	Electronic order communication system for laboratory exams	1	2	3
3	Electronic system to send and receive referral letters	1	2	3
4	Electronic system to send discharge letters to general practitioners	1	2	3
5	ePrescription	1	2	3
6	eAppointment system	1	2	3
7	Picture Archiving and Communication System (PACS)	1	2	3
8	Telemonitoring of outpatients at home	1	2	3
9	Videoconferencing for consultation	1	2	3

### ASK Q2 ONLY FOR APPLICATIONS THAT ARE NOT IN PLACE IN Q1

2. Regarding the following applications, please tell me if each of them is a priority for investment in the next 3 years or not.

		Yes	No	DK
1	Electronic patient record system common to most of the departments	1	2	3
2	Electronic order communication system for laboratory exams	1	2	3
3	Electronic system to send and receive referral letters	1	2	3
4	Electronic system to send discharge letters to general practitioners	1	2	3
5	ePrescription	1	2	3
6	eAppointment system	1	2	3
7	Picture Archiving and Communication System (PACS)	1	2	3
8	Telemonitoring of outpatients at home	1	2	3
9	Videoconferencing for consultation	1	2	3

Now we are going to discuss the electronic patient record system (EPR) in your hospital.

**ASK Q3, Q4 and Q5 TO THOSE WHO HAVE EPR IN PLACE (Yes to item 1 in Q1)**

3. Please estimate what share (%) of departments in your hospital are currently using a common EPR system.

**Interviewer: Code exact answer. If respondent hesitates prompt.**

			%
Don't know ( <b>Do not read</b> ), CODE 101			

4. I am going to read a number of statements concerning the possible impacts that the use of EPR system may have had in your hospital. Please tell me whether you totally agree, somewhat agree, somewhat disagree or totally disagree with each of them

		Totally agree	Somewhat agree	Somewhat disagree	Totally disagree	DK
1	Medical errors have been reduced	4	3	2	1	5
2	The quality of diagnosis decisions has improved	4	3	2	1	5
3	The quality of treatment decisions has improved	4	3	2	1	5
4	The working processes of medical staff are more efficient	4	3	2	1	5
5	Waiting lists have been reduced	4	3	2	1	5
6	Average number of patients your hospital can admit during one day has been increased	4	3	2	1	5
7	The amount of waste linked to unnecessary repetition of examinations has diminished	4	3	2	1	5

5. I am now going to read a list of possible barriers you may have encountered during the implementation of the common EPR system in your hospital. Please tell me whether you totally agree, somewhat agree, somewhat disagree or totally disagree with each of them

		Totally agree	Somewhat agree	Somewhat disagree	Totally disagree	DK
1	Current ERP systems are insufficiently adapted to the medical staff's needs	4	3	2	1	5
2	Incompatibility of organisational procedures of different departments	4	3	2	1	5
3	IT infrastructural limitations (i.e. limited or no connectivity)	4	3	2	1	5
4	Difficulties to determine the common data to be recorded in the electronic patient record	4	3	2	1	5
5	EPR systems of different departments are not interoperable and/or cannot be integrated with new solutions	4	3	2	1	5
6	Concerns about security issues related to the protection of medical data	4	3	2	1	5
7	Financial limitations of the ICT budget	4	3	2	1	5
8	Lack of financial incentives to staff for using the EPR system	4	3	2	1	5
9	Lack of ICT knowledge of the medical staff and/or lack of time and resources for medical staff training	4	3	2	1	5
10	Staff considers using EPR to be too time-consuming	4	3	2	1	5

**ASK Q6 IF EPR NOT IN PLACE (“No” to item 1 in Q1)**

6. I am now going to read a list of possible barriers for not implementing a common EPR system in your hospital. Please tell me whether you totally agree, somewhat agree, somewhat disagree or totally disagree with each of them:

		Totally agree	Somewhat agree	Somewhat disagree	Totally disagree	DK
1	Current ERP systems are insufficiently adapted to the medical staff's needs	4	3	2	1	5
2	Incompatibility of organisational procedures of different departments	4	3	2	1	5
3	IT infrastructural limitations (i.e. limited or no connectivity)	4	3	2	1	5
4	Difficulties to determine the common data set to be recorded in the EPR	4	3	2	1	5
5	EPR systems of different departments are not interoperable among themselves and/or cannot be integrated with new solutions	4	3	2	1	5
6	Concerns about security issues related to the protection of medical data	4	3	2	1	5
7	Financial limitations of the ICT budget	4	3	2	1	5
8	Lack of ICT knowledge of the medical staff	4	3	2	1	5
9	Lack of financial incentives to staff for using the EPR system	4	3	2	1	5
10	Staff considers using EPR to be too time-consuming	4	3	2	1	5

**TO ALL**

*Moving on to chronic disease management programs and tele-monitoring now*

7. Does your hospital run electronic/online chronic disease management programs for outpatients at home?

**ONLY ONE POSSIBLE ANSWER**

1	Yes
2	No
3	Don't know <b>(DO NOT READ)</b>

**IF 1 ("Yes") AT QUESTION 7**

8. In the framework of such chronic disease management programs, does your hospital offer tele-monitoring services to outpatients at home?

**ONLY ONE POSSIBLE ANSWER**

1	Yes
2	No
3	Don't know <b>(DO NOT READ)</b>

**IF 1 ("Yes") AT QUESTION 8: ASK Q9 AND Q10**

9. For which of the following conditions does your hospital offer tele-monitoring services to outpatients at home? (Please include pilot programs)

**MULTIPLE ANSWERS POSSIBLE**

1	Asthma
2	Diabetes
3	Cancer
4	Chronic obstructive pulmonary disease
5	Chronic renal diseases
6	Heart diseases
7	Other
8	Don't know <b>(DO NOT READ)</b>

10. Please estimate the number of patients at home who were tele-monitored by your hospital last year. (Please include pilot programs)

1	None
2	Less than 10
3	Between 11 and 25
4	Between 26 and 50
5	More than 50
6	Don't know

**ASK Q11 IF TELEMONITORING NOT IN USE (“No” to item 8 in Q1):**

11. I am now going to read a list of possible barriers for your hospital not offering tele-homecare/tele-monitoring. Please tell me whether you totally agree, somewhat agree, somewhat disagree or totally disagree with each of them

8.4		Totally agree	Somewhat agree	Somewhat disagree	Totally disagree	DK
1	Current systems are insufficiently adapted to the medical staff's needs	4	3	2	1	5
2	Difficulties to implement it due to hospital organisational issues	4	3	2	1	5
3	IT infrastructural limitations (i.e. limited or no connectivity)	4	3	2	1	5
4	Concerns about security issues related to the protection of medical data	4	3	2	1	5
5	Financial limitations of the ICT budget	4	3	2	1	5
6	The lack of ICT knowledge of the medical staff	4	3	2	1	5

## TO ALL

12. Please tell me whether you think tele-homecare and/or tele-monitoring services would positively impact to a great extent, to some extent, not much or not at all the following:

If your hospital offers these services, please refer to your experience in your hospital, if not please give your general opinion as a Medical Director

		Great extent	Some extent	Not much	Not at all	DK
1	Reduction in time for achieving therapy stabilisation	4	3	2	1	5
2	Improvement in the quality of life of patients	4	3	2	1	5
3	Reduction in the numbers and length of hospital stays	4	3	2	1	5
4	Reduction in medical errors	4	3	2	1	5
5	Improvement in the quality of diagnosis decisions	4	3	2	1	5
6	Improvement in the quality of treatment decisions	4	3	2	1	5
7	More efficient working processes among medical staff	4	3	2	1	5
8	Shorter waiting lists	4	3	2	1	5
9	Increased average number of patients receiving help during one day	4	3	2	1	5

## CLOSE INTERVIEW

## 8.5 Annex 5: Sampling and statistical details relating to the survey

### 8.5.1 Sampling procedure and sample sizes

Within each hospital sampled the larger target population was that of the CIOs. The CIO questionnaire focused mainly on ICT availability. It investigated medical applications such as electronic patient record systems (EPR systems), picture and archiving communications systems (PACS) and networking applications such as ePrescription and eReferral. Issues related to ICT security and resilience were also covered.

In one-third of hospitals, a second questionnaire module was directed to Medical Directors. This module concentrated on Medical Directors' attitudes and opinions about the impact of ICT in the hospital and the barriers to implementing applications such as EPR systems and telemonitoring.

#### 8.5.1.1 Description of the universe and sample construction

The overall sampling procedure aimed at reflecting representative information from all types of acute hospitals the 27 Member States and the three other European Economic Area (EEA) and candidate countries, with an attempt to maximise the response rates. This implied in particular:

- Establishment of a description of the universe and target sample in each country to obtain control data so as to monitor the actual sample achieved.
- Application of a specific sampling and field procedure in the field.

Extensive desk research was conducted by the national Ipsos Network members to locate the latest and most accurate lists and descriptions of acute hospitals in terms of size (number of beds), ownership (private/public) and regions (using the NUTS classification). Various sources were used or were purchased for this purpose. The materials were based on official statistics from Ministries, data available on health-related public websites, public and private directories and lists that were followed up by phone contacts, when necessary, to complete the information. The aggregated information that was collected for each country, including the main source used, is shown in Table 6.

Table 6 – Aggregated information collected for each country

Universe Data – Desk Research									
Country	Total number of acute hospitals	Total number of hospitals within different "number of beds" breakdowns				Total number of <u>private</u> acute hospitals		Total number of <u>public</u> acute hospitals	Main source used to define universe
		1 - 100 beds	101 - 250 beds	251 - 750 beds	751 or more beds				
<i>Austria</i>	153	19	72	47	15	44	109	Hospitals in Austria published by: Bundesministerium für Gesundheit (22.04.2008)	
<i>Belgium</i>	199	39	81	74	5	123	76	<a href="http://www.belgium.be/nl/gezondheid/gezondheidszorg/medische_diensten/ziekenhuizen/">http://www.belgium.be/nl/gezondheid/gezondheidszorg/medische_diensten/ziekenhuizen/</a>	
<i>Bulgaria</i>	158	46	59	32	21	30	128	<a href="http://www.lechebnizavedenia.com">www.lechebnizavedenia.com</a> and individual hospital websites	
<i>Croatia</i>	36	2	12	17	5	0	36	Croatian Health Service Yearbook 2008, published by Croatian National Institute of Public Health, November 2009	
<i>Cyprus</i>	71	63	5	3	0	63	8	List provided by Department of Medical and Public Health Services, Ministry of Health Cyprus in 2010	
<i>Czech Republic</i>	156	24	48	65	19	104	52	Institute of health information and statistics of the Czech republic (IHIS), June 2009	
<i>Denmark</i>	51	13	11	23	4	0	51	Websites for Danske Regioner and the specific hospitals and telephone calls to a number of hospitals	
<i>Estonia</i>	26	13	6	6	1	3	23	Directory published by National Institute for Health Development, updated 4.11.2009	
<i>Finland</i>	128	76	32	18	2	21	107	Dun&Bradstreet and individual hospitals'	

								websites
<i>France</i>	2452	921	820	604	107	160	2292	Ministry of Health website ( <a href="http://www.sante.gouv.fr/">www.sante.gouv.fr/</a> ) and Dun&Bradstreet
<i>Germany</i>	3713	2208	772	624	109	444	3269	Dun&Bradstreet
<i>Greece</i>	313	159	79	63	12	146	167	Website of the Ministry of Health and Social Solidarity ( <a href="http://www.mohaw.gr/gr/ygeia/links/hospitals">www.mohaw.gr/gr/ygeia/links/hospitals</a> ) and Dun&Bradstreet
<i>Hungary</i>	104	3	21	53	27	2	102	National Health Insurance Fund: Statement on the number of hospital beds and patient traffic, 2008
<i>Iceland</i>	18	16	1	0	1	0	18	Directorate of Health – <a href="http://www.landlaeknir.is/Pages/393">http://www.landlaeknir.is/Pages/393</a>
<i>Ireland</i>	107	47	41	17	2	9	98	<a href="http://www.hse.ie/eng/services/Find_a_Service/HospsCancer/hospitallist.html">http://www.hse.ie/eng/services/Find_a_Service/HospsCancer/hospitallist.html</a>
<i>Italy</i>	1220	582	367	214	57	613	607	List provided by the Ministry of Health
<i>Latvia</i>	21	1	11	5	4	0	21	Regulations of Cabinet of Ministers Nr.1046 "Health care organisation and financing arrangements"
<i>Lithuania</i>	74	3	23	27	21	3	71	Basis of Lithuania enterprises, 2008
<i>Luxembourg</i>	7	1	2	4	0	3	4	Ministère de la Santé: carte sanitaire 4ième édition 1998–2005
<i>Malta</i>	5	3	1	0	1	2	3	Hospital Beds in Malta & Gozo, 2008
<i>Netherlands</i>	298	158	90	40	10	99	199	<a href="http://www.kiesbeter.nl">www.kiesbeter.nl</a> ; <a href="http://www.ziekenhuis.nl">www.ziekenhuis.nl</a> ; <a href="http://www.rivm.nl">www.rivm.nl</a> ; <a href="http://www.igz.nl">www.igz.nl</a> ; <a href="http://www.independer.nl">www.independer.nl</a>
<i>Norway</i>	50	22	12	13	3	3	47	SINTEF 2008
<i>Poland</i>	920	359	268	270	23	356	564	Governmental source: <a href="http://www.rejestrzoz.gov.pl/RZOZ/">http://www.rejestrzoz.gov.pl/RZOZ/</a>

<i>Portugal</i>	123	59	25	32	7	53	70	Ministry of Health website ( <a href="http://www.min-saude.pt/portal">http://www.min-saude.pt/portal</a> ) and individual hospitals' websites
<i>Romania</i>	335	100	103	89	43	23	312	Government sources, the official website of the Romanian Ministry of Health and source for the private hospitals: official websites of these hospitals, Romanian media
<i>Slovenia</i>	21	6	6	7	2	2	19	Health portal ( <a href="http://www.zdravstvena.info">www.zdravstvena.info</a> )
<i>Slovakia</i>	130	65	44	11	10	21	109	Ministry of Health website, individual hospitals' website and Dun&Bradstreet
<i>Spain</i>	919	481	260	134	44	456	463	Ministry of Health website ( <a href="http://www.msps.es">http://www.msps.es</a> ) + individual hospitals' website
<i>Sweden</i>	56	16	8	28	4	1	55	Dun&Bradstreet and individual hospitals' website
<i>UK</i>	366	106	40	180	40	88	278	<a href="http://www.drfoosterhealth.co.uk/hospital-guide/">www.drfoosterhealth.co.uk/hospital-guide/</a>
<b>TOTAL</b>	<b>12230</b>	<b>5611</b>	<b>3320</b>	<b>2700</b>	<b>599</b>	<b>2872</b>	<b>9358</b>	
<b>In % of total number of acute hospitals</b>		<b>46%</b>	<b>27%</b>	<b>22%</b>	<b>5%</b>	<b>23.5%</b>	<b>76.5%</b>	

### 8.5.1.2 Sampling procedure

Based on the description of the universe, sampling objectives were defined. They are laid out in Table 7.

*Table 7 – Target sample for eHealth in European acute hospitals*

Country	Target respondent	
	Primary = CIO (10-15')	Secondary = Medical Directors (3-5')
<i>Austria</i>	15	5
<i>Belgium</i>	23	8
<i>Bulgaria</i>	15	5
<i>Croatia</i>	4	1
<i>Cyprus</i>	8	3
<i>Czech Republic</i>	15	5
<i>Denmark</i>	8	3
<i>Estonia</i>	3	1
<i>Finland</i>	15	5
<i>France</i>	150	50
<i>Germany</i>	150	50
<i>Greece</i>	26	9
<i>Hungary</i>	9	3
<i>Iceland</i>	3	1
<i>Ireland</i>	11	4
<i>Italy</i>	90	30
<i>Latvia</i>	3	1
<i>Lithuania</i>	8	3
<i>Luxembourg</i>	3	1
<i>Malta</i>	3	1
<i>Netherlands</i>	29	10
<i>Norway</i>	7	2
<i>Poland</i>	98	33
<i>Portugal</i>	19	6
<i>Romania</i>	38	13
<i>Slovenia</i>	3	1
<i>Slovakia</i>	12	4
<i>Spain</i>	90	30
<i>Sweden</i>	8	3
<i>UK</i>	38	13
<b>TOTAL</b>	<b>900</b>	<b>300</b>

To ensure a representative sample of hospitals in each country, the following random procedure was adopted:

- Hospitals were called at random from the exhaustive files of hospitals (identified and qualified through the desk research phase).
- Interviewers first asked the person at the hospital's general reception desk to speak to the CIO, and then posed a series of screening questions to ensure the eligibility of the hospital and the respondent.
- At the end of the interview with the CIO, interviewers asked to be connected by telephone to the Medical Director (or equivalent) for a short follow-up interview. If it was not immediately possible to speak with the Medical Director, they obtained the individual's name in order to call again and make an appointment for a later telephone survey interview.
- The universe data collected during the desk research phase were used as control data to ensure that the actual hospitals surveyed reflected the variety of hospitals in the individual country. In particular, fieldwork was closely monitored according to three important variables: size (number of beds), ownership (private/public) and region (NUTS classification). Table 8 identifies the NUTS level used in each country surveyed.

Table 8 – Regional classification for sampling based on the NUTS level or equivalent

Country	NUTS level or equivalent
<i>Austria</i>	NUTS 3
<i>Belgium</i>	NUTS 1
<i>Bulgaria</i>	NUTS 1
<i>Croatia</i>	NUTS 1
<i>Cyprus</i>	NUTS 1
<i>Czech Republic</i>	NUTS 3
<i>Denmark</i>	NUTS 2
<i>Estonia</i>	NUTS 3
<i>Finland</i>	NUTS 2
<i>France</i>	NUTS 1
<i>Germany</i>	NUTS 1
<i>Greece</i>	NUTS 1
<i>Hungary</i>	NUTS 3
<i>Iceland</i>	Austurland/Vesturland/Vestfirðir/Höfuðborgarsvæðir/Norðurland/ Suðurland
<i>Ireland</i>	NUTS 3
<i>Italy</i>	NUTS 2
<i>Latvia</i>	NUTS 3
<i>Lithuania</i>	NUTS 3
<i>Luxembourg</i>	NUTS 3
<i>Malta</i>	NUTS 3
<i>Netherlands</i>	NUTS 1
<i>Norway</i>	NUTS 3
<i>Poland</i>	NUTS 2
<i>Portugal</i>	NUTS 2
<i>Romania</i>	NUTS 2
<i>Slovenia</i>	NUTS 3
<i>Slovakia</i>	NUTS 3
<i>Spain</i>	NUTS 2
<i>Sweden</i>	NUTS 3
<i>UK</i>	NUTS 2

## 8.5.2 Fieldwork

Table 9 outlines the final samples of acute hospitals that were used in the survey.

*Table 9 – Number of interviews*

Country	Number of hospitals with CIO interviews	Size of hospital				Ownership		Number of hospitals with also Medical Directors interviews
		1 – 100 beds	101 – 250 beds	251 – 750 beds	751 or more beds	Private hospitals	Public hospitals	
<i>Austria</i>	15	1	9	5	0	5	10	5
<i>Belgium</i>	23	0	7	11	5	14	8	8
<i>Bulgaria</i>	15	5	3	4	3	4	11	5
<i>Croatia</i>	4	0	2	2	0	0	4	1
<i>Cyprus</i>	8	5	0	1	0	4	4	2
<i>Czech Republic</i>	15	1	4	3	6	4	10	5
<i>Denmark</i>	8	0	1	4	3	0	8	3
<i>Estonia</i>	3	0	1	0	2	0	3	1
<i>Finland</i>	15	3	7	5	0	0	15	5
<i>France</i>	150	46	59	41	4	71	76	50
<i>Germany</i>	150	36	58	45	11	59	90	31
<i>Greece</i>	26	5	11	7	3	2	24	9
<i>Hungary</i>	10	0	2	7	1	0	9	3
<i>Iceland</i>	3	2	1	0	0	0	3	1
<i>Ireland</i>	8	0	1	4	3	0	8	1

<i>Italy</i>	90	29	26	21	10	43	47	30
<i>Latvia</i>	3		2	1	0	0	3	1
<i>Lithuania</i>	10	0	3	4	3	0	10	3
<i>Luxembourg</i>	3	1	0	2	0	1	2	1
<i>Malta</i>	3	2	0	0	1	1	2	1
<i>Netherlands</i>	29	0	3	19	4	1	27	10
<i>Norway</i>	7	1	2	3	1	1	6	2
<i>Poland</i>	99	21	34	36	3	12	85	33
<i>Portugal</i>	20	7	5	7	1	7	13	6
<i>Romania</i>	38	8	13	10	6	0	37	13
<i>Slovenia</i>	3	1	1	1	0	0	3	1
<i>Slovakia</i>	12	4	4	1	2	8	3	4
<i>Spain</i>	90	19	27	26	16	27	62	30
<i>Sweden</i>	8	1	1	3	2	0	8	3
<i>UK</i>	38	9	4	18	7	10	28	12
<b>TOTAL</b>	<b>906</b>	<b>207</b>	<b>291</b>	<b>291</b>	<b>97</b>	<b>274</b>	<b>619</b>	<b>280</b>
<i>% in the sample</i>		23%	31%	32%	11%	31%	69%	
<i>Structure of the universe</i>		46%	27%	22%	5%	23.5%	76.5%	
<i>% of hospitals with MD interviews</i>		21%	35%	33%	9%	27%	72%	31%

Overall, the survey was very well accepted both by CIOs and the Medical Directors. The response rate to the survey is above what is generally expected for similar surveys (10–15%). Three measures that were undertaken contributed significantly to the low refusal rate (which was only around 5% on average):

- Experienced and well trained interviewers were used.
- A letter of introduction was sent to the hospitals to provide them with more information about the survey. This letter was endorsed and signed by officials from the EC.
- Interviewers adapted the timing of interview appointments to the busy schedule of the respondents. Appointments were fixed at the most convenient times for the respondents (at the appropriate hours or days of the week).

### 8.5.3 Statistical reliability of the results

This section contains brief background information on statistical reliability that can enhance an understanding of the survey results.

#### 8.5.3.1 What is statistical reliability?

In an ideal world, with unlimited time and budget available, every person in a survey target population would be sampled: the results from such a sample would reflect the population exactly. Realistically, however, it is generally only possible to obtain a sub-set of the population for the sample due to constraints of cost, time, and practicality. Whenever a sample is taken, there is always a degree of uncertainty about what are the true characteristics of the population. This level of uncertainty can usually be quantified: this quantification is known as the confidence interval or statistical reliability. When quoting any results or aggregate figures from a sample, it is good practice to present them in the context of their level of precision and/or certainty. A confidence interval should therefore accompany the data.

#### 8.5.3.2 How to calculate statistical reliability

Calculating statistical reliability involves making use of the normal approximation to the binomial, which is applied under the central limit theorem. The central limit theorem states that the means of sets of observations are normally distributed regardless of the distribution of the raw data or observations themselves: it holds with samples that exceed 30.

The confidence interval is calculated by using the following formula:

$$\hat{p} \pm z_{1-\alpha/2} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

Where the observed proportion is  $z_{1-\alpha/2}$ , it is in the  $1 - \alpha / 2$  percentile of a normal distribution. At a 95% confidence interval, its value is 1.96.

Where the central limit theorem does not apply, in small samples of less than 30, another calculation of the confidence interval – such as the Agresti–Coull interval – should be used. This formula is as follows:

$$\tilde{p} \pm z_{1-\alpha/2} \sqrt{\frac{\tilde{p}(1-\tilde{p})}{\tilde{n}}}$$

Where:

$$\tilde{n} = n + z_{1-\alpha/2}^2$$

$$\tilde{p} = \frac{X + z_{1-\alpha/2}^2/2}{\tilde{n}}$$

The formulae used to calculate the confidence interval for a given observed proportion do not use the size of the population. The statistical reliability is independent from the size of the population. However, it is commonly admitted that, when the proportion between the sample size and population size exceeds 5%<sup>85</sup>, the confidence interval can be adjusted to take this into account. This is done by applying what it is called a finite population correction (FPC) factor. Table 10 shows the confidence interval for an observed proportion of 50%, corrected by using the FPC factor.

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<sup>85</sup> This is the case in all the countries surveyed in this study.

Table 10 – Confidence interval for an observed proportion of 50% corrected with the FPC factor

Country	Universe	Sample of hospitals	Sample vs universe	Normal approximation Confidence interval at 95%		FPC	Normal approximation Confidence interval corrected		Agresti–Coull interval		Agresti–Coull interval with finite population correction
				+/-			+/-		+/-		
France	2452	150	6%	+/-	8.00%	96.91%	+/-	7.75%			
Germany	3713	150	4%	+/-	8.00%	97.97%	+/-	7.84%			
Poland	920	99	11%	+/-	9.85%	94.52%	+/-	9.31%			
Italy	1220	90	7%	+/-	10.33%	96.28%	+/-	9.95%			
Spain	919	90	10%	+/-	10.33%	95.03%	+/-	9.82%			
Romania	335	38	11%	+/-	15.90%	94.30%	+/-	14.99%			
UK	366	38	10%	+/-	15.90%	94.80%	+/-	15.07%			
Netherlands	298	29	10%			95.17%			+/-	17.10%	16.27%
Greece	313	26	8%			95.91%			+/-	17.94%	17.21%
Belgium	199	23	12%			94.28%			+/-	18.92%	17.83%
Portugal	123	20	16%			91.88%			+/-	20.07%	18.44%
Austria	153	15	10%			95.28%			+/-	22.58%	21.51%
Bulgaria	158	15	9%			95.44%			+/-	22.58%	21.55%
Czech Republic	156	15	10%			95.38%			+/-	22.58%	21.53%
Finland	128	15	12%			94.33%			+/-	22.58%	21.30%
Slovakia	130	12	9%			95.64%			+/-	24.62%	23.55%
Hungary	104	10	10%			95.53%			+/-	26.34%	25.16%
Lithuania	74	10	14%			93.63%			+/-	26.34%	24.66%
Cyprus	71	8	11%			94.87%			+/-	28.48%	27.02%
Denmark	51	8	16%			92.74%			+/-	28.48%	26.41%
Ireland	107	8	7%			96.64%			+/-	28.48%	27.52%
Sweden	56	8	14%			93.42%			+/-	28.48%	26.60%
Norway	50	7	14%			93.68%			+/-	29.76%	27.88%
Croatia	36	4	11%			95.62%			+/-	35.00%	33.46%

Estonia	26	3	12%		95.92%		+/-	37.47%	35.94%
Iceland	18	3	17%		93.93%		+/-	37.47%	35.19%
Latvia	21	3	14%		94.87%		+/-	37.47%	35.54%
Luxembourg	7	3	43%		81.65%		+/-	37.47%	30.59%
Malta	5	3	60%		70.71%		+/-	37.47%	26.49%
Slovenia	21	3	14%		94.87%		+/-	37.47%	35.54%
<b>TOTAL</b>	<b>12230</b>	<b>906</b>	<b>7%</b>	<b>+/-</b>	<b>3.26%</b>	<b>96.23%</b>	<b>+/-</b>	<b>3.13%</b>	

A confidence interval of, for example,  $\pm 7.75\%$  (which in Table 10 is the case in France) means that an observed proportion of 50% is in reality comprised of between 42.25% and 57.75% (if the survey had approached all the hospitals in the country). It is therefore possible to be confident at 95% that the “true” proportion is within this interval.

#### 8.5.4 Limitations

There are, nevertheless, a number of limitations with regard to the survey sample and findings.

Each national sample in this survey is representative of the acute hospitals in the country, whatever the size of the sample. Therefore, the results obtained in each country can be used to draw conclusions about the universe of hospitals in that country. In particular, the 7 large countries (France, Germany, Poland, Italy, Spain, Romania and the UK) as shown in table 5 have statistical robust samples.

Country comparisons should, however, be undertaken with caution. The confidence intervals involved should be taken into account when drawing any conclusion from a given observed proportion. Overall, the smaller the sample, the larger are the margins for error despite the large sample/universe ratio.

## 8.6 Annex 6: Information note

This note was circulated in spring 2010 to members of the i2010 sub-group on eHealth members for their information.

### In 2010: How do European hospitals make use of eHealth?

**At this early stage of the twenty-first century, Europe's health systems and services are under extreme pressure. Discovering how hospitals use eHealth services today, as well as how using eHealth may enable hospitals to handle future challenges, is vital. Building a robust and repeatable survey instrument to uncover such information is a comprehensive step.**

**Preparing the survey design so that the study's findings are highly relevant to European policy-makers is essential. This kind of benchmarking will constitute an important part of the decision-makers' toolkit.**

This eHealth benchmarking exercise is one of many i2010 initiative-supported studies. These studies help European decision-makers to measure the state-of-play in terms of Information Society implementation. This specific survey focuses on European hospitals' availability and use of eHealth. It is the first time that such an exercise has been done in the EU27. The study is called Benchmarking deployment of eHealth services III<sup>86</sup>. It follows on from a first exercise which measured eHealth in General Practitioners in 2007, and a second benchmarking exercise which developed a framework for future eHealth benchmarking in 2009. The survey is being undertaken on behalf of the European Commission by Deloitte and Ipsos Belgium with the support of external eHealth experts.

#### Background to the survey

The European Commission began to support exercises in European benchmarking in 2006. In eHealth, a decision was taken to concentrate on eHealth use by two sorts of health institutions: general practices and hospitals. This focus enables an early assessment of how different health providers might use eHealth.

This hospital survey will be the first to be performed in Europe to measure the deployment and use of ICT applications foreseen in the eHealth Action Plan (2004). It is being undertaken within a broadening of awareness of European decision-makers who wish to understand the availability and use of eHealth in hospitals within a wider international setting.

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<sup>86</sup> For administrative details, see:

[http://ec.europa.eu/information\\_society/newsroom/cf/itemdetail.cfm?item\\_id=5004&utm\\_campaign=isp&utm/](http://ec.europa.eu/information_society/newsroom/cf/itemdetail.cfm?item_id=5004&utm_campaign=isp&utm/)

## **Purpose of the survey**

This hospital-based survey measures the adoption of eHealth solutions by hospitals. It is a preliminary investigation which will enable a first benchmarking of the field. The European Commission's aim is to develop a more in-depth understanding of the current state of eHealth implementation in hospitals. The aim is to do it in a way that can support eHealth policy decision-making of the Union and Member States. It should be feasible to standardise the results of the survey, which should – where feasible – be comparable to the small number of similar surveys that have taken place in Europe and internationally. These have taken place among others in Australia, Canada, and the United States. Hence, cooperation with other international organisations is encouraged. Working relationships with both the Organisation for Economic Co-operation and Development and the World Health Organisation have been established from the study's start. These two organisations form part of the survey's steering committee.

## **General approach and methodology of the survey**

The unit of analysis of the survey will be "acute hospitals". The CATI telephone survey will target hospitals in all of the European Union's 27 Member States and three more countries: Croatia, Iceland, and Norway. The sample will include different type of hospitals according to their size, location and ownership.

A focus group was held on March 16, 2010 in the context of the eHealth Ministerial Conference in Barcelona. Its role was to help the European Commission and the study team to decide on and fine-tune the final questionnaire. In future years, it should be possible to repeat the survey.

Following the EC Terms of Reference for the study, this hospital-based questionnaire is designed to explore four main types of questions: basic indicators on connectivity, indicators on applications, attitudinal indicators and horizontal indicators.

Basic indicators will identify information about the hospital's Internet access, network architecture, videoconferencing, and workstations (types and number). Applications indicators will be the core part of the questionnaire: it will inventory the availability and use in hospitals of electronic patient records, picture and archiving communications systems, networking applications (ePrescription, eReferral, eBooking, teleradiology, and telemonitoring), and chronic disease management systems. We will also include indicators to measure the level of medical data exchanges with external health providers (at regional, national, European and international levels) and with patients. Attitudinal indicators will tease out hospital-based health professionals' motivations and intentions to use eHealth. Horizontal indicators will include security measures and disaster recovery plans prepared by hospitals.

## Work plan for the survey

This hospital-based questionnaire will survey over 1,000 acute hospitals in 30 countries. The design of the questionnaire will be based on a mix of desk research, focus group activity, and meetings held with international socio-economics and health-related organisations. Given the desk research first outcomes and the focus group discussions in Barcelona in March 2010, it seems that Chief Information Officers and Medical Directors are the preferred target populations for the CATI survey to collect all the level of information needed.

Data collection will take place mainly during May-early July 2010. Preliminary data analysis will take place by the end of summer 2010. Initial findings will then be presented in autumn 2010, and finalised in winter 2010/2011. Interim and final survey reports will be developed, and an article that describes the survey's results will be published. A workshop which presents the study's final findings is initially proposed to be held in autumn 2010.

## Role and involvement of the i2010 subgroup on eHealth

A focus group will be held as part of the study. The focus group's task is to help refine the design of the questionnaire. Its composition includes a variety of perspectives, including hospital clinicians, Chief Executive Officers and Medical Directors. Policy makers, and representatives of international organisations will also be present.

Two representatives of the i2010 subgroup on eHealth<sup>87</sup> were invited to attend the March 16, 2010 focus group, and accepted. They had both previously participated in the 2007 focus group which validated the questionnaire to general practitioners.

As the study team's work progresses, and its findings are firmed up, it will make more detailed presentations to the i2010 subgroup on eHealth. Subgroup members will of course be invited to a final meeting which will present the survey findings publicly.

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<sup>87</sup> The i2010 subgroup on eHealth is composed of important civil servants from the ministries of health of the Union's 27 Member States, and a limited number of observers from European Economic Area and candidate countries. Over its five years of existence, its role has been to consider, give feedback on, and help to develop European-wide priorities and developments. It met regularly on three or four occasions a year.

## 8.7 Annex 7: Validation workshop

This annex contains the announcement/invitation to a selected number of experts who attended the study's January 18, 2011 validation workshop.

### **How do European hospitals make use of eHealth? Validating the results of a 2010 telephone survey of European Union acute hospitals in 30 countries**

Tuesday, 18 January, 2011: 10:00 – 15:30 CET

Albert Borschette conference centre Room AB-3B , 36 rue Froissart,  
B-1040 Brussels, Belgium. Metro: Schuman

<http://wikimapia.org/5560799/Albert-Borschette-Conference-Centre>

**The workshop is an invitation-only event.**

**It will gather together around 30-40 experts in the field.**

European acute hospitals have been surveyed during 2010 on their use of a wide variety of eHealth applications in a benchmarking study. Hospitals in the EU27 and Croatia, Iceland, and Norway have been covered. This workshop is intended to validate and further enhance the policy conclusions of this telephone-based survey. Among the findings:

From **Chief Information Officers**: ICT availability of electronic medical applications (including electronic patient records; PACS; adverse health events reporting systems; telemonitoring); current state of electronic data exchange, and data protection and security.

From **Medical Directors**: their views on ICT use, investment priorities, barriers to implementation and during implementation.

**After careful validation**, public dissemination of the survey findings can be anticipated in February-March 2011.

**Background to the survey:** This survey focuses on European hospitals' availability and use of eHealth: the first of its kind in the EU27. The study is been commissioned by the EC, and undertaken by a consortium that includes Deloitte, Ipsos Belgium and a number of individual eHealth experts. In addition to the EC (including the IPTS), both the OECD and the WHO are part of the study's steering group.

**ID details:** To enter the Borschette building, ID details are required by the security desk. Please plan to arrive a good 30 minutes in advance of the meeting start to guarantee reasonably speedy processing at the building entrance.

## Workshop outline

10 00 - 10 15	Registration accompanied by coffee/tea
10 15 - 10 30	Introduction and background (EC and Deloitte, Brussels)
10 30 - 10 45	Methodology (Ipsos Belgium)
10 45 - 11 00	Q+A
11 00 - 11 40	Findings from hospital Chief Information Officers (Deloitte, Brussels)
11 40 - 11 55	Q+A
11 55 - 12 15	Findings from hospital Chief Medical Officers (Deloitte, Brussels)
12 15 - 12 30	Q+A
12 30 - 13 30	LUNCH
13 30 - 14 00	Country-related findings (Deloitte)
14 00 - 14 15	Q+A
14 15 - 14 45	Further, in-depth analysis (IPTS, Spain)
14 45 - 15 00	Q+A
15 00 - 15 15	Next steps
15 15 - 15 30	Conclusions and farewell

## 8.8 Annex 8: Key data from previous studies

This annex contains two examples of core data on figures from two of the most important, similar surveys that have taken place in the EU and nearby countries.

From the Health Information Network Europe (HINE) survey from 2005 to 2008<sup>88</sup>:

	EU 27:																				Total
Countries	AT	BE	BG	CZ	DK	EE	FI	FR	DE	HU	IT	LV	LT	NL	PL	PT	RO	ES	SE	GB/IE	19
Interviews	91	49	20	40	40	7	20	268	380	31	245	16	20	90	120	36	24	200	55	72	1,824
2004	45	49			20		20	134	190		124			45				100	25	72	824
2005				40						31				60							131
2006	46							134	190		121			45		36		100	30		702
2007			20		20	7						16	20				24				107
2008														60							60
Metaanalysis	x				x			x	x		x			x	x			x	x		9

From the e-Business W@tch survey 2006<sup>89</sup>:

	Number of beds				DK/no answer	Total
	1 - 100	101 - 250	251 - 750	> 750		
<b>Hospitals (EU-10)</b>	<b>205</b>	<b>162</b>	<b>103</b>	<b>38</b>	<b>31</b>	<b>539</b>
Belgium	1	9	10	1	1	22
Czech Republic	10	19	15	2	4	50
Germany	48	23	22	7	1	101
Greece	11	2	2	1	0	16
Spain	15	11	4	1	6	37
France	42	30	4	1	3	80
Italy	22	6	6	4	2	40
Latvia	20	14	5	4	12	55
Lithuania	29	15	10	2	2	58
Hungary	2	15	21	16	6	60
Netherlands	3	0	5	0	0	8
Poland	30	48	15	3	1	97
Portugal	25	9	14	1	1	50
Finland	18	7	5	1	1	32
Sweden	5	1	3	0	1	10
United Kingdom	15	3	6	3	7	34
Turkey	45	13	4	1	12	75
Norway	3	1	4	1	0	9
<b>Total (all countries)</b>	<b>344</b>	<b>226</b>	<b>155</b>	<b>49</b>	<b>60</b>	<b>834</b>

<sup>88</sup> HINE is no longer in existence. However, for more information about this network which operated during the middle part of the first decade of the twenty-first century, see the Deloitte website Last accessed 16 February 2011 [http://www.deloitte.com/view/en\\_GX/global/industries/life-sciences-health-care/66fba6c82b10e110VgnVCM100000ba42f00aRCRD.htm](http://www.deloitte.com/view/en_GX/global/industries/life-sciences-health-care/66fba6c82b10e110VgnVCM100000ba42f00aRCRD.htm)

<sup>89</sup> e-Business W@tch (2006) ICT and e-business in Hospital Activities. ICT and e-business activity in 2006. Sector Report No. 10 2006. Bonn/Brussels: empirica. See the project website accessed 16 February 2011 [http://www.ebusiness-watch.org/studies/sectors/health\\_hospital/documents/Hospitals\\_2006.pdf](http://www.ebusiness-watch.org/studies/sectors/health_hospital/documents/Hospitals_2006.pdf)

## 8.9 Annex 9: Reference List

Bjerknes, G. and T. Bratteteig. 1987. "Florence in Wonderland. System Development with Nurses." In *Computers and Democracy. A Scandinavian Challenge*, edited by G. Bjerknes, P. Ehn, and M. Kyng. Aldershot, UK: Avebury.

Bjerknes, G. and T. Bratteteig. 1995. "User Participation and Democracy: A Discussion of Scandinavian research on System Development." *Scandinavian Journal of Information Systems* 1:73–98.

Bødker, K., F. Kensing, and J. Simonsen. 2004. *Participatory IT design: Designing for business and workplace realities*. Cambridge, MA: MIT Press.

CALLIOPE. 2009. *2nd Open Session – Paris – 27 May 2009. Meeting Report*. Public report on the CALLIOPE Open Session organised in Paris, France.

Codagnone, C. and Lupiáñez-Villanueva, F. 2011. "A composite index for the benchmarking of eHealth Deployment in European acute Hospitals. Distilling reality in manageable form for evidence based policy". JRC Technical and Scientific Reports, Luxembourg: Publication Office of the European Union.

<http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=4179>

COM(2004)356 final. *e-Health – making healthcare better for European citizens: An action plan for a European e-Health Area*. Brussels: European Commission, 30.4.2004. Accessed February 16, 2011. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2004:0356:FIN:EN:PDF>.

COM(2005)229 final. *i2010 – A European Information Society for growth and employment*. Brussels: European Commission. Accessed February 16, 2011. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52005DC0229:EN:NOT>.

COM(2007)860 final. *A Lead Market Initiative for Europe*. Brussels: European Commission, 21.12.2007. Accessed February 16, 2011.

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0860:FIN:EN:PDF>.

COM(2008)689 final. *Telemedicine for the benefit of patients, healthcare systems and society*. Brussels: European Commission, 4.11.2008. Accessed February 16, 2011. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0689:FIN:EN:PDF>.

COM (2008)3282 final. *Commission Recommendation of 2nd July 2008 on cross-border interoperability of electronic health record systems. Official Journal of the European Union* L series 190:37–43, 18.7.2008. Accessed February 16, 2011. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008H0594:EN:NOT>.

COM(2009)567 final. *Solidarity in health: Reducing health inequalities in the EU*. 20.10.2009. Brussels: European Commission. Accessed February 16, 2011. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52009DC0567:EN:NOT>.

COM(2010)245 final/2. *A Digital Agenda for Europe*. Brussels: European Commission, 26.8.2010. Accessed February 16, 2011.

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0245:FIN:EN:PDF>.

COM(2010)546 final. *Europe 2020 Flagship Initiative Innovation Union*. Brussels: European Commission, 6.10.2010. Accessed February 16, 2011.

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0546:FIN:EN:PDF>.

COM (2010)2020 final. *Europe 2020: A strategy for smart, sustainable and inclusive growth*. Brussels: European Commission, 3.3.2010. Accessed February 16, 2011.

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF>.

Cordasev, Helena, Arne Björnberg, and Oscar Hjertqvist. 2010. *Cross border care EU: How to choose the best hospital? A study of hospital information portals in five EU countries*. Danderyd, Sweden / Brussels: Health Consumer Powerhouse. Accessed February 16, 2011.

<http://www.healthpowerhouse.com/files/HCP-study-Best-hospital-final-101119.pdf>.

Currie, Wendy L. 2010. *Towards a Healthier Europe! The TEMPEST Model*. October 2010. Accessed 16 February, 2011.

[http://www.eabis.org/fileadmin/eabis\\_uploads/News/EabisNewsletterCurrieOct2010.pdf?PHPSESSID=eeb4446122cd6fc555edcc16c9072409](http://www.eabis.org/fileadmin/eabis_uploads/News/EabisNewsletterCurrieOct2010.pdf?PHPSESSID=eeb4446122cd6fc555edcc16c9072409).

Danzon PM and M. Furukawa. 2001. "e-Health: Effects of the Internet on Competition and Productivity in Health Care." In *The Economic Payoff from the Internet Revolution*, edited by Alice M Rivlin and Robert E Liton. Washington DC: the Brookings Task Force on the Internet, Brookings Institution Press.

Directive 2006/123/EC of the European Parliament and of the Council of 12 December 2006 on *services in the internal market*. OJ L376, 27.12.2006, pp36-68. Accessed February 16, 2011.

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006L0123:en:NOT>.

Dugas, M, M Eckholt, and H. Bunzemeier. 2008. "Benchmarking of hospital information systems: Monitoring of discharge letters and scheduling can reveal heterogeneities and time trends." *BMC Medical Informatics and Decision Making*. 8:15. doi: 10.1186/1472-6947-8-15. Accessed February 16, 2011. <http://www.biomedcentral.com/1472-6947/8/15/>.

e-Business W@tch. 2006. *ICT and e-business in Hospital Activities. ICT and e-business activity in 2006*. Sector Report No. 10 2006. Bonn: empirica; Brussels: European Commission. Accessed February 16, 2011.

[http://www.ebusiness-watch.org/studies/sectors/health\\_hospital/documents/Hospitals\\_2006.pdf](http://www.ebusiness-watch.org/studies/sectors/health_hospital/documents/Hospitals_2006.pdf).

empirica & WRC [Work Research Centre]. 2008. *ICT & Ageing - European study on Users, Markets and Technologies, Preliminary findings*. Interim report. Bonn: empirica; Dublin: Work Research Centre. Accessed February 16, 2011.

[http://www.ict-ageing.eu/ict-ageing-website/wp-content/uploads/2008/11/ictageing\\_vienna\\_handout\\_final2.pdf](http://www.ict-ageing.eu/ict-ageing-website/wp-content/uploads/2008/11/ictageing_vienna_handout_final2.pdf).

European Commission. 2006. *Connected Health: Quality and safety for European citizens*. Luxembourg: Office of Official Publications of the European Communities. Accessed February 16, 2011.

[http://ec.europa.eu/information\\_society/activities/ict\\_psp/documents/connected-health.pdf](http://ec.europa.eu/information_society/activities/ict_psp/documents/connected-health.pdf).

European Commission. 2007. *eHealth priorities and strategies in European countries*. eHealth ERA report. Brussels: European Commission. Accessed February 16, 2011.

<http://www.ehealth-era.org/documents/2007ehealth-era-countries.pdf>.

European Commission (2008)3282. *Explanatory Memorandum, Scope of the Recommendation; Draft Commission Recommendation of 2nd July 2008 on cross-border interoperability of electronic health record systems*. Brussels: European Commission, 2008. Accessed February 16, 2011.

<http://www.epractice.eu/files/media/media2134.pdf>.

European Commission and empirica. 2008. *Benchmarking ICT use among General Practitioners in Europe. Final Report*. Brussels / Bonn. Authors: Alexander Dobrev, Marten Haesner, Tobias Hüsing, Werner B. Korte, and Ingo Meyer. Accessed February 16, 2011.

[http://ec.europa.eu/information\\_society/eeurope/i2010/docs/benchmarking/gp\\_survey\\_final\\_report.pdf/](http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/gp_survey_final_report.pdf/).

European Communities. 2006. *eHealth is worth it. The economic benefits of implemented eHealth solutions at ten European sites*. Luxembourg: Office of Official Publications of the European Communities. Accessed February 16, 2011.

<http://www.ehealth-impact.org/download/documents/ehealthimpactsept2006.pdf>.

European Communities. 2007. *Accelerating the Development of the eHealth Market in Europe. eHealth Taskforce Report 2007*. Luxembourg: Office of Official Publications of the European Communities. Accessed February 16, 2011.

[http://ec.europa.eu/information\\_society/activities/health/docs/publications/lmi-report-final-2007dec.pdf](http://ec.europa.eu/information_society/activities/health/docs/publications/lmi-report-final-2007dec.pdf).

European Communities. 2010. *Interoperable eHealth is worth it. Securing benefits from eRecords and ePrescribing*. Luxembourg: Office of Official Publications of the European Communities. Accessed February 16, 2011.

[http://ec.europa.eu/information\\_society/activities/health/docs/publications/201002ehri-mpact\\_study-final.pdf](http://ec.europa.eu/information_society/activities/health/docs/publications/201002ehri-mpact_study-final.pdf)

Eurostat. 2002. *Health statistics: Key data on health 2002. Data 1970–2001*. Luxembourg: Office of Official Publications of the European Communities. Accessed February 16, 2011.

[http://epp.eurostat.ec.europa.eu/cache/ITY\\_OFFPUB/KS-08-02-002/EN/KS-08-02-002-EN.PDF](http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-08-02-002/EN/KS-08-02-002-EN.PDF)

European Parliament. 2011. *European Parliament legislative resolution of 19 January 2011 on the Council at first reading with a view to the adoption of a directive of the European Parliament and of the Council on the application of patients' rights in cross-border healthcare (11-38/2/2010 – C7-0266/2010-2008/0141/COD)*. Accessed February 16, 2011. <http://www.europarl.europa.eu/oeil/file.jsp?id=5661632/>.

Gartner. 2009. "eHealth for a Healthier Europe! – opportunities for a better use of healthcare resources." Study conducted by Gartner on behalf of the Ministry of Health and Social Affairs in Sweden. Västerås, Sweden: Edita. Accessed February 16, 2011. <http://www.sweden.gov.se/content/1/c6/12/98/15/5b63bacb.pdf>

Groene, Oliver, Niek Klazinga, Cordula Wagner, Onyebuchi A Arah, Andrew Thompson, Charles Bruneau, and Rosa Suñol. 2010. "Investigating organizational quality improvement systems, patient empowerment, organizational culture, professional involvement and the quality of care in European hospitals: the 'Deepening our Understanding of Quality Improvement in Europe (DUQuE)' project." *British Medical Council Health Services Research* 2010, 10:281. Accessed February 16, 2011. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2949856/>.

Holzinger, Andreas, Klaus Schwabberger, and Matthias Weitlaner. 2005. "Ubiquitous Computing for Hospital Applications: RFID–Applications to Enable Research in Real–Life Environments." In *29th Annual International Computer Software and Applications Conference (COMPSAC'05) Volume 2*: 19–20. doi:<http://doi.ieeecomputersociety.org/10.1109/COMPSAC.2005.166>.

Hübner U, C Schaubmayr, D Flemming, B Delleman, C Aehlen, E Ammenwerth. 2009. "ICT supporting nurses and physicians in hospitals: results of a comparative survey in Austria and Germany." *Studies in Health Technology and Informatics*. 2009;146:20–4. Accessed February 16, 2011. <http://www.ncbi.nlm.nih.gov/pubmed/19592802?ordinalpos=1&itool=PPMCLayout.PPMCAppController.PPMCArticlePage.PMCPubmedRA&linkpos=1>.

Hübner U, E Ammenwerth, D Flemming, C Schaubmayr, B Sellemann. 2010. "IT adoption of clinical information systems in Austrian and German hospitals: results of a comparative survey with a focus on nursing." *BMC Medical Informatics and Decision Making* 2010; 10: 8. Published online February 2, 2010. doi: [10.1186/1472-6947-10-8](https://doi.org/10.1186/1472-6947-10-8).

IP/10/1744. 2010. "Digital Agenda: Commission signs eHealth agreement with US Department of Health," press release December 17, 2010. Accessed February 16, 2011. <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/1744&format=HTML&aged=0&language=EN&guiLanguage=en/>.

Le Xuan Hung, Sungyoung Lee, Young-Koo Lee, Heejo Lee, Murad Kalid and Ravi Sankar. 2010. Activity-oriented access control to ubiquitous hospital information and services. *Information Sciences*. 180 (2010): 2979–2990. Accessed February 16, 2011. <http://www.just.edu.fo/~amerb/teaching/1-10-11/cs728/2.pdf/>.

*Memorandum of Understanding between the United States Department of Health and Human Services and the European Commission on cooperation surrounding health related information and communication technologies.* 2010. Accessed February 16, 2011.

[http://ec.europa.eu/information\\_society/activities/health/docs/policy/eu-usa-mou-ehealth-signed2010.pdf](http://ec.europa.eu/information_society/activities/health/docs/policy/eu-usa-mou-ehealth-signed2010.pdf).

Organisation for Economic Co-operation and Development. 2010. *Improving Health Sector Efficiency: The Role of Information and Communication Technologies.* OECD Health Policy Studies. Paris: OECD Publishing. Accessed February 16, 2011.

[http://www.oecd.org/document/61/0,3746,en\\_2649\\_33929\\_45501565\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/61/0,3746,en_2649_33929_45501565_1_1_1_1,00.html).

Paré, Guy, Mirou Jaana and Claude Sicotte. 2007. "Systematic Review of Home Telemonitoring for Chronic Diseases: The Evidence Base." *Journal of the American Medical Informatics Association* 14(3) (May-Jun 2007): 269-277. doi:10.1197/jamia.M2270.

Runyon, Barry, Barbara A. Kelly, Thomas J. Handler, Barry R. Hieb, John-David Lovelock, Vi Shaffer, Jonathan Edwards, Cynthia E. Burghard. 2005. *Hype Cycle for Healthcare Provider Applications and Systems.* Report number G00127849. Stamford CT: Gartner Research.

Strandberg, Martin and Allan Krasnik. 2008. "Does a public single payer system deliver integrated care? A national survey among professional stakeholders in Denmark." *International Journal of Integrated Care* 8, July-September 2008.

Tokuda, Yasuharu, Eiji Goto, Junji Otaki, Joshua Jacobs, Fumio Omata, Mina Shapiro, Kumiko Soejima, Yasushi Ishida, Sachiko Ohde, Osamu Takahashi, and Tsuguya Fukui. 2010. "Educational environment of university and non-university hospitals in Japan." *International Journal of Medical Education* 1 (2010):10-14. doi: 10.5116/ijme.4ba1.4034.

World Health Organisation. 2010. *Telemedicine: Opportunities and developments in Member States. Based on the findings of the second global survey on eHealth.* Global observatory for eHealth series – Volume 2. Geneva: WHO Press. Accessed February 16, 2011. [http://whqlibdoc.who.int/publications/2010/9789241564144\\_eng.pdf/](http://whqlibdoc.who.int/publications/2010/9789241564144_eng.pdf/).

World Health Organisation. 2011. *ATLAS. eHealth country profiles. Based on the findings of the second global survey on eHealth.* Global observatory for eHealth series – Volume 1. Geneva: WHO Press. Accessed February 16, 2011. [http://whqlibdoc.who.int/publications/2011/9789241564168\\_eng.pdf/](http://whqlibdoc.who.int/publications/2011/9789241564168_eng.pdf/).