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European Hospital Survey: Benchmarking Deployment of e-Health Services (2012–2013)

Methodological Report

Manuela Deidda
Francisco Lupiáñez-Villanueva
Ioannis Maghiros

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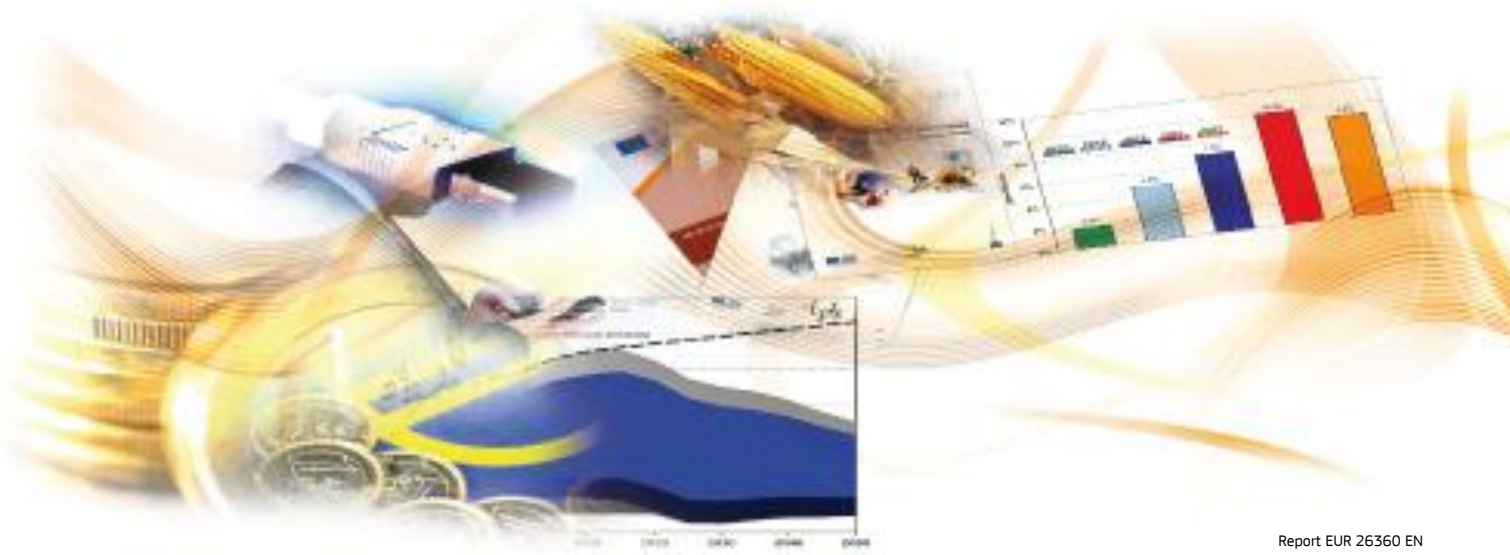

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Joint Research Centre
Institute for Prospective Technological Studies

Contact information
Address: Edificio Expo. c/ Inca Garcilaso, 3. E-41092 Seville (Spain)
E-mail: jrc-ipts-secretariat@ec.europa.eu
Tel.: +34 954488318
Fax: +34 954488300

http://ipts.jrc.ec.europa.eu
http://www.jrc.ec.europa.eu

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1. Background and Rationale

1.1 IPTS and the Unit

The Institute for Prospective Technological Studies (IPTS), based in Seville (Spain), is one of seven European Commission research institutes, making up the Directorate General Joint Research Centre. Its mission is to provide techno-economic analysis in support of the EU policy-making process. The prime objectives of IPTS are to monitor and to analyse science and technology developments, their cross-sectoral impact, their inter-relationship with the socio-economic context, and their implications for future policy development.

The Information Society Unit of the IPTS carries out prospective analyses in selected and highly-focused areas in an attempt to explore the limits and opportunities of technological advances in this rapidly developing field. The mission of the Unit is to support the Commission services and Community institutions in the process of policy formulation by interpreting and alerting its clients to the socio-economic implications of emerging Information and Communications Technologies.

Within the IS Unit, the TIESC Action - Techno-economic Impacts Enabling Societal Change - aims at supporting the policy making process by providing strategic knowledge on the evolution of technologies, business structures, innovation models and potential disruptions that may affect Europe in the coming decade, so as to better understand the way ICTs (Information and Communication Technologies) help shape society and the lives of individuals ('Living Digital'). The research is carried out through a combination of integrated market and business model studies, and techno-economic foresight analysis from the perspectives of the demand, the supply and the policy making side. ICT for health is one of the TIESC research areas where the use of ICTs to enhance the individual's extended 'quality of life' is investigated as well as existing market conditions, including stakeholder strategies, business models and innovation processes that empower patients.

1.2 Policy background

The key role of e-Health in social and economic terms has been widely recognised. For instance, the Global Observatory for e-Health, established by the World Health Organisation[1], and various projects by the OECD[2] focus on the potential of ICT to improve quality and efficiency in healthcare. The European Commission is coordinating its actions with the above international organisations, in order to get a shared knowledge of the main developments in the e-Health area.

European Commission eHealth Action Plan defines eHealth as referring to "*the application of information and communications technologies across the whole range of functions that affect the health sector' and including 'products, systems and services that go beyond simply Internet-based applications*" [1].

eHealth has figured high in the European Commission Information Society policy agenda for a decade: starting with the **eEurope** framework [2], continuing into ***i2010 strategy*** [3], and today is part of Pillar 7 (ICT for Societal Challenges) the new ***Digital Agenda for Europe*** (DAE) for the period 2010-2015 [4].

Moreover, European Commission has launched Pilot European Innovation Partnership on Active and Healthy Ageing (EIP-AHA)[3] and its Strategic Implementation Plan (SIP)[4] *"to foster innovation in products, processes and services, and in parallel facilitate the innovation chain and reduce the time*

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1 Global Observatory for e-Health http://www.who.int/kms/initiatives/ehealth/en/

2 OECD http://www.oecd.org/document/42/0,3343,en_2649_33929_38311850_1_1_1_37407,00.html

3 Pilot European Innovation Partnership on Active and Healthy Ageing http://ec.europa.eu/research/innovation-union/index_en.cfm?section=active-healthy-ageing

4 Strategic Implementation Plan - http://ec.europa.eu/research/innovation-union/index_en.cfm?section=active-healthy-ageing&pg=implementation-plan

to market for innovative solutions. Ultimately this will produce benefits for innovation's final users – the older people and care providers"

The main eHealth related target of the DAE (and the corresponding actions described in the scoreboard are the following (we split the fist into two separate targets):

Action 75a: Give Europeans secure online access to their medical health data[5]

Objectives: increase empowerment and quality of life for citizens while contributing to healthcare system sustainability, contribute to (EIP-AHA)

Target: undertake pilot actions to equip Europeans with secure online access to their medical health data by 2015

Action 75a: achieve widespread telemedicine deployment[6]

Objectives: increase empowerment and quality of life for citizens while contributing to healthcare system sustainability, contribute to (EIP-AHA)

Target: achieve by 2020 widespread deployment of telemedicine services

Action 76: Propose a recommendation to define a minimum common set of patient data[7]

Objectives: establish minimum set of criteria to achieve inter-operability of patient records for cross-border access and/or exchange. Contribute to action 77

Target: to be achieved by 2012.

Action 77: Foster EU-wide standards, interoperability testing and certification of eHealth [8]

Objectives: unleash a EU eHealth market by overcoming local and market fragmentation;

Target: achieve the above by 2015 through stakeholder dialogue.

1.3 Research context

An important element of the Commission's contribution to the improvement of public services – amongst which is healthcare - is benchmarking of progress. This is not a purely statistical exercise but aims to provide information to enable Member States to monitor their performance in relation to the use of ICT in the healthcare sector and to take into account the recent developments and deployment of services included in the e-Health Action Plan. The benchmarking exercise is intended also to orientate policy development in the field of e-Health. However, benchmarking is complicated by wide differences across healthcare systems at both national and regional level and by the absence of commonly agreed indicators. To overcome this, the Commission is launching a series of benchmarking studies.

The first study focused on the use of ICT by general practitioners[9]. The study shows that e-Health applications have a growing role in the doctors' practices. However, there remain significant differences in the availability and use of e-Health applications across Europe and there are areas for improvement and further deployment (such as e-Prescribing, telemedicine, and cross-border

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5 http://ec.europa.eu/information_society/newsroom/cf/fiche-dae.cfm?action_id=233&pillar_id=49&action=Action%2075%3A%20Give%20Europeans%20secure%20online%20access%20to%20their%20medical%20health%20data .

6 *Ibid.*

7 http://ec.europa.eu/information_society/newsroom/cf/fiche-dae.cfm?action_id=234&pillar_id=49&action=Action%2076%3A%20Propose%20a%20recommendation%20to%20define%20a%20minimum%20common%20set%20of%20patient%20data

8 *Ibid*

9 Benchmarking ICT use among General Practitioners in Europe, European Commission, 2008, available at http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/gp_survey_final_report.pdf

interoperability). A positive and consistent result across countries is the high percentage of general practitioners using the Internet and computers for their own continuous education.

The second study has collected and analysed existing e-Health monitoring and benchmarking sources in Europe and beyond, identified good practices in data gathering and developed an indicator framework for an EU-wide quantitative benchmarking[10]. The framework covers key e-Health actors and e-Health related activities. It splits the actor group of "health professionals" into various sub-groups (general practitioners, specialists, hospital administrative and IT staff, hospital medical staff, therapists, pharmacists, care providers and nurses) and divides the activity dimension into four categories of indicator (basic indicators, activity-dependent indicators, attitude indicators and indicators related to some "horizontal issues".

The third study focused on Hospitals, as key institution in the healthcare system. Thus, their role in adoption e-Health processes is central to get new forms of healthcare delivery adopted. This study elaborated the survey results descriptively presented in the Deloitte/Ipsos report [5] so as to develop A composite index for the benchmarking of eHealth Deployment in European acute Hospitals [6]. Previous to this study, the eBusiness W@tch survey of 2006[11], which surveyed 834 acute care hospitals in 18 countries, found that hospitals were in general better equipped with basic ICT infrastructure than other sectors, but identified their main weaknesses in relation to the introduction of ICT applications directly with patients.

1.4 European Hospital Survey: Benchmarking deployment of e-Health services (2012-2013)

The European Hospital Survey: Benchmarking deployment of e-Health services (2012–2013) project is the continuation of eHealth benchmarking Phase III survey. This survey funded and managed by Unit F4 of DG CONNECT, gathered data from a statistically representative sample of European acute hospitals in order to benchmark their level of eHealth deployment. IPTS researchers were part of the steering board of this project and were given the opportunity to access and use the data as soon as they were ready. In 2011 as a result of this collaboration between IPTS and DG CONNECT/F4 "A composite index for the benchmarking of eHealth Deployment in European acute Hospitals. Distilling reality in manageable form for evidence based policy" was published.

The aim of the European Hospital Survey: Benchmarking deployment of e-Health services (2012–2013) Project is to design, gather and analyse eHealth deployment in European acute Hospitals to develop a follow up of the composite indicator carried out by IPTS and to identify the trends among the other benchmarking exercises.

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[10] eHealth Benchmarking (Phase II), European Commission, available at http://ec.europa.eu/information_society/eeurope/i2010/benchmarking/index_en.htm

[11] ICT and e-Business in Hospital Activities. ICT adoption and e-business activity in 2006, Sector Report No. 10/2006, European Commission, 2006, available at http://www.ebusiness-watch.org/studies/sectors/health_hospital/documents/Hospitals_2006.pdf

2. Methodological overview

2.1 eHealth Benchmarking III

The main objective of this study was to undertake a survey in hospitals in the EU27 and three other countries: Croatia, Iceland, and Norway to introduce, for the first an understanding of the level of deployment and take-up of ICT and eHealth applications in acute hospitals in Europe.

The **unit of enquiry** was European Acute Hospitals, which guarantee coherence and comparability with e-Business W@tch[12]. **Acute hospital** is defined by Deloitte/IPSOS report as those public, private or university hospitals which treat predominantly patients who are in immediate need of healthcare. 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. Therefore, the **universe** represented was the population of hospitals and **coverage** will reach EU27 plus Croatia, Iceland, and Norway. 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.

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)**.

2.2 eHealth benchmarking and evaluation agenda

IPTS researchers were part of the steering board of eHealth Benchmarking III and were given the opportunity to access and use the data as soon as they were ready. As a result of this collaboration between IPTS and DG CONNECT/F4 "A composite index for the benchmarking of eHealth Deployment in European acute Hospitals. Distilling reality in manageable form for evidence based policy" was published.

It is worth pointing out that the composite indicator developed by IPTS based on multivariate statistical analysis of the previous benchmarking data covered deployment of eHealth / Availability of applications dimension. All the indicators gathered were grouped into four main blocks:

- ICT Infrastructure;
- ICT Applications
- Health Information Exchange;
- Security and Privacy

Moreover, final recommendations from this report emphasised the importance of three main blocks within an eHealth benchmarking and evaluation agenda:

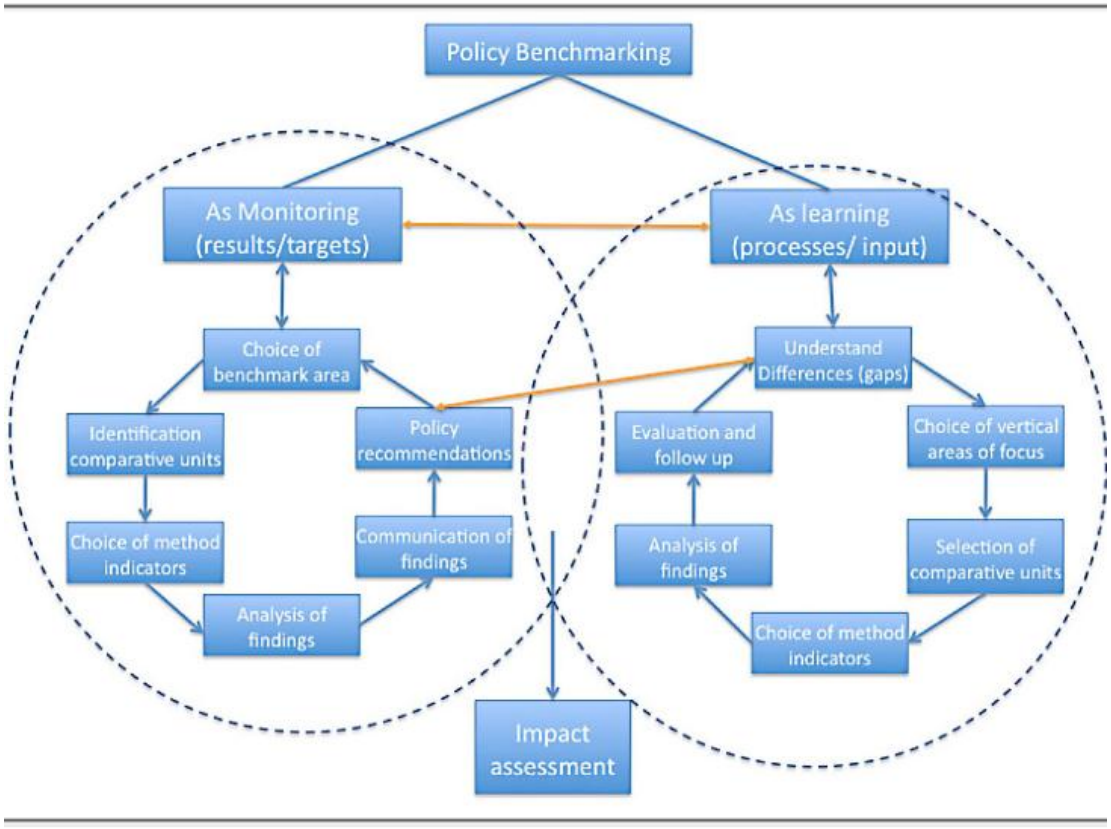
- **Replicate the survey on hospitals.** The survey should be replicated in 2011 or, at the latest, in 2012 to test the reliability if the CI and to benchmark progress.

[12] e-BusinessW@tch (2006) was conducted by Ipsos for the EC's Directorate-General Enterprise under the direction of Empirica

- **Link eHealth deployment to other data.** Future surveys should include new modules to retrieve additional data in order to tackle wider research questions and contribute to impact evaluation objectives.
- **Work on Survey Model Framework.** Different stakeholders should engage the OECD and WHO in a joint project to develop such a framework for future use in both survey and administrative data gathering to ensure increased cross-sectional and longitudinal comparability in the future.

Figure 1 summarised the message that a complete international benchmarking of policy presupposes a clear links and reciprocal feedback loop between benchmarking for monitoring (basically focussed only on high-level quantitative indicators of results/targets) and benchmarking for learning. The latter should focus on further exploring what explains the differences in results identified by ´benchmarking for monitoring´ and especially the point of excellences (best performers) and the gaps (worst performers).

Figure 1: Holistic approach to policy benchmarking



Source: Codagnone, C. and F. Lupiañez-Villanueva, (2011). A composite index for the benchmarking of eHealth Deployment in European acute Hospitals. Distilling reality in manageable form for evidence based policy. Institute for Prospective Technological Studies - European Commission's Joint Research Centre.

2.3 Lessons learned

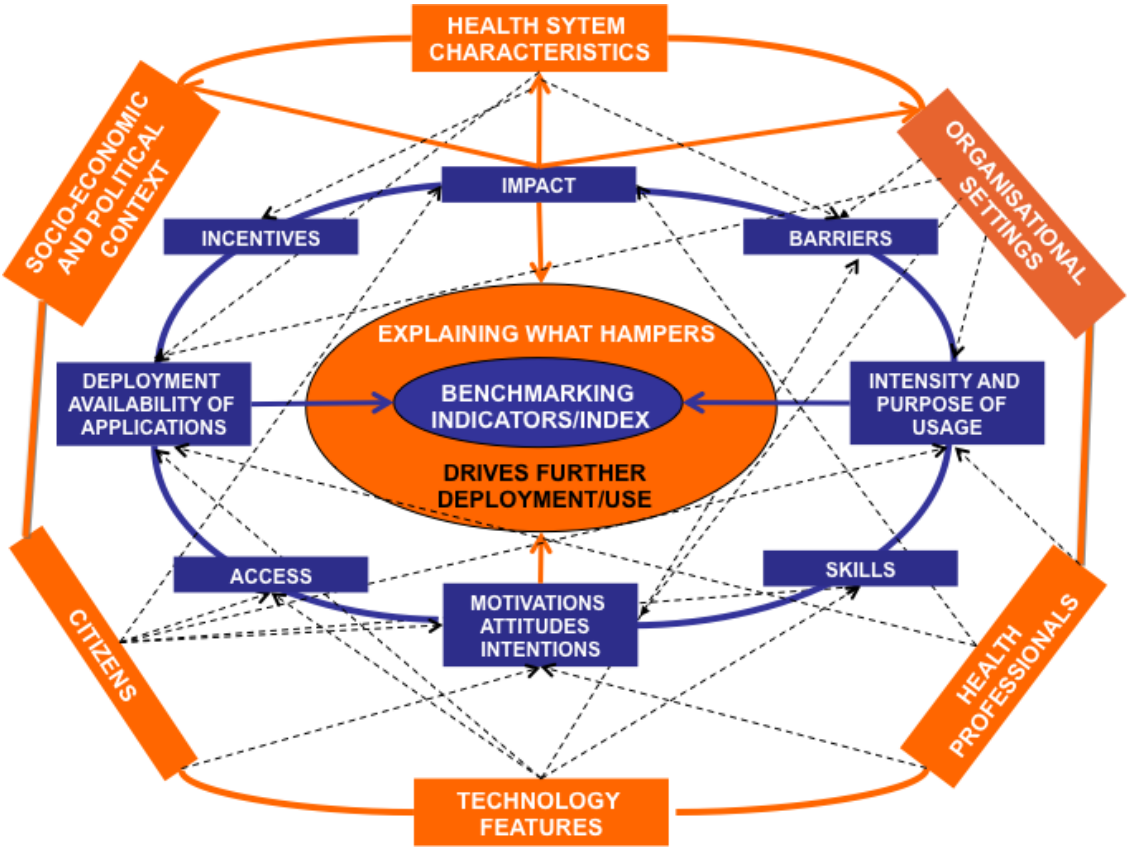
Benchmarking as monitoring (results and targets) and as learning (process and inputs) will facilitate the analysis of the factors producing the results. Therefore this approach will allow us to understand and explain what drives deployment of e-Health services in European Acute hospitals.

On the one hand, benchmarking for learning should focus on environmental or structural dimension at a macro and meso level such as socio-economic an political context; health system characteristics; organisational settings; health professionals characteristics; technological features and citizens characteristics.

On the other hand, at a micro level capturing re-organisational and management dimensions benchmarking for learning should focus on issues related with adoption and usage activities at a micro level such as availability of applications; incentives; impact; barriers; intensity and purpose of use; skills; motivation, attitudes and intentions; and material access to technology. Figure 2 sketches the complexity of macro, meso and micro dimensions relationships identifying drivers and barriers of deployment.

Figure 2 presents the overall model. Orange blocks show macro and meso dimensions at country level while the blue blocks show micro dimensions at hospital level. Therefore, the model includes both the individual level variables and the contextual variables and, thus, link together the measurement of deployment and usage with the expected explanation of what shapes different levels of deployment and usage and the identification of main drivers and barriers

Figure 2: Holistic eHealth analytical framework



3. eHealth Benchmarking IV methodological set up

3.1 Methodological set up roadmap

In view of the background premises and insights set out in the previous sections, the overall goal of Benchmarking deployment of eHealth services in European Acute Hospitals Phase IV can be formulated as follows:

> *"Design, gather and analyse eHealth deployment in European acute Hospitals to develop a follow up of the composite indicator carried out by IPTS and to identify the trends among the other benchmarking exercise"*

The first steps (design and gather) to reach this objective are connected with the setting-up and implementation of the research design, including literature review, questionnaire design, sampling proposal and multivariate analytical framework (see sections 2.2 and 2.3). Over the last two months IPTS have been carrying out a methodological set up validation process, based on two steps:

- Test the new questionnaire (see Annex 1 - Draft questionnaire) in four different countries (UK, Italy, Germany and Hungary) through in-depth interviews of 3-4 CIOs within each country. The pilot testing exercise included the translation of the questionnaire in four different languages with preliminary comments from the researchers. In addition, the questionnaire was validated with CIOs in Spain (Andalusia and Catalonia).

- Secondly, organise a validation workshop in Brussels with 15 experts (industry, practitioners, policy makers, researchers) from different countries.

In parallel with these two steps, IPTS has been following "**Benchmarking deployment of eHealth Among General Practitioners II"** and OECD to align all efforts towards a European eHealth benchmarking framework.

In the following sections we are presenting the results of this process in four sections tackling the fieldwork carried out in five different countries; the validation of the research strategy, the validation of the main blocks of the questionnaire and the validation of the items and indicators.

3.2 Pilot testing exercise

3.2.1 Italy[13]

3.2.1.1 Background information

The informants involved in the pilot-test are depicted in Table 1 together with the main characteristics of their hospitals and their email in case of further requests.

[13] This study has been tendered by IPTS and carried out by Luca Gastaldi Politecnico di Milano, Department of Management, Economics and Industrial Engineering, ICT in Health Care Observatory.

Table 1: Hospitals involved in the methodological analysis of the questionnaire

Hospital	**Azienda Ospedaliera Universitaria Ospedali Riuniti di Ancona**	**Ente Ospedaliero Ospedale Galliera di Genova**	**Gruppo Multimedica**
Region	Marche	Liguria	Lombardia
Geographical area	Centre Italy	North-West	North-West
Address	Via Conca 71 I-60026, Ancona (Italy)	Mura delle Cappuccine, 14 I-16128, Genova (Italy)	Via Milanese, 300 I-20099, Sesto San Giovanni (Italy)
Teaching status	Teaching	Non-teaching	Non-teaching
Beds	1,000	500	850
Employees	3,400	1,800	2,200
Ownership	Public	Public	Private
Website	http://www.ospedaliriuniti.marche.it	http://galliera.it	http://www.multimedica.it
CIO name	Giovanni Libertini	Carlo Berutti Bergotto	Claudio Caccia
CIO email	g.libertini@ospedaliriuniti.marche.it	carlo.berutti@galliera.it	claudio.caccia@multimedica.it

The hospitals have been selected in order to be representative of the different Italian health care regional systems. The process that led the selection of the cases is depicted in Figure 3, Figure 4 and Figure 5.

.First, we have graphed the **20 regional health care systems** characterising the Italian health care industry according to:

- The regional expenditure in secondary care per citizen[14], a proxy of the **level of efficiency** achieved within the regional health care system;
- The percentage of patients highly satisfied with the service received in the health care organisations of the different regions, a proxy of the **level of perceived effectiveness** achieved within the regional health care system.

The data are taken from the Italian section of the **Health for All** database[15], developed by **ISTAT**[16]. All the data in Figure 3 (as well as in the next figures) are relative to 2008.

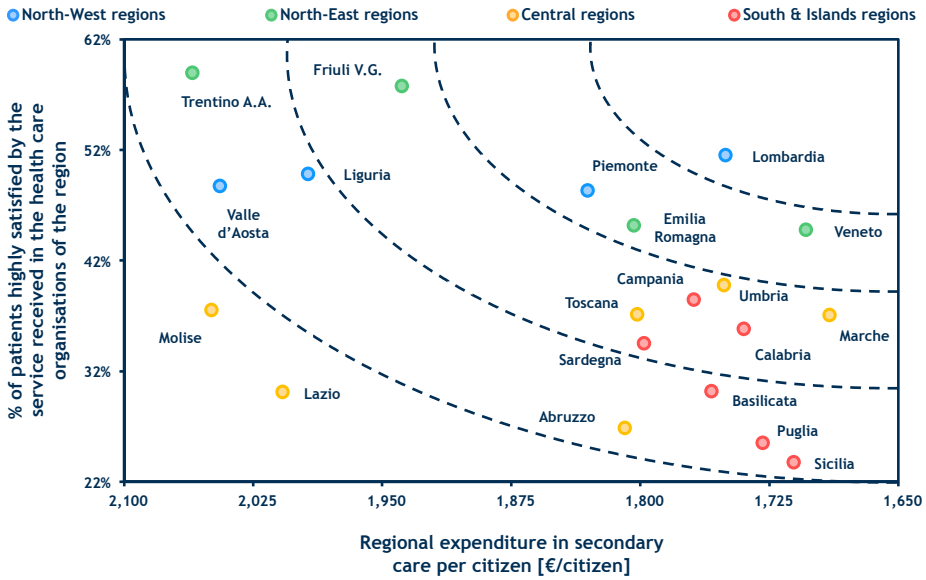
[14] An index "per citizen" allows to avoid dimensional effects, and, thus, to better compare the expenditures made by big and small regions. The number of citizen is a reasonable proxy of the number of patients that need to receive treatments by the health care organisations in a region.

[15] The European Health for All is a database developed by the World Health Organisation with a selection of core health statistics covering basic demographics, health status, health determinants and risk factors, health care resources, utilisations and expenditure, for the 51 Member States in Europe. The data are compiled from different sources, including a network of country experts, WHO/Europe's technical programmes, and partner organisation such as agencies of the United Nations system, EUROSTAT and the Organization for Economic Cooperation and Development (OECD) updated annually. The Italian section of the Database contains more than 4,000 indicators on the Italian health care system, and it is updated on an annual basis. The maximum level of detail available is the regional one.

[16] ISTAT is the Italian National Institute of Statistics, a public research organisation that, since 1926, is the main producer of official statistics in Italy (www.istat.it).

As it is possible to see in Figure 3, if there are regions (e.g. Lazio and Molise) where health care organisations are characterised by high inefficiencies and low perceived quality, others (e.g. Lombardia, Venetom Emilia Romagna and Piemonte) have health care organisations with qualitative and affordable health care processes.

Figure 3: Efficiency and effectiveness of the 20 regional secondary care systems in Italy[17]



According to the experience of the **ICT in Health Care Observatory (IHCO)**, the amount of money in the hands of a CIO can explain most of the different behaviours of her/his health care organisation—especially in terms of infrastructure, ICT applications, ICT functionalities, and barriers against ICT development.

Exploiting the data collected by the ICT in Health Care Observatory, we have run an econometrical model to estimate the **ICT budget per citizen** of all the health care organisations in each Italian region. An analysis of the values depicted in Figure 4 shows that, during 2008, on average, the ICT spending per citizen by health care organisations in the Northern part of Italy is more than double that spent by the health care organisations in the Centre, the South and the Islands.

An interesting element emerging from Figure 4 is the absence of a straightforward link between ICT expenditure per citizen and the performances achieved both in terms of efficiency and effectiveness.

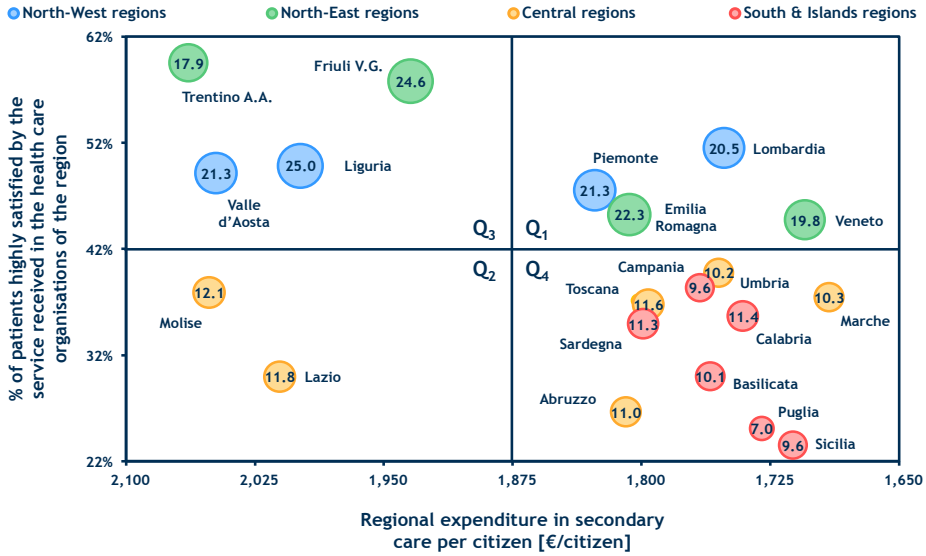
From this viewpoint, it is possible to group the different regional health care systems into the **four quadrants** highlighted in Figure 4:

- The top-right quadrant (Q_1), with the regions in which health care organisations spend less than average for the health care services offered to their citizens (**system savers**), but more than the average on ICT (**ICT spenders**);
- The bottom-left quadrant (Q_2), with the regions in which health care organisations spend more than the average for the health care services offered to their citizens (**system spenders**), but less than the average on ICT (**ICT savers**);

[17] The values on the horizontal axis are in reverse order to increase the readability of the graph.

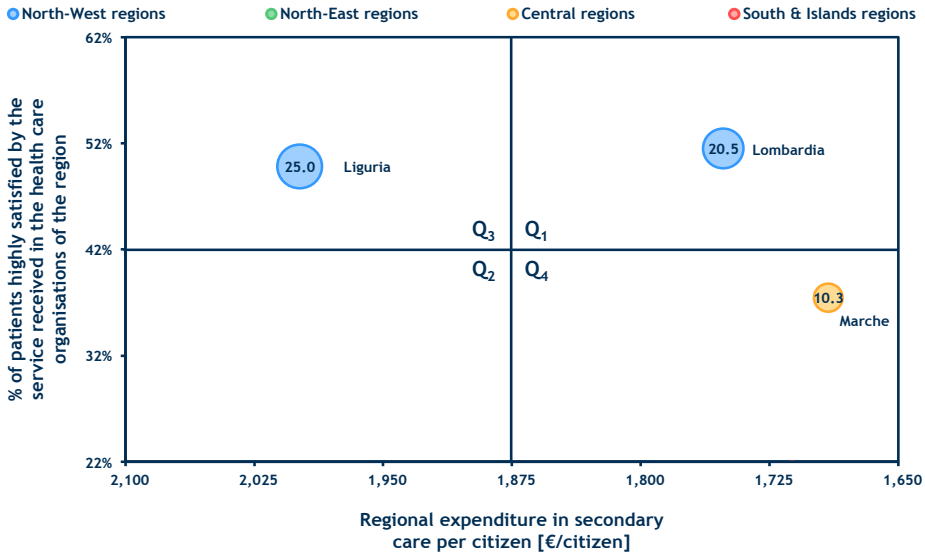
- The top-left quadrant (Q_3), with the regions in which health care organisations spend more than the average for the health care services offered to their citizens (**system spenders**), and more than the average on ICT (**ICT spenders**);
- The bottom-right quadrant (Q_4), with the regions in which health care organisations spend less than the average for the health care services offered to their citizens (**system savers**), and less than the average on ICT (**ICT savers**).

Figure 4: ICT expenditure per citizen of the health care organisations in each Italian region



We have chosen to select the health care organisation to be studied in three of the four different quadrants available (see Figure 5). This choice allows consideration of highly **variegated boundary conditions** in the pilot-test of the questionnaire.

Figure 5: Regional healthcare systems whose acute hospitals have been involved in the pilot-testing of the questionnaire



The Italian translation of the original questionnaire has been shared with the informants one week before fixing a meeting with them.

One informant (Giovanni Libertini) has been interviewed **face-to-face;** the other two (Carlo Berutti Bergotto; Claudio Caccia), by **phone**. Each interview, lasting approximately **1 hour**, and in which the interviewer and the interviewee have jointly scanned the translated survey, brought to light the questions that were not clear and collected all the suggestions that have been systematised in sections 0 and 0.

3.2.1.2 Research strategy

In the next three sub-paragraphs we provide a few suggestions in terms of research strategy emerged from the interviews carried out with the CIOs. The dissertation is organised around three main topics:

- The typology of hospitals to consider in the empirical study (**universe**);
- The informant to which to ask the questions in the questionnaire (**target**);
- The process through which to accomplish the empirical analysis (**fieldwork**).

Universe

With the organisational changes in hospital care provision, the definition of **acute hospital** needs to be revised, and further questions need to be identified for a more accurate hospitals' characterisation. According the CIOs involved in the analysis of the questionnaire, in order to better characterise the acute hospital it is necessary to **test the presence of (at least) the following units**:

- Operating room block;
- Intensive-care unit;
- Emergency department.

It is possible to exploit the necessity of a better hospital characterisation in order to **survey the different departments present within each hospital** that will answer the questionnaire. These variables could be potentially interesting in explaining specific results in terms of eHealth development.

Alternatively, the European Hospital Survey could focus on all the **hospitals that do not provide only tertiary care**.

It must be pointed out that the CIOs that have been interviewed do not consider the issues related to the characterisation of acute hospitals to be particularly critical. Excluding the health care organisations explicitly focused in providing tertiary care, all the other Italian hospitals can be considered acute hospitals.

Target

The CIOs who participated in the pilot-test deem a generic CIO is able to answer to all the questions present in the questionnaire. Thus, we suggest that the **CIO be considered the main informant** to be contacted in order to answer the survey.

While the main part of the questionnaire is specifically targeted to CIOs, some questions (for example in relation to use, attitudes and impacts), only reflect CIO perception, e.g. regarding the benefits associated with a specific ICT-based solution. However, we do not suggest eliminating these questions. Of course, it would be better if the questions related to ICT impact could be answered by the physicians who actually use the ICT-based solutions. However:

- It is difficult to collect the answers of both a **CIO as well as a hospital physician representative** (e.g. the Chief Medical Officer) within the same health care organisation;
- Information collected remains the **perception of an individual**—a subjective opinion on the topic.

We suggest **progressively involving other C-levels** (e.g. Chief Executive Officers and Chief Financial Officers) **and hospital physician representatives** (e.g. Chief Medical Officer, Chief Radiologist, Chief of the Laboratory, Chief Cardiologist Head of nursing, etc.) in the studies on eHealth development to be accomplished in years that follow.

The target of 2,000 CIOs could raise some **issue during data analysis**. In the experience of the Observatory, it is necessary to collect at least 100 answers to have an empirical base sufficiently large to produce relevant insights. In fact, the extreme heterogeneity—in terms of both efficiency and effectiveness (Figure 1)—of the Italian health care organisations forces the need for at least a 10% response rate and for coverage of the different regional health care systems characterising the Italian health care industry. If the budget available so allows, we suggest increasing the target of responding CIOs from 2,000 to 3,000.

Moreover, we suggest to **defining the minimum number of responses** to collect in each country **according to the dimension of the population** of acute hospitals present within it (form this viewpoint, the best thing to do is to collect at least 10% from all the hospitals in each country). If the number of acute hospitals is not available, the number of hospitals in the country and/or the number of citizens in the country can be used a rough proxy to determine the number of responses to collect.

Fieldwork

Due to the potential difficulties in reaching the health care CIOs, **different channels** should be exploited to disseminate the questionnaire. Of course it is necessary to take into account not only that each channel has its pros and cons, but also that the interaction among different channels introduces further research issues to be tackled—e.g. the ones relative to statistical conclusion errors.

In the experience of the ICT in Health Care Observatory, an **online survey** delivered through a **professional electronic platform** (e.g. Opinio[18]) is the most efficient and effective dissemination channel. The main reasons are the following:

- An online survey allows the CIOs to nominate a collaborator able to answer specific questions (to then review the answers given); this option would be extremely interesting for achieving a hospital's physician representative responses;
- An online survey simplifies the process through which a respondent sees specific blocks/questions only if she/he has provided specific threshold answers;
- An online survey allows the respondent to reflect on each question, collect the data necessary to provide an accurate answer to the questions (e.g. when asking the number of beds in her/his hospital), and answer to the questionnaire in more than one unique session;
- An online survey can be designed in a way that allows the respondent to easily expound on each question with comments and/or further information;
- An online survey simplifies the push for an answer to the questionnaire (e.g. through automatic emails);
- From a researcher viewpoint, the delivery through an electronic platform allows for better analysis of closed questions throughout data collection. The research team could thus not only compress the data collection phase, but also identify anchors to guide future data gathering and detect connections between data for further theory generation.

We suggest combining the online survey with a set of **phone calls** to increase the response rate in specific blocks that are particularly relevant for the specific aims of the questionnaire. Moreover we suggest preparing an **invitation letter** that - independently of the specific set of channels to be used - will:

[18] http://www.objectplanet.com/opinio.

- Describe the initiative, emphasising the confidentiality in data collection and analysis;
- Outline the benefits health care practitioners achieve in answering the questionnaire.

Regarding this last point, the experience of the ICT in Health Care Observatory suggests two things:

- Providing a set of incentives to the health care practitioners who answer the questionnaire;
- Organising an event to share the results of the questionnaire, disseminate knowledge, and foster networking among health care professionals.

In the "Introduction" block of the revised questionnaire we have outlined the main points that the invitation letter should touch upon.

3.2.1.3 Main Blocks of the Questionnaire and Indicators

The main blocks of the questionnaire (as well as the relative indicators adopted within them) have been analysed according the following points:

- Typos and Errors;
- Effectiveness of question wording;
- Order of the questions;
- Intelligibility of the questions;
- Necessity to add and/or eliminate some questions;
- Adequacy of the instructions given to interviewers.

Typos and errors

- The progressive numbers used to refer to the questions are not consistent (e.g. in Block E there is a question indicated as Q26, but there is also a Q26 in Block F). We suggest to correcting this in order to address in advance the potential problems related to data collection and analysis.
- There lacks consistency between healthcare and health care. We suggest choosing one term and using it throughout the whole questionnaire.
- We suggest referring to EMR / EHR / EPR in singular forms.
- In the fourth response option of Q12 "computers systems" should be translated in "computer systems".
- In the question part of Q29a in Block F there is a typo ("such or laboratories") to be corrected.

Effectiveness of Question Wording

General considerations:

- In Italy the term "hospital" refers to a facility of a health care organisation or a specific kind of public health care organisation that doesn't provide treatment on the territory surrounding it. Moreover, we have regional health care organisations (in Italian: Azienda Sanitaria Locale, ASL) that are usually networks of hospitals, but that do not always refer to the different facilities within their groups with the term "hospitals". For more information from this viewpoint, see Lo Scalzo et al. (2009). Thus, in the Italian translation we suggest substituting "hospital" (in Italian: "ospedale") with the more general term "health care organisation" (in Italian: "struttura sanitaria"). We suggest using the same wording for the other translations.
- We propose naming Block F "ICT Functionalities" instead of "IT functionalities".

Block A — Characterisation:

- *Q1*: In Italy, the difference between "Chief Information Officer" and "ICT manager/director" is not very clear. Sometimes, Italian CIOs do not manage the communication issues (connectivity, etc.). Is the difference between the two alternatives related to the management of this field? In any

case, we suggest either adding a note explaining the different roles or merging the alternatives. — NOT IMPLEMENTED IN THE REVISED VERSION OF THE QUESTIONNAIRE[19]

- *Q3*: A CIO that has been involved in the pilot analysis of the questionnaire suggested we clarify that, if the hospital of the respondent is part of a group of different hospitals, it is necessary to specify to the respondent that in the rest of the questionnaire answers must refer to the whole health care organisation (and not a specific facility and/or department). In fact, all care institution groups in Italy have a unique CIO dealing with all the ICT-based issues and investments. — NOT IMPLEMENTED IN THE REVISED VERSION OF THE QUESTIONNAIRE

Block B — ICT infrastructure:

- *Q13*: We suggest changing the first response option of this question to "Yes, through an extranet—i.e. using a secure connection over the Internet". Moreover, we suggest changing the second response option to "Yes, through a value added network or proprietary infrastructure". Finally we suggest changing the third answering option to "No, the computer system of the health care organisation is not connected".

Block C — ICT Applications:

- *Q17*: According to all the CIOs involved in the analysis of the questionnaire, this question is a little bit too complex and potentially misleading. EPR, EMR and EHR are concepts that are quite different. An *EPR* is a repository containing patient data; an *EMR* is an ICT-based solution allowing health care practitioners to manage patient data within a hospital; an *EHR* is an ICT-based solution allowing health care practitioners to share patient data among hospitals. We suggest rephrasing the questions to read "*Which type of Electronic Patient Records does your hospital mainly use? An EPR is a computer-based patient record system which contains patient-centric, electronically-maintained information about an individual's health status and care.*".
- *Q20*: According to all the CIOs involved in the analysis of the questionnaire, the term "radiologic" is restrictive. For example there are systems that are not located in a radiologic department, which share eco-cardiogram images within the hospital, and which are highly integrated with the rest of the hospital information system. We suggest using the term "imaging" instead of "radiologic". The former comprises the latter, and is considered more appropriate by the CIOs.

Block D — Health Information Exchange:

- *Q24*: One CIO involved in the analysis of the questionnaire suggested talking about "information on pharmacology therapy" instead of "medication lists information". The forms comprise the latter, and is considered more appropriate.
- *Q25*: According to all the CIOs involved in the analysis of the questionnaire, the term "radiologic" is restrictive. For example there are systems that are not located in a radiologic department, which share eco-cardiogram images within the hospital, and which are highly integrated with the rest of the hospital information system. We suggest to use the term "imaging" instead of "radiologic". The former comprises the latter, and is considered more appropriate by the CIOs.

Block E — Security and Privacy: there are no suggestions for this block from the CIOs involved in the analysis of the questionnaire.

[19] We add this statement each time the proposed suggestion has not been implemented in the revised version of the questionnaire.

Block F — ICT Functionalities:

- *Q26*: According to all the CIOs involved in the analysis of the questionnaire, this question is too complex and potentially misleading. EPR, EMR and EHR are concepts that are quite different. An *EPR* is a repository containing patient data; an *EMR* is an ICT-based solution allowing health care practitioners to manage patient data within a hospital; a *EHR* is an ICT-based solution allowing health care practitioners to share patient data among hospitals. We suggest changing the question to "To what extent is the management of the following patient identifiable data implemented through electronic solutions within your health care organisation? To what extent do the health professionals use these solutions?". Moreover, we suggest changing "AVAILABILITY" to "IMPLEMENTATION" in the Table.
- *Q27*: According to all the CIOs involved in the analysis of the questionnaire, this question is too complex and potentially misleading. We suggest changing it to "To what extent are the following functionalities implemented through electronic solutions within your health care organisation? To what extent do the health professionals use these solutions?". Moreover, we suggest to changing "AVAILABILITY" to "IMPLEMENTATION" in the Table.
- *Q28*: According to all the CIOs involved in the analysis of the questionnaire, this question is too complex and potentially misleading. We suggest changing it to "To what extent are real-time electronic alerts implemented on the following activities within your health care organisation? To what extent do the health professionals use these alerts?". Moreover, we suggest changing "AVAILABILITY" to "IMPLEMENTATION" in the Table.
- *Q29a*: We suggest changing the question consistently with the modified version of questions 26, 27 and 28. Refer to the translated version of the questionnaire for the specific wording that is suggested.
- *Q29b*: We suggest changing the question consistently with the modified version of questions 26, 27 and 28. Refer to the translated version of the questionnaire for the specific wording that is suggested.
- *Q30*: We suggest changing the question consistently with the modified version of questions 26, 27 and 28. Refer to the translated version of the questionnaire for the specific wording that is suggested.

Block G — Barriers, Impacts and Attitudes:

- *Q31*: The question has a style that is different from the previous ones. We suggest changing its wording as indicated in the revised version of the questionnaire.
- *Q32*: The question has a style that is different from the previous ones. We suggest changing its wording as indicated in the revised version of the questionnaire.
- *Q33*: The question has a style that is different from the previous ones. We suggest changing its wording as indicated in the revised version of the questionnaire.

Order of the questions

- The CIOs involved in the analysis of the questionnaire did not see particular problems in the order of the questions.
- We suggest reflecting on which questions should be made mandatory, and clearly emphasising them in the questionnaire**.**

Understanding of questions

General considerations:

- We have translated Q1 as D1 because the Italian translation for "Question" is "Domanda". In order to simplify the translation of the questionnaire in the different European languages and/or avoid misunderstandings, we suggest using a numeration and not an alpha-numeric format..
- We suggest improving the layout of the questionnaire. The one proposed (see the attached files) simplify: (i) the phone interview, in case the questionnaire is prompted by phone; (ii) the input of the questionnaire in the electronic platform used to send the online survey, in case the questionnaire will be delivered through an online platform.

Block A — Characterisation:

- *Q7*: According to the CIOs involved in the pilot analysis of the questionnaire, this question makes sense only for the hospitals providing their services over a territory. In Italy there are many other health care organisations providing treatment to the population, but—due to a specialisation in a medical field (e.g. oncologic care)—do not assist specific portions of inhabitants. We suggest a combination of the following methodological strategies: (i) rephrasing the question; (ii) asking the number of admissions—focusing on both inpatients and outpatients (see also §4.5); and (iii) requesting the number of patients outside the region and/or the country treated by the health care organisation. — NOT IMPLEMENTED IN THE REVISED VERSION OF THE QUESTIONNAIRE
- *Q10*: If the number of CAT scanners is used as a measure to understand the amount of resources in the hands of the CIO, we suggest using alternative measures, e.g. the ICT expenditure (see last suggestion in Block A). Even if the number of CAT scanners has historically helped determine the structure and complexity of the reality under exam, two of the Italian CIOs involved in the pilot test of the questionnaire told us that it is not more representative in the explanation of either the complexity or the dimension of health care organisations nor in determining the amount of budget in their hands. If the questionnaire ends up being too long, we suggest deleting this question. — NOT IMPLEMENTED IN THE REVISED VERSION OF THE QUESTIONNAIRE
- *Q11*: If the number of MRI units is used as a measure to understand the amount of resources in the hands of the CIO, we suggest alternative measures, e.g. the ICT expenditure (see last suggestion in Block A). Even if the number of MRI units has historically helped determine the structure and level of complexity of the reality under exam, two of the Italian CIOs involved in the pilot test of the questionnaire told us that it is not more representative in the explanation of either the complexity and the dimension of health care organisations, nor in determining the amount of budget in their hands. If the questionnaire ends up being too long, we suggest deleting this question. — NOT IMPLEMENTED IN THE REVISED VERSION OF THE QUESTIONNAIRE

Block B — ICT Infrastructure:

- *Q16*: According to the CIOs involved in the analysis of the questionnaire, the term "videoconferencing facilities" is too general. We suggest adding a note and/or rephrasing the question in order to clarify what the questionnaire means when it refers to video-conference facilities.

Block C — ICT Applications:

- There are no suggestions for this block from the CIOs involved in the analysis of the questionnaire.

Block D — Health Information Exchange:

- *Q22*: According to the CIOs involved in the analysis of the questionnaire, it is quite rare to see an exchange of health information between health care providers in other European countries and/or outside them. Thus, we suggest considering the elimination of the relative option responses (5 and 6)—especially if the questionnaire is too long. The CIOs involved in the analysis

suggested substituting these two options with the following: (i) “among different departments”, (ii) “with patients”, (iii) “with governing entities”, and (iv) “others (specify)”.

- *Q23*: According to the CIOs involved in the analysis of the questionnaire, it is quite rare to see an exchange of health information health care providers in other European countries and/or outside them. Thus, we suggest considering the elimination of the relative option responses (5 and 6)—especially if the questionnaire is be too long. The CIOs involved in the analysis suggested these two options with the following: (i) “among different departments”, (ii) “with patients”, (iii) “with governing entities”, and (iv) “others (specify)”.
- *Q24*: According to the CIOs involved in the analysis of the questionnaire, it is quite rare to see an exchange of health information with health care providers in other European countries and/or outside it. Thus, we suggest to consider the elimination of the relative option answers (5 and 6)—especially if the questionnaire will be too long. The CIOs involved in the analysis suggested to substitute these two option whit the following ones: (i) “among different departments”, (ii) “with patients”, (iii) “with governing entities”, and (iv) “others (specify)”.
- *Q25*: According to the CIOs involved in the analysis of the questionnaire, it is quite rare to see an exchange of health information with health care providers in other European countries and/or outside it. Thus, we suggest to consider the elimination of the relative option answers (5 and 6)—especially if the questionnaire will be too long. The CIOs involved in the analysis suggested to substitute these two option whit the following ones: (i) “among different departments”, (ii) “with patients”, (iii) “with governing entities”, and (iv) “others (specify)”.

Block E — Security and Privacy:

- There are no suggestions for this block from the CIOs involved in the analysis of the questionnaire.

Block F — ICT Functionalities:

- *Q26*: The CIOs involved in the analysis of the questionnaire suggested adding a category between “Fully implemented across all units” and “Fully implemented in at least one unit”. We suggest naming it “Fully implemented in at least 3 units”. Moreover, the CIOs have underlined the absence of some items in the list presented in this question. They suggested adding the following items: (i) “ambulatory records”, (ii) “discharge records”, and (iii) “operating room registry”. Moreover, we suggest adding the option “other (specify)”. Finally, if the questionnaire is too complex/long we underline that it is possible to delete the USAGE section.
- *Q27*: The CIOs involved in the analysis of the questionnaire suggested to add a category between “Fully implemented across all units” and “Fully implemented in at least one unit”. We suggest to name it “Fully implemented in at least 3 units”. Moreover, we suggest to add the option “other (specify)”. Finally, if the questionnaire is too complex/long we underline that it is possible to delete the USAGE section.
- *Q28*: The CIOs involved in the analysis of the questionnaire suggested to add a category between “Fully implemented across all units” and “Fully implemented in at least one unit”. We suggest to name it “Fully implemented in at least 3 units”. Moreover, we suggest to add the option “other (specify)”. Finally, if the questionnaire is too complex/long we underline that it is possible to delete the USAGE section.
- *Q29a*: The CIOs involved in the analysis of the questionnaire suggested to add a category between “Fully implemented across all units” and “Fully implemented in at least one unit”. We suggest to name it “Fully implemented in at least 3 units”. Moreover, we suggest to add the option “other (specify)”. Finally, if the questionnaire is too complex/long we underline that it is possible to delete the USAGE section.
- *Q29b*: The CIOs involved in the analysis of the questionnaire suggested to add a category between “Fully implemented across all units” and “Fully implemented in at least one unit”. We suggest to name it “Fully implemented in at least 3 units”. Moreover, we suggest to add the

option “other (specify)”. Finally, if the questionnaire is too complex/long we underline that it is possible to USAGE section.

- *Q30*: The CIOs involved in the analysis of the questionnaire suggested to add a category between “Fully implemented across all units” and “Fully implemented in at least one unit”. We suggest to name it “Fully implemented in at least 3 units”. A CIO involved in the analysis of the questionnaire underlined the absence of some items in the list presented in this question. He suggested to add the following items: (i) “pay for hospital services (billing)” and (ii) “download their medical records” (in order to bring them to their general physician and/or for a second opinion). Moreover, we suggest to add the option “other (specify)”. Finally, if the questionnaire is too complex/long we underline that it is possible to delete the USAGE section.

Block G — Barriers, Impacts and Attitudes:

- *Q31*: According to the CIOs involved in the analysis of the questionnaire there are too many options available to answer this question. We suggest a combination of the following methodological strategies: (i) joining some options; (ii) scanning the literature to understand if there are taxonomies that can be used; and (iii) identifying some overarching categories in which to collect the response options in order to simplify data analysis (for example it could be interesting to run a factor analysis on the answers provided to previous versions of the questionnaire). Finally, we suggest adding the option “other (specify)”. — NOT IMPLEMENTED IN THE REVISED VERSION OF THE QUESTIONNAIRE
- *Q32*: According to the CIOs involved in the analysis of the questionnaire there are too options available to answer this question. We suggest a combination of the following methodological strategies: (i) joining some options; (ii) scanning the literature to understand if there are taxonomies that can be used; and (iii) identify some overarching categories in which collect the answering options in order to simplify data analysis (for example it could be interesting running a factor analysis on the answers provided to previous versions of the questionnaire). Finally, we suggest to add the option “other (specify)”. — NOT IMPLEMENTED IN THE REVISED VERSION OF THE QUESTIONNAIRE
- *Q33*: According to the CIOs involved in the analysis of the questionnaire there are too options available to answer this question. We suggest a combination of the following methodological strategies: (i) joining some options; (ii) scanning the literature to understand if there are taxonomies that can be used; and (iii) identifying some overarching categories in which collect the response options in order to simplify data analysis (for example it could be interesting to run a factor analysis on the answers provided to previous versions of the questionnaire). Finally, we suggest adding the option “other (specify)”. — NOT IMPLEMENTED IN THE REVISED VERSION OF THE QUESTIONNAIRE

Necessity to add and/or eliminate some questions

General considerations:

- The Italian CIOs that have been contacted told us that the questionnaire is not too long, but that some specific questions (especially in Block F and Block G) could be simplified in order to achieve higher response rates.

Block A — Characterisation:

- We do not think that the gender of the respondent is a significant control variable able to explain the findings of the questionnaire. Thus, we suggest removing this question.
- *Q6*: There is a substantial percentage of Italian hospitals—especially the Regional Health Authorities (in Italian: Azienda Sanitarie Locali, ASLs)—with more than 750 beds. Thus, we suggest: (i) substituting the 4th response alternative with “Between 751 beds and 1,000 beds”,

and (ii) adding the following alternatives “More than 1,000 beds”, and “Actual number: specify”. In this way, the Italian health care organisations should better fit the different categories and/or provide the researchers with the actual number of beds—allowing better econometrical analyses to be performed.

- *Q8*: The time that a patient spends within a health care organisation is quite different depending on whether you are referring to inpatients (patients whose condition requires admission to a hospital) or outpatients (patients who are not hospitalized for 24 hours or more, but who visit a hospital, clinic, or associated facility for diagnosis or treatment). We suggest either focusing on inpatients in the wording of the question or asking both inpatient and outpatient average length of stay. — NOT IMPLEMENTED IN THE REVISED VERSION OF THE QUESTIONNAIRE
- We suggest adding to the characterisation block a question related to the number of employees of the health care organisation. According to our experience, this variable could be highly important in explaining the propensity toward ICT investments and usage. The Italian hospitals are experiencing a process of de-hospitalization that will progressively reduce the number of beds. Measuring both the beds as well as the employees allows further analysis of the dynamics associated with ICT usage—even in the case of de-hospitalization processes in act. We suggest giving the question the same structure as the one regarding hospital beds (a set of ranges and the possibility to report the actual value; in the revised version of the questionnaire we have proposed a potential classification based on both our own experience and that of the CIOs involved in the pilot analysis of the questionnaire).
- We suggest adding to the characterisation block a set of questions on the overall expenditure of the health care organisation in the year 2011 and on the expenditure in ICT in the same year—possibly classifying this last one in capital expenditures (CAPEX) and operational expenditures (OPEX). The amount of money in the hands of a CIO can explain most of the different behaviours of her/his health care organisation—especially in terms of infrastructure, ICT applications, ICT functionalities, and barriers against ICT development. In our experience, CIOs are reluctant in providing the exact amount of money available for their activities. Thus, it could be useful to ask the actual value of ICT CAPEX, OPEX and Budgets—if known and shareable—or the range in which the actual value is comprised. In the revised version of the questionnaire we have added only a question relative to the percentage of ICT budget over the overall operative expenses of the health care organisation. This question should be easily made even in different monetary systems. We suggest reflecting on how to collect information on ICT budgets due to their importance in the eHealth development.

Block B — ICT Infrastructure:

- *Q13*: According to the CIOs involved in the analysis of the questionnaire all the computer systems are externally connected. We suggest considering removing the question—especially if the questionnaire is too long. — NOT IMPLEMENTED IN THE REVISED VERSION OF THE QUESTIONNAIRE

Block C — ICT Applications:

- We suggest adding a question with the same structure of Q17 in order to understand which kind of PACS is used by the hospital of the respondent. It would also be interesting to understand if the PACS and the EPR are integrated. — NOT IMPLEMENTED IN THE REVISED VERSION OF THE QUESTIONNAIRE

Block D — HIE: there are no suggestions for this block from the CIOs involved in the analysis of the questionnaire.

Block E — Security and Privacy:

- According to the CIOs involved in the analysis of the questionnaire this block should be improved. The suggestions were related to assessing the presence of single sign-on and identity management systems because they seems to be particularly critical in managing today's privacy and security issues — NOT IMPLEMENTED IN THE REVISED VERSION OF THE QUESTIONNAIRE
- *Q27*: According to a CIO involved in the analysis of the questionnaire answering response option should be added. We suggest adding "Separating personal data and clinical data"

Block F — ICT Functionalities: there are no suggestions for this block from the CIOs involved in the analysis of the questionnaire.

Block G — Barriers, Impacts and Attitudes:

- *Q31*: According to the CIOs involved in the analysis of the questionnaire this question is very similar to the Q33 of the same block. If the survey is too long and/or too complex, they suggest deleting this question—also considering the fact that what is collected is only the CIOs' perception of the benefits and not that of the physicians who use ICT-based solutions. — NOT IMPLEMENTED IN THE REVISED VERSION OF THE QUESTIONNAIRE

Adequacy of the Instructions Given to Interviewers

- *Q4*: We suggest changing the sentence: "IF CODE 2 in Q4 ASK Q5" in "IF CODE 1 in Q4 ASK Q6 OTHERWISE ASK Q5".
- *Q17*: There is a typo in the instruction to interviewers. We suggest changing the sentence: "IF CODE 1 or 2 or 3 in Q17 ASK Q265" in "IF CODE 1 or 2 or 3 in Q17 ASK Q26".
- *Q26*: The sentence: "If a feature is C, D or E skip the related "usage" question" is an instruction to interviewers. We suggest formatting it as "IF CODE…".
- *Q27*: The sentence: "If a feature is C, D or E skip the related "usage" question" is an instruction to interviewers. We suggest formatting it as "IF CODE…" in Q26.
- *Q28*: The sentence: "If a feature is C, D or E skip the related "usage" question" is an instruction to interviewers. We suggest formatting it as "IF CODE…" in Q26.
- *Q29a*: The sentence: "If a feature is C, D or E skip the related "usage" question" is an instruction to interviewers. We suggest formatting it as "IF CODE…" in Q26.
- *Q29b*: The sentence: "If a feature is C, D or E skip the related "usage" question" is an instruction to interviewers. We suggest formatting it as "IF CODE…" in Q26.
- *Q30*: The sentence: "If a feature is C, D or E skip the related "usage" question" is an instruction to interviewers. We suggest formatting it as "IF CODE…" in Q26.

3.2.1.4 Final Remarks, Lessons Learned and Recommendations

- We suggest adding a dictionary to the questionnaire in order to clarify the meaning of the terms used within it. In the experience of the ICT in Health Care Observatory the presence of a dictionary can improve the reliability of the answers.
- If there are significant problems in terms of privacy, we suggest adding a question asking the name and the surname of the respondent, as well as the name of her/his health care organisation. In Italy the turnover among health care CIOs is high, and—in our experience—the request of the business contact of the respondent doesn't decrease the response rate (of course it is necessary to specify that all the information will be treated confidentially). Otherwise, the possibility to keep track of the respondents would allow adding the JRC to progressively construct an updated DB of the health care CIOs in the different European countries. Moreover, the local researchers can contact the respondents in order to check unexpected findings and/or

solve inconsistencies among data (see also the next suggestion from this viewpoint). The benefits of collecting this information seem greater than the relative disadvantages.

- We suggest adding a question through which to ask the email address of the respondent. The questionnaire could ask the email address, using it to send the respondents a feedback report with not only their answers but also other answers that would allow them to compare their health care organisations with others health care organisations within or outside their respective countries. The general idea behind this strategy is to increase the response rate by providing the respondents with valuable material related to the survey. The production of this information can be highly automated, and it is particularly interesting for practitioners. More generally, any feature allowing to increase the response rate produce interesting results. In our experience, it is necessary to both show the value of responding to the questionnaire as well as provide direct/indirect incentives to answer it.

3.2.2 Germany[20]

3.2.2.1 Background information

The goal of this work is to translate the existing questionnaire to German and to identify limits and potentials for a sustainable presentation of the status quo. Special interest during translation process is focused on the identification of clearness regarding the terminology used. Further issue in the translation and adaption process is to integrate specialties of the German hospital situation, German law and its health system. By interviewing experts of hospitals a pre-test of the survey should gain further implications on its validity and additional adaption.

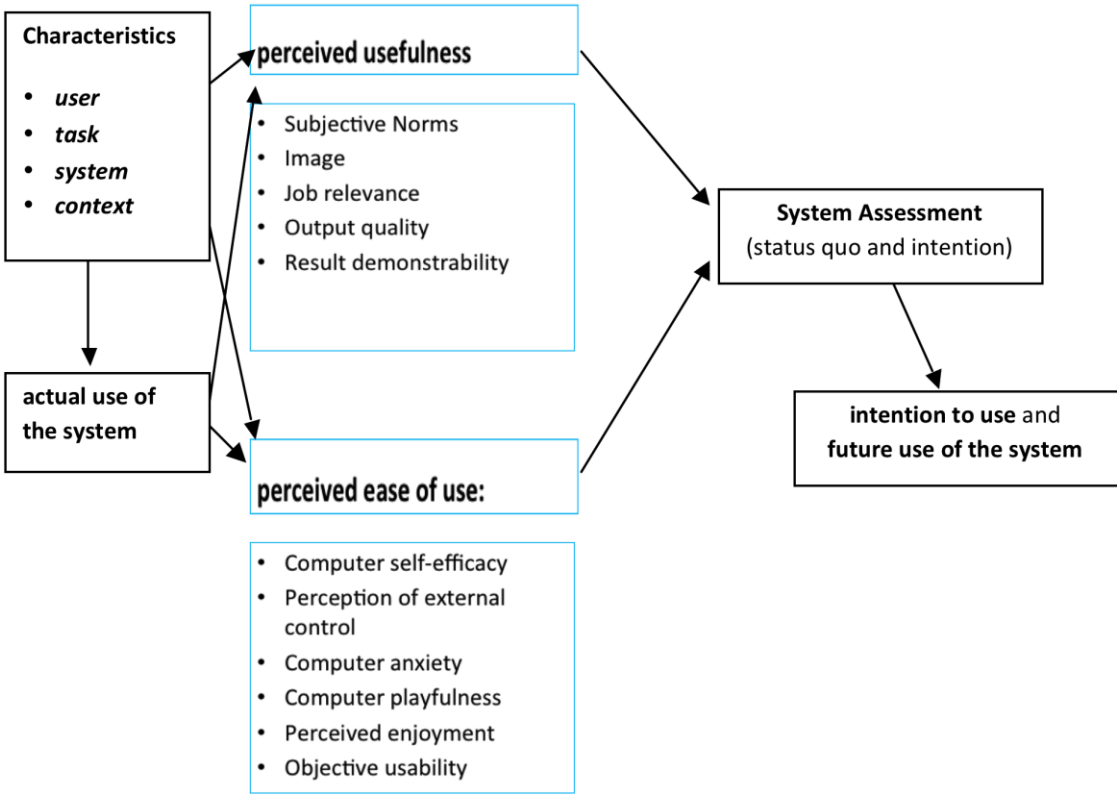
To validate the conceptual framework of the survey actual literature on the acceptance of availability of technology is evaluated. Research on technology acceptance was done by F.D. Davis in 1986 providing the Technology acceptance model (TAM). Further development of the theoretical model was done by Vetschera, Kersten & Köszegi (2003) by defining the relevant basic information ("user", "task", "system", "context" and the "actual use of the system") in the "Assessment Model on Internet Systems" (AMIS)[21]. The basic TAM model was extended by Venkatesh & Bala (2008) to a model called TAM3[22]. Within this extension the variables "ease of use" and "usefulness" were empirically tested and clustered. Using a combination of the AMIS and TAM3 models gains a comprehensive and powerful framework, which allows the adaption of the specific research element to the given structure. What needs to be considered is the validity of the model's assumptions: homogeneous user group (TAM, not AMIS), user can determine the degree of usage of the system (system usage is voluntary). Figure 6 shows the integrated theoretical model.

[20] This study has been tendered by IPTS and carried out by Martin Richter Universität Hohenheim Institut für Health Care & Public Management. Final version of the deliverable has been edited by IPTS.

[21] Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Science, Vol.39*(2), pp. 273-315.

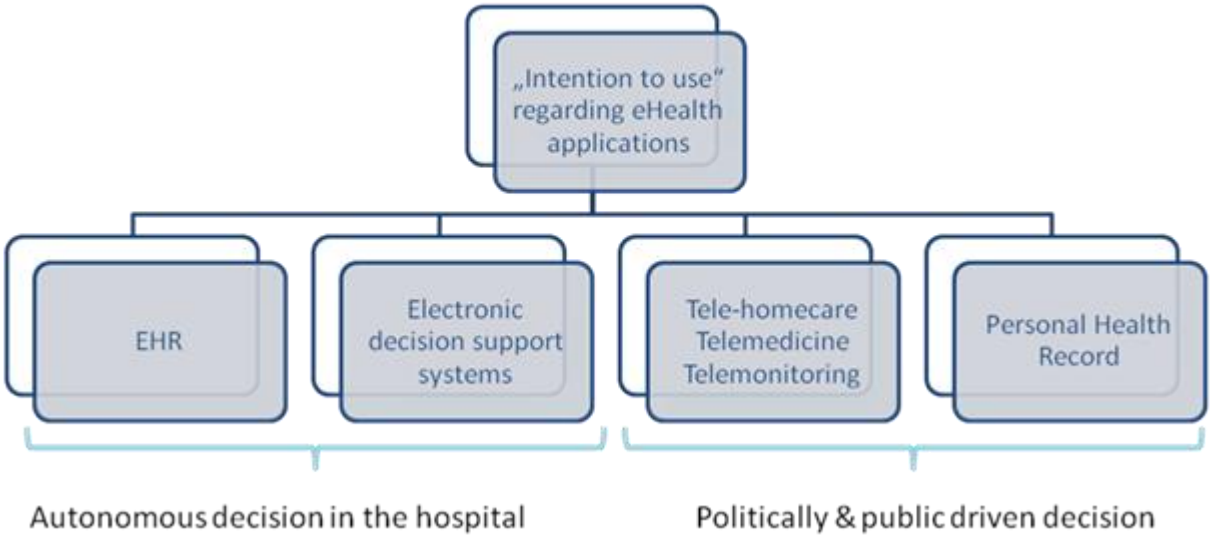
[22] Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Science, Vol.39*(2), pp. 273-315.

Figure 6 - Integrated research model on system Assessment



Considering the assumptions of the model and its power to interpret the results of questionnaire arises of the multidimensionality of eHealth applications. The decision towards usage of eHealth applications is based on the different intentions of users and regarding to the political background of the national health system. For Germany the following dilemma (illustrated in Figure 7) arises: While decision towards the usage and implementation on electronic health record (EHR) and electronic decision support systems are driven by the individual expectations of the health care provider, tele-homecare/ tele-monitoring and personal health record (PHR) is driven by the public and political debate and decision. This field of tension might not exist in all EU member countries, but is relevant for understanding the situation and preliminary results in Germany.

Figure 7: Dilemma of the research topic in Germany



Using the data for the planned composite set of indicators by the IPTS suggests a precise definition of the terms "user", "task", "system" and "context" as well as its individual "actual use" in the different countries under study. To find (political) explanations and implications would be the next step using the indicators of "ease of use" and "usefulness".

To provide a questionnaire that generally fits to all European health systems and to gain a econometric analysis of panel data for all EU member states a consistent terminology has to be aspired. For this reason a literature review was done. Although the provided questionnaire was tested during the first wave of the studies in 2008/09 uncertainties still existed. In order to be able to cluster hospitals under study in the first chapter of the questionnaire measures of German hospital studies are analysed. Further terminology-based research had be performed in the chapters on eHealth adoptions. Especially regarding the different types of records used a high dispersion of terms exists that co-exist while having overlapping meanings and usage in theory and practice. Table 2: Translation of terminology of electronic **records** shows the actual agreed national German phrases with the corresponding international standard terminology on electronic health/ patient records. The terms used in the modified German questionnaire use these phrases.

Table 2: Translation of terminology of electronic records[23]

Bezeichnung national	Bezeichnung international	Merkmale
Institutionelle Elektronische Fallakte	Keine Entsprechung	Alle Daten und Dokumente eines Behandlungsfalles einer Patientin und eines Patienten in einer Gesundheitsversorgungseinrichtung, ärztlich geführt und moderiert.
Institutionelle Elektronische Patientenakte (iEPA)	Electronic Medical Record (EMR) Electronic Patient Record (EPR)	Alle Daten und Dokumente aller Behandlungen einer Patientin und eines Patienten in einer Gesundheitsversorgungseinrichtung, ärztlich geführt und moderiert.
Einrichtungsübergreifende medizinische Fallakte (EFA)	Keine Entsprechung	Die zur Kommunikation bei einer gemeinsamen Behandlung von den Behandelnden als relevant eingestuften Daten und Dokumente über alle Gesundheitsversorgungseinrichtungen hinweg, ärztlich geführt und moderiert.
Einrichtungsübergreifende Elektronische Patientenakte (eEPA)	Electronic Health Record (EHR) Electronic Patient Record (EPR)	Die wichtigsten Daten und Dokumente aller Behandlungen einer Patientin und eines Patienten über alle Gesundheitsversorgungseinrichtungen hinweg, ärztlich geführt und moderiert, ggf. mit behandlungsrelevanten eigenen Eintragungen der Patientin oder des Patienten auf Anweisung der Ärztin bzw. des Arztes ergänzt.
Persönliche Elektronische Patientenakte (pEPA)	Personal Electronic Health Record (PHR) Personally Controlled Health Record (PCHR)	Fallübergreifende Akte unter der Datenhoheit der Patientin bzw. des Patienten. Die Entscheidung über die konkrete Nutzung (Zweckbestimmung) erfolgt im Einzelfall durch die Patientin bzw. den Patienten, indem diese die Informationen bei Bedarf einer behandelnden Ärztin oder einem behandelnden Arzt zur Verfügung stellen. Die Patientin bzw. der Patient kann Rechte auch an eine Ärztin bzw. einen Arzt ihres/seines Vertrauens delegieren. Sinn der pEPA ist, als Quelle für die Speisung der zweckbestimmten Patientenakten in der Verantwortung der Ärztinnen und Ärzte zu dienen.
Elektronische Gesundheitsakte (EGA)	Personal Electronic Health Record (PHR) Personally Controlled Health Record (PCHR)	Von den Patientinnen bzw. den Patienten ausgewählte Daten und Dokumente aller ihrer Behandlungen über alle Gesundheitsversorgungseinrichtungen hinweg, ärztlich- oder patientengeführt oder hybrid und rein patientenmoderiert, ergänzt um beliebige eigene Eintragungen der Patientin und des Patienten.
Elektronische Basisdokumentationsakte	Minimum Basic Data Set (MBDS)	Nur wenige ausgewählte, lebenslange und im Notfall wichtige medizinische Daten wie Diagnosen, Maßnahmen, Risikofaktoren etc., keine Dokumente, ärztlich geführt und moderiert.
Registerakte		Ganz wenige vollständig strukturierte und formalisierte Inhalte zu einer definierten Krankheitsklasse.

[23] Zentrum für Telematik im Gesundheitswesen (ZTG). (2011). Elektronische Akten im Gesundheitswesen – Ergebnisse des bundesweiten Arbeitskreises EPA/ EFA. Bochum, Germany.

After the terminology is adapted the particularities of the German health system have to be integrated under the restriction of not violating the Europe wide usability of the questionnaire. This chapter deals mainly with legal restrictions and hospital management structure as well as with state interventions in the German hospital markets. Although various incentives for German hospitals arise of the different insurance levels of patients (private and statutory health insurance) its influence in the field of infrastructure can be neglected for this survey.

The legal circumstances can be divided into the actual legislative situation (laws for protecting data security and privacy) and the aspired availability of health information for patients and health providers. Aspects of the first item (legal status quo) are the German Bundesdatenschutzgesetz and the additional limitations by regional law (Landesdatenschutzgesetz). Within these legal restrictions data usage, storage and transmission is allowed. One of the rare situations data must be transferred out of providers sphere is the transmission for reimbursement with the insurance company. Although different legal changes during the last decade (e.g. enabling integrated care [integrierte Versorgung](§140a-d SGB V in 2004)) aim on networking between different providers in the German health Care system, a cross-linking of health related patient data was not established sufficiently. Regarding the second item of the topic regarding the availability of personal health information (e.g. PHR) a service company (Gematic (TM)) was founded to implement a national health data system. Due to legal aspects of data security and access regulation on this system a sustainable solution is still in discussion.

Taking this situation into account there will be only limited data and results for Germany in the fields of data transfer and health information exchange. Electronic health data will predominantly be stored and processed within each hospital or provider group (using electronic medical records (Germany: "iEPA", see Table 2: Translation of terminology of electronic records).

3.2.2.2 Research strategy

The provided questionnaire asked for basic information on the hospital, eHealth deployment, functionalities and barriers, attitudes and impact. Using a scientific theory on the content of technology and system assessment and actual literature on eHealth adoptions different dimensions are not sufficiently included in the existing questionnaire. One of the most discussed factor in literature is the economic impact of eHealth on hospitals and on the provision of eHealth services.

The variety of individual national health systems all over Europe gains a challenge. While some governments centrally rule the provision of eHealth services other countries (like Germany) try to set up legal security that hospitals can provide eHealth services regarding to their decision and resources. For German hospitals investment in eHealth services is based on own funding therefore has to be cost effective. According to Jackson and McCLean (2012)[24] cost assessments and satisfaction ratings [both, patient and health care provider] are crucial criteria for determining the potential effectiveness of a new interventions and its future success. As Mutschler & Reichert (2004)[25] suggest that beside costs and effectiveness a risk assessment of eHealth applications should be considered additionally to secure the managerial investment decision.

To include a sustainable and strategic dimension into the survey questions on the intention to use cloud computing, the expected eHealth infrastructure in the next 3-5 years and investment intentions were added. Regarding the limited health data exchange in German hospital sector the actual use of telemedical pre-stage technology (e.g. point-of-care technology) is documented. This might help for future design of the panel questionnaire.

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[24] Jackson, D. E., & McCLean, S. I. (2012). Trends in telemedicine assessment indicate neglect of key criteria for predicting success. Journal of Health Organization and Management, 26(4).

[25] Mutschler, B., & Reichert, M. (2004). Usability-Metriken als Nachweis der Wirtschaftlichkeit von Verbesserungen der Mensch-Maschine-Schnittstelle. *Proc. IWSM / MetriKon Workshop on Software Metrics (IWSM / MetriKon'04)*, (pp. 407-418). Königs Wusterhausen, Germany.

On the other hand, using measures guarantees an overall objective and competitive analysis of data collected. Therefore the measures used are tested and proved by the existing literature. Converting data to ratios might give the chosen indicators more power for international comparison. But what data are available broadly and what data can be asked for without violating privacy of the organisations asked for? This topic arose when the suggestion of including economic measures arose. Including a strategic dimension in the survey would provide hints for the following wave of the panel study: what are the expectations on the future use/ assessed technology?

To guarantee an international interpretation of data performance and economic indicators must be defined precisely. Depending on the national installation of hospitals and other health service facilities differences in size and acute hospital beds per inhabitants might differ. Further contrast is expected regarding rural and urban regions. Though a additional question for the location is requested.

A main initial question is on defining "acute hospital". The negative definition: not rehab or psychiatric hospital is helpful but not precise. So an additional question on providing 24/7 availability for emergency care or operation theatre would be helpful.

The requested data on "average length of stay" of all patients, as well as "number of hospital beds", number of MRI or CT scanners does not provide a satisfactory and valid database for displaying the hospitals necessity of eHealth usage.

For implementation of economic measures a percentage of investment in ICT infrastructure relative to total investment is intended. Investment in infrastructure relative to the turnover of the hospital is difficult to interpret in the German hospital financing setting where operating costs are covered by the health insurance companies and investment costs are covered and coordinated by the regional governments (Bundesländer). Investments in infrastructure in Germany are therefore independent of the proceeded cases of a hospital and rather bound to cyclical trends and the tax income of the regional governments.

Gathering all the necessary information from the CIO (as suggested by the committee) seems to be not possible. Lessons learned so far (from other projects) the CIO knows about infrastructure, data exchange, applications and limitations and has a technical perspective on future eHealth deployment. As CIOs are mainly not members of the board in Germany basic data of the hospital and strategic decisions are not in her/ his field of activity. Due to this fact the interviews of the pretest are considered to be performed with the CIA and the medical director of the hospitals. This was already carried out in the first wave of the survey in 2008 by IPSOS.

To gain a complex feedback on the questionnaire the three hospitals under study were chosen under the objective of high heterogeneity. The first criterion was the ownership: Therefore a public and a non-profit acute hospital were selected. No private for-profit acute hospital was willing to take part. The next criterion was the hospital size: A non-profit private hospital with ~700 beds and the public hospital with >2000 beds were contacted and were willing to take part. As third hospital a regional health provider with >20 hospitals was contacted; the CIO was responsible for all hospitals of the group. All three participating hospitals are located in southern Germany. While two of the hospitals serve in urban regions, the third (group of) hospital(s) offers its health services in mainly rural areas.

Having the commitment of the CIOs and medical directors of the hospitals scheduling for the interviews was a challenge. Several dates were cancelled (by CIO/ medical director), in one hospital two visits became necessary because of time restrictions of the CIO and medical director.

The time for proceeding the questionnaire was estimated on basis of the information of pre-questionnaire (2008 version). It informed on 20 minutes to the CIO and about 5-10 minutes to the medical director. Finally the arranged time was 40 minutes for the talk to the CIO and 10 minutes for the medical director.

The interviews were performed in the different hospitals in qualitative face to face situation, giving the partners space and time to add their experience and thoughts. This approach extended the scheduled time. The atmosphere of the interviews was concentrated, friendly and interested. The technical knowledge of the CIOs was adequate regarding infrastructure and eHealth applications. Knowledge on strategic decisions and goals of the hospital CIOs lacked information. In the hierarchical structure of the hospital the involved CIOs are integrated in the technical services and were not members of the board of directors.

Medical directors had basic information on ICT infrastructure. Regarding strategic development of eHealth services and information on the barriers, attitudes and impact they were able to answer in detail and had ideas to solve some of the challenges of eHealth services.

Both, CIOs and medical directors quoted an "inadequate legal situation" in Germany which hinders the implementation of necessary eHealth applications and data exchange in Germany. Especially the uncertainty of jurisdiction in case of patient data loss and its potential effect on the risk management was referred.

The times spent on the interviews were 55 to 60 minutes for the talks to the CIO and 20 to 60 minutes talking to the medical director.

Documentation of the interviews was done by commenting on a digital version of the questionnaire on a tablet computer. The preliminary results of interviews are showed below:

Characterisation:

hospital 1
Q1: Assistant of the CIO, male; Leading medical doctor, male, anaesthesiologist
Q2: public hospital
Q3: An independent hospital on multiple sites
Q4: university hospital: no
Q5: non-university teaching hospital: yes
Q6: more than 750 beds (estimated: 2.000)
Q7: not available, only in rural areas to be estimated
Q8: number discharge 2011: 78.314 in 2010 (data of 2011 not available)
Q9: Length of stay 2011: data not available.
Q10: Number of Computed Axial Tomography scanners (CAT scanners): 4 (own research)
Q11: Number of Magnetic Resonance Imaging Units (MRI units): min 2 (quality report)

hospital 2
Q1: CIO, male, responsible for all hospitals ; Leading medical doctor, male, radiologist
Q2: private not for profit hospital
Q3: Part of a group of different hospitals
Q4: university hospital: no
Q5: non-university teaching hospital: yes
Q6: more than 750 beds (2010: 784)
Q7: not available, only in rural areas to be estimated
Q8: number discharge 2011: 30.684 in 2010 (data of 2011 not available)
Q9: Length of stay 2011: data not available.
Q10: Number of Computed Axial Tomography scanners (CAT scanners): 2
Q11: Number of Magnetic Resonance Imaging Units (MRI units): 1

hospital 3
Q1: CIO, male, responsible for all hospitals of the group; hospital manager, male
Q2: public hospital
Q3: Part of a group of different hospitals

Q4: university hospital: no
Q5: non-university teaching hospital: yes
Q6: more than 750 beds
Q7: 1.7 mio inhabitants, only for neuro-surgery full covering of inhabitants.
Q8: number discharge 2011: 10.589 in 2010 (in **one** of the hospitals, main site) (data of 2011 not available)
Q9: Length of stay 2011: data not available.
Q10: Number of Computed Axial Tomography scanners (CAT scanners): 1
Q11: Number of Magnetic Resonance Imaging Units (MRI units): 1 owned & 1 in cooperation with private service provider

Infrastructure:

- Infrastructure (wired & wireless) and online-access (for staff and patients/ visitors) are on acceptable level (wired data transmission > 50 Mbit/s, while wireless access available variably, not all over the hospital site)
- Inter-organisational electronic health records (EHR) is NOT available because there is no statutory regulation.
- iEPA/ Electronic medical records (EMR) or electronic patient records (EPR) are available broadly. These data are transmitted digitally only within the own infrastructure. Hospital 1 implemented the EMR not completely on all care units. Hospital 2 has the EMR implementation on all care units except the ICUs, hospital 3 has a complete implementation. Within this point the implemented ICT-System is different in the three hospitals.
- All external communication and data transfers are paper based. One provider (hospital 3) uses teleconferencing for clinical audits with patients (inpatient to health professionals in other sites) and teleradiology and therefore sends and receives digital radiology images including patient data to/ from other health providers (teleradiology services).
- Regarding the patient data safety one interviewed hospital is developing and testing a remote solution aiming on availability of data and information without transferring data beyond the organisations firewall (legal restriction).

Integration:

- Standardised cost-collection by INEK for calculating fees, DRG-billing with statutory health insurance (GKV)
- Integration of different participants (information exchange) in the health care system is realised partially (e.g. hospital 2 with rehab hospital of the same owner, only internal)
- Waiting for political and regulatory guidelines esp. of patient data security
- National Electronic Health Record is in progress ("Gesundheitskarte" by Gematik®)
- Critical incident reporting system (CIRS) is implemented partially only in hospital 1, according to philosophy of the individual hospital. Hospitals under study.
- Electronic appointment systems are only used internal, resources (staff, rooms, med. advices) are not planned automatically (predominantly no patient access). For outpatient services a electronic appointment system is implemented in hospital 3 (but without in-house resource planning).

Tele-homecare and Telemonitoring:

- The hospitals under study do not provide any telemedical services (but planning to implement).

- Teleradiology is used by hospital 3 (only one with external service)
- Main restriction in Germany: unclear reimbursement of Tele- and eHealth services (existing projects have individual financing concepts)
- "Duale Finanzierung"(Separation of investment costs and operating costs of hospitals) in the inpatient care sector, separate reimbursement and budgeting system for outpatients/ primary care services is one of the main challenges in investments in inter-sectoral care.

Functionalities:

EMR

- Implemented (>60%) for basic care units
- No active advice/support systems, only passive signalling (e.g. pathologic laboratory results printed bold)

Health Information Exchange

- **No EHR** implemented because of German national law.
- Only within hospital or provider group (own firewall)
- "No digital data outside my hospital"
- Waiting for political and jurisdictional advice

Telemedicine

- Video-conferencing with patients (1 of 3), Teleradiology (2 of 3)
- Planning of projects, reimbursement is unclear
- Motivation: mainly marketing-reasons

PHR

- Not *enabled in Germany, in political discussion, low progress*
- *Hospitals are not willing to access patient-organised health records*

Barriers reported (Q31/Q32):

- Perceived usefulness of medical staff (as long as still parallel paper based documentation is necessary)
- Financial restrictions
- Q31.17: Resources given: hardware is available, time and skills are missing (self-critical statements of the CIOs regarding the offered further training for health professionals)
- Q31.21: Medical hierarchy prevents decision making towards a general use of ICT (it depends on the doctor in chief)
- Missing financial incentives for hospitals for implementing eHealth services and applications

Attitudes reported (Q33):

- Totally agree: 1,3,6,7,8,12,13,14:
    - Reduce medical errors
    - Improvement in the quality of treatment
    - Increased patients' access to health care
    - Avoid unnecessary tests and duplications
    - Increased average number of patients receiving help during one day

- Allow more efficient consultations
- Improvement in the coordination between the different levels of health system
- Speed up working process due to the availability of clinical information about patients

- Somewhat agree: 2,4,5,9,10,11,15:
  - Improvement in the quality of diagnosis decisions
  - Facilitate patients' treatment adherence
  - Improvement in patients' satisfaction
  - Reduce pharmaceutical expenditure
  - Shorter waiting lists
  - More efficient working processes among health professionals
  - Improvement in the efficiency of the whole health system

Undecided/critical: patient satisfaction: All CIOs argue, that patients profit from a faster and more secure treatment but suffer from an IT-based more un-personal medical decision making (nurses and doctors concentrating on ICT and not on the patient).

3.2.2.3 Main blocks of the questionnaire and indicators

Terminology

Using the identical phrases in all European countries with the same meaning is the goal of this survey. The following terms are in focus:

***Acute hospital*:** hospital proceeding acute cases, surgical and medical department, additional questions may be: 24/7 availability of at least one physician (preferred: 24/7 availability of emergency care and operating theatre).

EHR: national/ inter-organisational available patient health data and relevant medical documents with optional patient access to the data. For Germany the definitions of the ZTG (2011) are available and therefore be used for identification of the different types of patient records.

As long as no consistent nation-wide EHR is available in Germany, the status quo of its pre-stages can be validated and trends towards a standardised management of documents and their structure should be screened.

Complexity

The pre-test of the survey showed a high amount of time per interview, so a reduction of the complexity of the survey would be recommended. For the not-existence of an EHR these questions could be deleted, but in case of some existing projects of networks of health providers their experience might be helpful and is lost in case of not asking (example: "Gesundes Kinzigtal": http://www.gesundes-kinzigtal.de/).

For statistical analyses of subgroups Block A of the survey can be extended especially by adding a group of hospitals between 750 and 1.000 beds, which would be helpful for clustering German hospitals. Further reduction of complexity would be gained by not asking the status quo of the legal situation of Block E (security and privacy) but provide the national status on security and privacy of each country by the research team.

The variety of electronic records in Q26 (EMR, EHR and EPR) in Block F opened the possibility for German hospitals to answer questions on usage and availability of eHealth functionalities. The overall inclusion of all types records makes it difficult to answer for the CIO. In an in depth interview situation this can be handled while in a telephone interview situation this multidimensional question will arise problems and misunderstanding. In the German pre-test questionnaire additional fields of "degree of implementation" and "degree of usage" were used for the sub-questions of Q27 to Q30.

The differentiation of the degree of availability of these questions between A [Fully Implemented Across All Units] and B [Fully implemented in At Least One Unit] is too rough. In some cases the ICU or other specialty unit might not use the application or functionality. So a re-definition of A [Fully Implemented in at Least 80% of all Units] gives a more realistic picture of the availability.

Regarding a theory-based approach more questions regarding the usefulness and ease of use could support the understanding of deficits of implementation of eHealth application and services e.g. in Germany. ***Therefore the users of eHealth applications themselves should be asked (nurses, physicians).*** The questions Q31-13 to Q31-16 already try to find out the influence of hierarchy on degree of usage of eHealth applications. The influence of "image", "job relevance", "output quality" and "result demonstrability" are not considered yet. The same with the items influencing "perceived ease of use" in the integrated model of user acceptance (Figure 6 - Integrated research model on system Assessment)

These factors can enable scientific research towards knowledge and understanding of user's intention to use eHealth and give the opportunity to combine these results with external data e.g. of quality of care or health professional's satisfaction. With the actual research strategy, combining OECD and other international data sources and the existing status quo of eHealth provision these extensions might not be necessary.

CIOs interviewed have raised the following remarks:

- Infrastructure (wired & wireless) and online-access are on high level
- EHR's are available broadly (-***name of the system used***)
- Depending on the basic ICT-System the interfaces to subsystems are problematic (e.g. SAP-System, platform systems)
- PACS are standard applications, enabled by an unique data format
- Integration: Billing-Management is generally implemented,
  - Germany: **standardised cost-collection** by INEK for calculating fees, DRG-billing with public health insurance (GKV)
  - **Integration of different participants (information exchange)** in the health care system is realised partially (e.g. with rehab hospital of the same owner, only internal)
  - Waiting for political and regulatory guidelines esp. of **patient data security**
  - **National Electronic Health Record** is in progress ("Gesundheitskarte" by Gematik®)
  - **CIRS** is implemented partially, according to philosophy of the individual Hospital (potential of a portal for all EU countries?)
  - **Electronic appointment systems** are only used internal, resources (staff, rooms, med. advices) are not planned automatically (predominantly no patient access).
- **Tele-homecare and Telemonitoring**
  - The hospitals under study do not provide any telemedical services (but planning to implement).
  - Teleradiology is used by hospitals, (but: access only for internal users)
  - Main restriction in Germany: **Reimbursement** of eHealth services (existing projects have individual financing concepts)
  - "Duale Finanzierung"(Separation of investment and operating costs)
- **Security and privacy:**
  - Guidelines on a national and regional level. Individual interpretation, e.g. Public hospitals: strictly
  - Remote-solution in planning stage (1 of 3), but legal uncertainty

3.2.2.4 Final recommendations

The existing survey with the recommendations of the expert group enables research on eHealth availability and implementation in Europe. One of the main goals of the expert group is to create a clear terminology and translation to all languages and adaption to all EU-countries. Implementation of eHealth applications especially the degree of health data exchange depends on national legislation. Due to this fact the international strategy of this project might give implications for a political EU-wide set of guidelines concerning (medical) data and network security and privacy.

To understand and evaluate the national status quo of the topic, economic measures might be necessary to be introduced (e.g. investment in hospital ICT in relation to hospital beds or total investment of the hospitals). Further point of interest would be the size of the ICT unit staff. This might help to gather information on ICT impact on hospital productivity.

Taking into account the different experiences in the light of the various national health systems of European countries, the results and findings of the IPTS composite indicator study will show the impact of eHealth implementation on quality and effectiveness of hospital care. Further it will enable research to find implications for improving European health care.

3.2.3 Hungary[26]

3.2.3.1 Background information

The European Hospital Survey: Benchmarking deployment of e-health services targeted to research e-health deployment among acute hospitals in the European Union. IPTS researchers defined the methodology of the survey and created a questionnaire to be applied during the program. Before launching the survey IPTS designed a methodological set up validation process consisting on two phases: (1) testing the questionnaire in four different countries (UK, Italy, Germany and Hungary) through in-depth interviews with 3-4 CIOs of acute hospitals within each country and (2) organizing a validation workshop in Brussels with different experts including the ones carrying out the test interviews in order to share experience of the tests and determine necessary changes of the questionnaire.

I had the following tasks to carry out within the framework of the validation process:

- To review, validate and translate the draft questionnaire provided by IPTS at the kick-off meeting to Hungarian.
- To pilot-test the translated draft questionnaire through in-depth face to face interviews with three different Chief Information Officers (CIO) from three different acute hospitals in Hungary.
- To improve the questionnaire provided by IPTS with the analysis of the in-depth face to face interviews.
- To join the validation workshop on 2 July 2012 and share experience with other experts
- To finalize a written report for IPTS about the experience of the test interviews
- To provide translation of the initial questionnaire
- To provide impressions and recommendations regarding the research strategy
- To provide recommendations about reasonable changes of the questionnaire
- To provide feedback from CIOs interviewed.

3.2.3.2 Research strategy

Wording and structure of the questionnaire is clear and logical. The translation was demanding in terms of duration. There are some phrases which do not have their Hungarian equivalent e.g. e-health, which is used as e-health in Hungarian although it can be translated. There are some abbreviations which are difficult to be translated or even used in Hungarian (e.g. EHR, EMR, EPR).

[26] This study has been tendered by IPTS and carried out by Dr. Gabor Karai**.** Final version of the deliverable has been edited by IPTS

Phrases like Electronic Medical Records (EMRs) / Electronic Health Records (EHRs) / Electronic Patient Records (EPR) are difficult to use and also confusing even after translating them. Apart from the aforementioned phrases the questions could be translated and well adopted to Hungarian language.

CIOs of three acute hospitals in Budapest were interviewed. The acute hospitals selected were:

- Semmelweis University is Hungary's biggest medical university with several university clinics on different sites. It has got over 2000 beds. They treat 163.191 inpatients and 2.256.941 outpatients a year.
- Jahn Fernec and Szent István Hospitals are huge municipal hospitals in Budapest with over 1000 beds both.

All three institutions render acute care meaning 24 hours emergency departments and acute inpatient care in many specialties. All of them cover 0.5 to 10 million inhabitants.

In case of Semmelweis University I managed to meet the strategic director who is also responsible for IT. In case of the two other hospitals I met the CIOs. In general I can put down that it was rather difficult to have a physical meeting with these people. They are all very busy with a lot of responsibility. They have a very strict daily agenda. It occurred several times that they postponed the appointments. I would therefore recommend shortening the duration of interview. On the other hand face to face interviews will complicate the research although telephone interviews will be difficult as well. The interviewed CIOs raised the possibility of an online survey, which they would better prefer. I fear if it goes online, the CIOs will not be the ones filling in the questionnaires. There has been one more mitigating factor that cannot be underestimated: CIOs can participate in the survey only after getting the approval from their hospital's CEO. It was denied in one case, as my request for the interview was refused by e-mail at another hospital. I was supposed to send a short e-mail to the CEO in case of each institution. The CIOs were only allowed to answer the questions after getting the written approval from the CEO. These circumstances would also apply if the research is done through a telephone conversation. One way to avoid such complications could be if Hungarian Ministry of Human Resources (responsible for health policy) is involved and orders participation in the survey for each hospital.

Response rates could be maximized if we could target face to face interviews and substitute them with telephone interviews only if the physical meeting fails. This could be offered a second solution. This could of course raise expenses, which has to be considered. As the survey was designed for approximately a total of 2000 hospitals Hungary would be most probably represented with not more the 25-30 hospitals in the entire research. The Hungarian Hospital's Association has got currently 123 members. Among these members there are 4 medical Universities and several non-acute hospitals as well. Considering the potential number of hospitals to be interviewed in Hungary face to face interviews seem to be feasible even if countryside hospitals should be involved as well. The entire project dedicated 3 months (Oct-Dec 2012) for the fieldwork, which must be sufficient for performing 25-30 face to face or telephone interviews within the country.

The interviews took approximately 30-40 minutes. There were often some doubts or further questions raised while going through the questionnaire. It became obvious that the questionnaire is too long and has some superfluous or repeatedly occurring questions. It is also remarkable that most answers were the same by all three interviewed persons. There are strict legal requirements in Hungary regulating medical documentations, data protection and reporting form health care providers to the national health insurer. I have the impression that hospitals do the required minimum but do not invest in new functions which is not compensated by the national health insurer. The basic reason is finances. Our health care institutions are suffering from a chronic lack of resources. The only exception is tele-radiology where hospitals are in a lack of human resources therefore they need to have the technical background for tele-radiology otherwise they could not cover their daily needs. All interviewed persons were very much missing those questions which could display the quality, age, value of their hospitals' IT systems, and which could reveal yearly IT expenditures, capacity of stuff, support etc.

Finally, definition of acute hospitals should be revised. Based on my experience and common understanding after the physical meeting in Brussels acute hospital should be determined based on the following criteria: hospital with emergency care for inpatients in any of the medical specialties. It is a wide definition. Some hospitals have emergency care departments. Some others do not have any, but they still have departments e.g. internal medicine, cardiology, surgery etc. rendering night and day acute service for patients with acute diagnoses based on the referral of GPs or emergency outpatient centres.

Targeting CIOs of hospitals seems to be reasonably, however there are some questions, which CIOs cannot answer. Typically these questions are related to number of beds, average duration of inpatient care, yearly number of patients, number of population covered. On the other hand there are some questions which should better be answered by the end users instead of CIOs who are less familiar with the usage of their software. User attitudes are not so easy to be understood and described by CIOs. It is clear that the current survey has not been designed to check users' attitudes although it would be useful to research users' behaviour as well. Questions related barriers, impacts and attitudes (BLOCK G.) should be answered by the end users or chef medical officers instead of CIOs.

3.2.3.3 Main blocks of the questionnaire and indicators

BLOCK A. Characterisation

Q6-Q11 These questions are difficult to answer for a CIO as this person may not be aware of precise figures. I would only ask approximate number of hospital beds in order to get an impression about the size of the hospital. I believe that the rest of questions do not have a close relationship with IT deployment.

In case of Q6 I would only ask for number of beds. The question regarding ranges (under 100, 101-250, over 250 etc.) should be completed by the person doing the interview based on the number given.

As to Q7 it is difficult to answer even for a CMO, especially not for a CIO. Some hospitals have a geographical area to cover. The population of this is covered by the appointed hospital, meaning that all acute cases from that territory are to be treated by this hospital. The problem is that the population covered is different form specialty to specialty. While there are some specialties where it is easy to determine the number of should covered, in some other specialties a hospital can even cover the entire country. If we only consider the population who can be eligible for the hospital's services in emergency cases, it is still difficult to have an exact figure. As this figure should normally not have any influence on the quality of care or IT deployment, I would cancel this question as well.

BLOCK B. ICT infrastructure

I would complete this block with some further questions in order to get an impression about average number of devices, IT budget and how CIOs see their budget, whether it is sufficient or not. It would be crucial to compare these figures within the European countries to see whether there are basic resources missing in some areas. E.g. in Hungary, CIOs would first invest in hardware and basic software not to use free trial versions any more instead of spending money on new functionalities of their EPR system, like tele-health or tele-conferences etc. New questions are:

How many computers do you have in your hospital?

What is the average age of your hospital's IT devices?

What is the yearly IT budget of your hospital?

Does your hospital spend enough resources on IT infrastructure including hardware and software?

BLOCK C. ICT Applications

Wording in Q17 is confusing. It does not make sense to use 3 different phrases if we try to describe one single system even if it has got several, at least 3 different functionalities. Instead of using Electronic Medical Records (EMRs) / Electronic Health Records (EHRs) / Electronic Patient Records (EPRs) I would only use Electronic Patient Records (EPRs). Documentation in hospitals is always linked to patients. The phrase can be accepted and easily understood by everyone. I would follow this logic in the entire questionnaire and simplify wording.

Q17 is not belonging this block. The question, whether the hospital has got a EMR/EPR/EHR system is asked thoroughly in BLOCK F (functionalities). Therefore I would simply delete Q17 from here and move to BLOCK F to the first position. On the other hand if we jump to Q26 as described in Q17, we would skip some useful questions.

Q18 belongs to functionalities as well. According to current questionnaire if answer is 1 or 2 then Q30 is the next to be asked. This is confusing again. It sounds like all questions in-between should be skipped. Therefore I would delete this question from this block and move it to BLOCK F (functionalities).

BLOCK D. Health Information Exchange

Requires no adjustment

BLOCK E. Security and privacy

Q26: Is there any regulation in use that guarantees the security and privacy of electronic patient medical data? – This question can be deleted. There is a nationwide regulation in Hungary. The necessary minimum is done by all hospitals. All further security measures are mandatory. The next question can clarify this.

BLOCK F. IT functionalities

I would start this block with the question (initially Q17) which I would move here from BLOCK C. First two questions in this block (in the original questionnaire this is Q26 again) can be deleted. All Hungarian hospitals have these functionalities and they all use it. Answer would be yes to all items of Q26 and Q27. Phrases of Electronic Medical Records (EMRs) / Electronic Health Records (EHRs) / Electronic Patient Records (EPRs) should not be applied. Only EPR should be sued. This also applies for Q28 Q98. In case of Q27 I deleted one option: conduct clinical audits. It is confusing, difficult to understand. I moved the questions about PHR (personal health records) to this block as well.

BLOCK G. Barriers, Impact and Attitudes

These questions could be answered by the end user or by chef medical officers much easier. As this current survey does not allow interviewing such personnel I would simplify these questions and delete redundant items. Answers seem to be quite obvious. It is easy to understand that everyone would believe that EPRs would facilitate efficacy and systems' development is first of all depending on lack of resources. The best option would be to completely delete this block.

3.2.3.4 Final Remarks, Lessons Learned and Recommendations

Goals and basic methodology of the planned survey are reasonable. The survey is feasible and can deliver useful information about IT deployment in Hungarian hospitals.

Interviewing CIOs seems to be the best choice. Requiring less information about the hospital's medical statistics and users' attitude is reasonable as CIOs do not have a real insight on these

topics. Another survey to research users' behavior and preferences could be also considered in the future. Interviews should be carried out face to face or on the phone if personal meeting is not possible. I hope that my contribution will support the survey and I managed to add useful comments and recommendations which enhance the implementation of the final questionnaire. I will be glad to render any support in organizing the survey in Hungary and in completing the interviews after the program is launched.

3.2.4 England[27]

3.2.4.1 Background information

Three interviews were carried out. Two of the interviewees were chief information officers (CIOs) and one a director of finance. In this latter case the trust CIO reported to the director of finance. This is not uncommon, the director of finance sitting on the trust board with executive responsibility for information management technology (IMT), although the CIO may well also attend board meetings. All three interviewees were from NHS acute hospitals: one a local district hospital in eastern England and two from university hospitals; one in a large metropolitan conurbation in northern England and the other located in a smaller city in southern England, but providing general and specialist services for a large geographical area. Each interview took approximately an hour, starting with some discussion about the interviewee's position then going systematically through the questionnaire and discussing key issues as they arose. Finally, the interviewees' more general feelings about the questionnaire as a whole were discussed. Two of the interviews were conducted face to face and one by telephone. In this latter case the interviewee was known to the interviewer and so it was less important to develop the rapport possible face to face.

3.2.4.2 Research strategy

The healthcare systems are different in the four countries, as is the state of IMT development. It will be important to ensure sampling a sufficient number of organisations from each country if all four are to be included. A decision should be taken as to which parts of the United Kingdom the survey will cover i.e. is the survey to cover England *and* the devolved administrations - Wales, Scotland and Northern Ireland.

It is understood that the main survey will be conducted by telephone. This is likely to be efficient and effective as long as the interviewee is sent a copy of the questionnaire before the interview. Some questions will require the interviewee to find information before the interview is conducted and others will be more clearly understood if the interviewee has had a chance to look through the questionnaire beforehand.

It is also understood that the interviewers are likely to have an IMT background. My feeling is, given the type of questions being asked, that familiarity with the health care system is at least, if not more important, than familiarity with IMT.

Overall the questionnaire was well received and felt to cover most important information. Gaps in information or areas that need clarification are addressed in the relevant sections below.

Generally, the organisation of the questionnaire works well; the sections make sense and are logically ordered. The questionnaire might benefit overall from an additional block at the beginning, or as an additional part to Block A covering national and local IMT policy.

The term 'Information Management Technology' or IMT should be used and not ICT, which is somewhat dated. Moreover, use 'Other: Please state' as a response option throughout.

[27] This study has been tendered by IPTS and carried out by Sian Rees**.** Final version of the deliverable has been edited by IPTS

3.2.4.3 Main blocks of the questionnaire and indicators

Block A.

All National Health Service, NHS (i.e. state run or public) hospitals are part of 'trusts'. Trusts are administrative units with a chief executive and board. Each trust may include services or facilities on a number of geographically separate sites. Trusts may therefore include more than one hospital site and other services such as community nursing. In the private sector this is also the case; a private sector provider may run a number of hospitals. Maybe it is this type of administrative unit that it is important to ask about rather than 'the hospital', as it is likely that the IMT strategy and developments will span the hospitals encompassed by a trust or private sector organisation.

Some trusts provide 'back office functions' such as IMT to other trusts. It may be helpful to ask additional questions relating to this i.e. ask if the trust/organisation provides IMT services to other organisations, if it buys in IMT services or if it has its own in house IMT function -see suggested questions in conclusion.

In order to understand the full picture for e-health, and to give context to the answers provided by interviewees, a thorough understanding of the national and /or local policy context for IMT is needed. The extent to which this acts as a driver for local IMT development will clearly vary across EU countries, depending on the nature of the particular health system. Background context will be needed for each country. The extent to which national policy informs local IMT developments will determine whether there are additional country specific questions that need to be asked in the questionnaire.

An understanding of any national IMT systems will also be necessary, for example the 'choose and book' appointment system that is in operation in primary care in England. The existence of such systems will have an impact on local IMT development.

It is important to consider the interface with social care. This is also likely to be country specific, integration of health and social care is a key policy objective in England and is very challenging. Currently, there are different IMT systems in health and social care with different datasets and different priorities. It would be useful to understand the policy context at least for health and social care IMT and perhaps ask a specific question about interoperability of systems.

In addition to the national or local policy context an understanding of the strategic importance placed on IMT by the trust/organisation would be helpful context. This would help to develop understanding of whether either national policy or local strategic importance explains variation in implementation or maturity of e-health utilisation. A number of questions relating to this could be asked in this section covering existence of strategic and operational plans, monitoring, accountability and investment – see suggestions for additional questions in conclusion.

Telehealth or other e-health technologies have the potential to impact on hospital and other healthcare costs; for example, if telehealth reduces the need for patients to attend hospital for planned appointments or unplanned emergency admission. Depending on how funding for the healthcare system is organised this may act as a disincentive for hospitals to develop e-health. It would be worth asking about whether this is perceived to be an issue in terms of impact on costs and impact on e-health development. Such questions could be incorporated into Block 9, as part of new block on context or as part of Block A - see suggestions for additional questions in conclusion.

The monitoring of patient experience is a key policy objective in England. E-health technology can be used to assist in this, for example use of ipads to record real-time feedback from patients. It may be worth asking a specific question about patient experience monitoring - see suggestions for additional questions in conclusion.

Specific questions:

- Q6-11 These figures are not necessarily in head of average CIO, they would need to either have the questionnaire in advance and prepare answers or send in responses after the interview.

- Q7 Population covered: the answer to this question may depend on which services. Trusts may include general or local services (maybe covering 400 000 local population) and specialist services such as transplant or cardiac surgery (maybe covering 1 million or more regional population). In addition, private hospitals may not cover a geographical population in the same way as an NHS trust would. It may be worth asking this question in three parts - see suggested format in recommendations.

- Q9 The average length of stay will differ for elective i.e. planned admissions and non-elective admissions. It may be worth splitting this into two questions. There are other measures of activity that it might be as helpful to ask about such as outpatient or emergency care attendances or births.

- Q10 and 11 It was unclear to all interviewees why this information was important.

Block B and C

No specific comments.

Specific questions

- Q12 There are usually lots of different computer systems within any given trust/organisation e.g. radiology, pharmacy etc. It maybe therefore worth asking how many systems there are, what they are and whether they are all interoperable? This would need to be asked in advance - see suggestions for additional questions in conclusion

- Q13 It was unclear to interviewees what option 2 meant.

- Q16 Is this question to tease out readiness for telehealth i.e. about accessibility of VC facilities to clinicians within the hospital? In which case the location as well as the number of facilities maybe important - see suggestion for additional questions in conclusion.

Block D

It will be important to understanding why information exchange maybe challenging or limited for example whether band width in different parts of the healthcare system, such as between hospital and primary care, acts as a limiting factor for e-information exchange - see suggestions for additional questions in conclusion.

Specific questions

- Q20 would need to be asked in advance.

Block E

The extent to which national policy informs security and monitoring of breaches is important. It is a significant factor in the NHS. In the local context it might also be helpful to ask about the resilience of electronic systems in place and what back-up systems exist - see suggestions for additional questions in conclusion.

Block F

The questions in this section are very difficult to answer in the current format, particularly over the telephone; it may be worth restructuring the options into a web-form that is sent out in advance.

Specific questions:

- Q26 It is unclear what exactly is meant by 'treatment outcomes' and 'problem list'. Treatment outcome could simply mean discharge or death which will be routinely recorded. However, more detailed information about clinical outcomes may be what is being referred to here.
- Q29 on telehealth. It is unclear who the training question refers to - patients or clinicians?

Block G

It is important to be clear with the answer to all these questions how the interviewee 'knows' the answers: are their responses simply their 'feel' for the situation or have they carried out staff surveys or training needs analysis? It might therefore be worth asking an initial specific question about what the organisation has done to ascertain what different professional groups' views are on IMT, what their training needs are etc - see suggestions for additional questions in conclusion.

The questions refer to 'health professionals'. It is likely that there are some differences between doctors, nurses, allied health professionals such as occupational therapists, pharmacists etc. It may be worth structuring the questions so that this information can be collected.

These questions are also difficult to answer over the phone, so either need restructuring or sending out beforehand.

Specific questions:

- Q32 – Some interviewees were unclear what the question on lack of legislation meant.

3.2.4.4 Final Remarks, Lessons Learned and Recommendations

Overall the questionnaire is well thought through. There are a number of areas in which it could be improved which are outlined in the recommendations and suggestions for additional questions below.

Regarding policy context, the survey should collect information on national IMT policy, to determine how far this acts as a lever for local implementation, including mandated national IMT systems, data security and management of data breaches. It should also cover the relationship between health and social care and the interoperability of their respective IMT systems.

Regarding methodological aspects, the survey should cover England, Wales, Scotland and Northern Ireland if there is sufficient resource. Furthermore, the questionnaire should be sent to interviewee prior to the interview.

Regarding the content of the questionnaire, firstly, the term 'Information Management Technology' or IMT is suggested rather than ICT. Secondly, use the term trust/organisation as the unit being asked about rather than hospital. Thirdly, it would be better to use 'Other: Please state' as a response option throughout. Finally, some additional questions are suggested in relation to

Strategic priority of IMT:

- Do you have a written strategic plan for IMT development in your organisation for the next 5 years? Y/N
- Do you have annual operational plans for delivery of your IMT strategy? Y/N
- Do you have named accountability for IMT strategy and operations at board level?

- Does the board receive regular, at least quarterly, reports on the status of IMT plan delivery? Y/N
- What is your organisation's annual capital investment in IMT or what has your organisational investment in IMT been over the past 5 years?
- What is your organisation's annual revenue investment in IMT as a proportion of total income?
- Do you have a nominated clinician/s with responsibility for IMT? Y/N

Financial impact of e-health

- Do you think that development of telehealth or other e-health technologies will have an impact on hospital costs/income? Y/N
- If so, could this be a disincentive for hospitals to develop some aspects of e-health? Y/N

Patient experience monitoring

- Do you use e-health technology to monitor patient experience eg for real-time feedback surveys
- If so, what do you use?

Provision of IMT

- Does your trust/organisation have an in-house IMT function? Y/N

  If not do you purchase IMT services from an external organisation? Y/N

  If so from whom?
- Do you provide IMT services to organisations other than your own?

It is worth pointing out that some of the questions could be rephrased as follow:

Q7

- Does your hospital cover the population of defined geographical area? Y/N
- What size population does your organisation cover for general, non-specialist services? Y/N
- What size population does your organisation cover for specialist services? Y/N

Q9

- What was your organisations average length of stay in 2011?
    - For elective admissions?
    - For non-elective admissions?
- Consider asking additional activity questions such as outpatient or emergency care attendances or births.

Q12

- How many computer systems do you have in your organisation?
- Maybe also ask what systems there are
- Are these systems all interoperable where this would be operationally useful? Y/N

Q16

- Are these VC facilities easily accessible by clinicians?

Block D

- What acts as a barrier to exchange of information exchange across the healthcare system?
    - Bandwidth
    - IMT system differences
    - Dataset differences etc., – there may be other additional options that should be included.

Block E

- What back-up IMT systems does your organisation have in place?

Block G

Views of workforce

- Has your organisation carried out any surveys of the views of staff on IMT developments? Y/N
- Do you plan to carry out such a survey? Y/N
- Has your organisation carried out any IMT training needs analysis of your workforce? Y/N
- Do you plan to carry out such a survey? Y/N

3.2.5 Spain

3.2.5.1 Background information

Two focus groups were carried out in Andalusia and Catalonia with 5 CIOs from different acute hospitals in each group. During these focus groups overall research strategy; the blocks of the questionnaire and all the items and indicators were presented to the participants. After the presentation all the participants gave feedback on:

- Comments about the research strategy
- Comments about the blocks of the questionnaire
- Comments about the items and indicators

3.2.5.2 Research strategy

Most of the participants emphasised the difficulties to define the meaning of acute hospital within the health system transition, where new typologies of hospitals are emerging. However, acute hospitals (those including Emergency department and Outpatient services) still have a central role in health systems due to their close ties with palliative care or ambulatory care.

CIOs were considered as an appropriate target group as long as barriers, attitudes and impact bias are considered. Moreover, it is worth mentioning that new profiles such as Chief Medical Information Officer are emerging. In addition to that, it was mentioned that CIO may need help to answer Block A and Block G, therefore there is a need to clearly identify who is replying each block to avoid bias

Finally, to guarantee the quality of the responses, in the medium term an audit exercise is needed.

3.2.5.3 Main blocks of the questionnaire and indicators

Participants mentioned that the current eHealth deployment index is mainly focused in medical practice so a block of items related with managerial aspects and IT such as human resources; accounting; facilities; invoicing; purchase should be considered because these applications support medical practice and facilitate eHealth deployment. IT business models were also mentioned as an important issue (software as a service; infrastructure as a service and platform as a service) as well as questions related with IT provision (from in-house to outsourcing). Other characteristics of IT department such as human resources, outsourcing, software, hardware, investment and expenditure are needed (percentage of expenditure within the hospital budget – range 0-1; 1-3; 4-5).

There was a consensus about the importance of including interoperability and standards, both missing in the draft questionnaire. (list of standards such as HL7; SNOMED; DICOM…).

Participants in both groups mentioned the importance of acute hospital characterization and proposed new items such as: number of emergency visits; number of outpatient consultations; number of emergency visit with hospital admission.

Infrastructure dimension was considered appropriate but there is a need to identify more advance infrastructures such as: localization, IP Telephone and mHealth.

Application dimension covered an extensive range of application. However, some remarks were raised:

- PAC is not just related with Radiology but also with other specialities such as Cardiology, Dermatology.
- More functionalities related with support tools could be added such as codification module: analytical tools which allow specialists to research their own data and requests from Intensive Care Unit

Participants mentioned the difficulties to capture Security and privacy dimension due to the legal issues that all hospitals must accomplish. It would be very interesting to identify hospital level of compliance with the legislation.

3.2.5.4 Final Remarks, Lessons Learned and Recommendations

Spanish Nation Health Service is decentralised in seventeen regional health ministries that have primary control over the funding, organization, and delivery of health services with a purchaser provider split within their territory. The focus groups were carried out in two of these regions and in both cases the participants emphasised the importance of having this type of data and benchmarking exercise at a regional level. This analysis would be useful to design Health IT policies.

The research strategy was considered appropriate but attention should be paid to acute hospital and IT department characteristics as well as CIO responses bias. Moreover, interoperability and standards should be included into the questionnaire.

3.3 Validation of the research strategy

The survey target will be Chief Information Officers (CIOs) of acute hospitals. Coverage will reach EU27 Norway, Iceland and Croatia with a total minimum population of 2,000 CIOs (one CIO per acute hospital). Moreover, in order to ensure the representativeness and the transparency of the sample, the following items in the sampling proposal should be addressed :

- Geographical location, using the NUTS classification.
- Size of the hospital
- Ownership

- About the **universe** (European Acute Hospitals) With the organisational changes in hospital care provision, the **definition of acute hospitals** needs to be revisited and further questions are needed for a more accurate characterisation of hospitals leading to a better sampling process.
- About the **target** (at least 2,000 CIO). While the main part of the questionnaire is targeted to CIOs, some of the questions, for example in relation to use, attitudes and impacts, would be very difficult to answer by CIOs. These questions may have to be removed or transformed.
- About the **fieldwork** (mix-methods). All participants emphasised the difficulties to reach and engage CIOs. Different dissemination channels should be designed to maximise the response rate. Care should be taken into account to avoid bias between the different channels.

3.4 Validation of the main blocks of the questionnaire

- All participants considered that these six blocks (plus the acute hospitals characterization block) perfectly cover eHealth deployment. However, some remarks were made about:
    - The overlapping between ICT applications and IT functionalities.
    - The inclusion of IT Governance and IT Strategic plans.
    - The inclusion of standards and interoperability issues.
    - The inclusion of characteristics of the IT department such as budget; human resources; services.
    - The inclusion of questions related with a better characterization of acute hospitals such as: emergency department; type of services provided; number of health professionals; number of departments within the hospital; number of employees
- To avoid bias responses, Impact and Attitudes would be better addressed by health professionals. However the perception of CIOs on these issues is also valuable.
- The IT functionalities group (EHR, HIE, TeleHealth and PHR) have in principle received positive feedback, but was deemed as too complex and in need of further clarification (i.e. dictionary needed) and further training for interviewers

3.5 Validation of the items and indicators

1. Acute Hospital Characteristics Block
    - Clarification of teaching hospital is needed.
    - Add number of beds instead of ranges.
    - Difficulties to identify population covered by the hospital
    - IT department characteristics.
2. Infrastructure Block
    - Clarification of videoconference facilities.
    - Add number of beds instead of ranges
3. Application Block
    - Add collaboration tools between health professionals.
    - Clearly identify distinction between administrative and clinical application
    - Check definitions included in Q20 and Q21.
    - Identify the integration of the application within the hospital.
4. Health Information Exchange Block
    - Identify the integration of HIE within the hospital, adding a new category such as Among several departments
    - Include social care
5. Security and Privacy Block
    - This block should be improved by enhancing with questions from 2010 questionnaire

6. IT functionalities Block
    - Improve the lay out of the questionnaire (Availability and Usage)
    - One more category is needed between fully implemented and just one department (all, most, some, none).
    - Include questions about data codification.
    - Add clinical pathways and protocols
    - Q26 radiology images and report
    - Q28 push and pull real time DSS

To note also that the desired ideal target to obtain information on the actual use of ICT in hospitals eHealth measurement surveys was also debated. Several participants (Agfa Health Care, Cisco, EFN, University of Portsmouth, Empirica) raised the issue that hospital medical staff (e.g. doctors, nurses) ought to be targeted for this purpose. In fact Empirica had already recommended this action (in the conclusions of the 'eHealth Benchmarking phase II project) and as a result a survey of GPs was planned and launched and is currently under way – although this targets GPs in general and not Hospital medical staff. The workshop experts pointed out and argued that not only for their work and activities but most urgently for supporting policy and strategy development at European and national levels, it would desirable for the EC to ultimately address this issue in addition to the CIO survey currently planned.

4. Lessons learned: new questionnaire and next steps

As a result of the process described in Section 3, eHealth Benchmarking IV methodological set up the following steps to be taken:

- July - Sep 2012 → Methodological set up including validated questionnaire
- Oct – Dec 2012 → Fieldwork
- Jan – Feb 2013 → Data analysis
- Mar - April 2013 →Preliminary results and Validation workshop
- May 2013 → Final report

Moreover, the following questionnaire has been developed:

BLOCK A. CHARACTERISATION		
Q1*	**What is your current position in the hospital? (Only one answer possible)**	
	1	Chief information officer
	2	ICT manager/director
	3	Chief operational officer (COO)/ Operation Manager
	4	Other: specify
Hospital characterization		
Q2*	**Is this hospital…? (Only one answer possible)**	
	1	Public
	2	Private for profit
	3	Private not for profit
	4	Other: specify
Q3*	**And is this hospital …? (Only one answer possible)**	
	1	An independent hospital on one site
	2	An independent hospital on multiple sites
	3	Part of a group of different hospitals
	4	Part of a group of care institutions
	5	Other: specify
Q4*	**Is this hospital a university hospital? (Only one answer possible)** IF CODE 2 IN Q4: ASK Q5	
	1	Yes
	2	No
Q5*	**Is this hospital a non-university teaching hospital? (Only one answer possible)**	
	1	Yes
	2	No
Q6*	**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
Q7	**Total number of full time employees**	
	Number _____	
Q8	**Total number of full time physicians**	
	Number _____	
Q9	**Total number of full time nurses**	
	Number _____	
Q10	**How many inhabitants are covered by this hospital?**	
	Number _____	
Q11	**Number of hospital discharge during 2011**	
	Number _____	
Q12	**Average length of stay in this hospital during 2011**	
	Number _____	
Q13	**Number of emergency visits during 2011**	
	Number _____	
Q14	**Number of outpatients consultations during 2011**	
	Number _____	
Q15	**Number of Computed Axial Tomography scanners (CAT scanners)**	
	Number _____	
Q16	**Number of Magnetic Resonance Imaging Units (MRI units)**	
	Number _____	
IT Department Characteristics		
Q17	**Number of full time employees in IT Department**	
	Number _____	
Q18	**IT Budget**	
	1	Less than 1% of total Hospital's budget
	2	Between 1%-3% of total Hospital's budget

	3	Between 3,1%-5% of total Hospital's budget
	4	More than 5% of total Hospital's budget
Q19	**Does your IT Department have an IT Strategic Plan**	
	1	Yes
	2	No
	3	Don't know
Q20	**Does your Hospital receive any financial incentives from health plans and other organizations that are tied to the types of information technology systems (e.g., electronic health records or electronic prescribing systems) it adopts?**	
	1	Yes
	2	No
	3	Don't know

BLOCK B. ICT infrastructure		
Q21*	**Do you have a computer system in your hospital?**	
	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
Q22*	**Is your hospital computer system externally connected…?**	
	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
Q23*	**What type of Internet connection does your hospital have?**	
	1	Narrowband (Dial-up/PSTN) ISDN (128 kbit/smax)
	2	Broadband (below 30 MBps)
	3	Broadband (from 30 MBps to 49 MBps)
	4	Broadband (from 50 MBps to 100MBps)
	5	Broadband (above 100 MBps)
	6	No Internet connection (DO NOT READ)
Q24*	**How does your hospital support wireless communications?**	
	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
Q25*	**Does your hospital have videoconferencing facilities?**	
	1	Yes
	2	No

BLOCK C. ICT Applications		
Q26*	**Which type of Electronic Medical Records (EMRs) / Electronic Health Records (EHRs) / Electronic Patient Records (EPRs) does your hospital mainly use? By this type of application I mean a computer-based patient record system which contains patient-centric, electronically-maintained information about an individual's health status and care .**	
	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
Q27*	**Do patients have online access to their electronic patient records?**	
	1	Yes, to everything
	2	Yes, but only to certain data (e.g. results and protocols)
	3	No
Q28*	**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**	
	1	Yes
	2	No
Q29*	**Which of the following computerised systems has the hospital integrated?**	
	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 let 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 form 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.
Q30*	**Does the hospital have the following computer-based system or applications…**	
	1	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.

	2	An electronic transmission of results of clinical tests? (e.g. laboratory results)
	3	An electronic service order placing? (e.g. test/diagnostic results)?
	4	An electronic appointment booking system?
	5	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.

BLOCK D. Health Information Exchange		
Q31*	**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?**	
	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
Q32*	**Does your hospital exchange electronically laboratory results information about patients with any of the following providers?**	
	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
Q33*	**Does your hospital exchange electronically medication lists information about patients with any of the following providers?**	
	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
Q34*	**Does your hospital exchange electronically radiology reports about patients with any of the following providers?**	
	1	1 With a hospital or hospitals outside your own hospital system
	2	2 External general practitioners
	3	3 External specialists
	4	4 Health care providers in other EU countries
	5	5 Health care providers outside the EU countries
	6	6 None

BLOCK E. Security and privacy		
Q35*	**Is there any regulation in use that guarantees the security and privacy of electronic patient medical data?**	
	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
Q36*	**Which of the following security measures are taken to protect the patient data stored and transmitted by the hospital's IT system?**	
	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
Q37	**Are there clear structured rules on accessing (reading-writing) patients' electronic medical data?**	
	1	Yes
	2	No
	3	Don't know
Q38	**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.**	
	1	Yes
	2	No
	3	Don't know
Q39	**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".**	

	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

BLOCK F. IT functionalities						
Q40	**"Electronic Medical Records" (EMRs) or "Electronic Health Records" (EHRs) or "Electronic Patient Records" (EPRs) are terms which refer to systems that are used by healthcare professionals (doctors and nurses) to enter, store, view, and manage patient health and administrative information and data. Does your office have this type of ICT-supported systems?**					
	1. Yes 2. No 3. I don't know					
Q41	**What type of information does your EHR or any other ICT system is implemented to allow health professionals to view and/or to input? And to what extent do they use such functionalities?** **Please indicate the extent to which they are implemented (fully implemented means it has completely replaced paper record for the function) in your hospital and the extent to which health professionals use them** If a feature is D, E or F skip the related "usage" question					
	AVAILABILITY					
	(A) Fully Implemented Across All Units	(B) Fully Implemented in at least 75% of units	(B) Fully implemented in at least 25% of units	(C) Beginning to Implement	(D) Not in Place and Considering Implementing	(E) Not in Place and not Considering Implementing
	USAGE					
	YES, routinely		YES, occasionally	No	DK/NA	
	1	Allergies				
	2	Vital signs				
	3	Problem list / diagnoses				
	4	Medication list				
	5	Immunizations				
	6	Medical history				
	7	Patient demographics				
	8	Lab test results				
	9	Radiology test reports				
	10	Radiology test images				
	11	Symptoms (reported by patient)				
	12	Reason for encounter				

	13	Clinical notes
	14	Prescriptions / medications
	15	Ordered tests
	16	Create/update disease management/ care plan (e.g., diabetes)
	17	Finances / billing

Q42	**Does your EHR or any other ICT system have any of the clinical decision support functionalities listed below (such as real-time alerts or prompts) and to what extent you use them?** **Please indicate the extent to which they are implemented (fully implemented means it has completely replaced paper record for the function) in your hospital and the extent to which health professionals use them** If a feature is D, E or F skip the related "usage" question

	AVAILABILITY					
	(A) Fully Implemented Across All Units	(B) Fully Implemented in at least 75% of units	(C) Fully implemented in at least 25% of units	(D) Beginning to Implement	(E) Not in Place and Considering Implementing	(F) Not in Place and not Considering Implementing

	USAGE			
	YES, routinely	YES, occasionally	No	DK/NA

	1	Clinical guidelines and best practices (e.g., alerts, prompts)
	2	Drug-drug interactions
	3	Drug-allergy alerts
	4	Drug-lab interactions
	5	Contraindications (e.g., based on age, gender, pregnancy status)
	6	Be alerted to a critical laboratory value
	7	Provide preventive care

Q43	**Health Information Exchange (HIE) is electronically transferring / sharing / enabling access to patient health information and data. Do the ICT systems in place in your hospital allow health professionals to engage into any of the following forms of HIE? And to what extent do they use such functionalities?** **Please indicate the extent to which they are implemented (fully implemented means it has completely replaced paper record for the function) in your hospital and the extent to which health professionals use them.** If a feature is D, E or F skip the related "usage" question

	AVAILABILITY					
	(A) Fully Implemented Across All Units	(B) Fully Implemented in at least 75% of units	(C) Fully implemented in at least 25% of units	(D) Beginning to Implement	(E) Not in Place and Considering Implementing	(F) Not in Place and not Considering Implementing

	USAGE			
	YES, routinely	YES, occasionally	No	DK/NA

	1	Interact with patients by email about health-related issues
	2	Make appointments at other care providers on your patients' behalf
	3	Send/receive referral and discharge letters
	4	Order supplies for your practice
	5	Transfer prescriptions to pharmacists
	6	Exchange medical patient data with other healthcare providers and professionals?
	7	Receive laboratory reports
	8	Receive and send laboratory reports and share them with other healthcare professionals/providers
	9	Exchange patient medication lists with other healthcare professionals / providers
	10	Exchange radiology reports with other healthcare professionals / providers"
	11	Exchange medical patient data with any healthcare provider in other countries
	12	Certify sick leaves
	13	Certify disabilities

Q44	**This is a question about "telehealth" which is the use of broadband-enabled information and communication technology to deliver health services, medical education, and health education remotely. It includes both clinical elements of the health care system such as remote consultations with patients and remote monitoring of their vital signs and health status, and non-clinical elements such as remote training.** **Please indicate the extent to which they are implemented in your hospital and the extent to which health professionals use them.** If a feature is D, E or F skip the related "usage" question					
	AVAILABILITY					
	(A) Fully Implemented Across All Units	(B) Fully Implemented in at least 75% of units	(C) Fully implemented in at least 25% of units	(D) Beginning to Implement	(E) Not in Place and Considering Implementing	(F) Not in Place and not Considering Implementing
	USAGE					
	YES, routinely	YES, occasionally	No	DK/NA		
	1	Training				
	2	Holding consultations with other healthcare practitioners				
	3	Holding consultations with patients				
	4	Monitoring patients remotely (at their homes)				
Q45	**You said that you provide telemonitoring services to patients at their homes. How is the services is paid for?**					
	1	I provide the services as part of my mandate and contract obligations (no additional payment / funding is required)				
	2	The service is fully reimbursed by the national health system				
	3	The service is fully reimbursed by social insurance fund				
	4	The service is provided only for patients with a private insurance coverage				
	5	The service is partially reimbursed (by national health system or social health insurance or private insurance) and partially paid by patients				
	6	The services is entirely paid by the patients and is not reimbursed				
	7	Other (please specify):……				
	8	I don't know				

Q46	**"Personal Health Records" (PHRs) are electronic systems allowing patients to have secure access to, and manage, their health information. Does your system allow you to provide patients with some form of online access to their data?**					
	1. Yes 2. No 3. I don't know					
Q47	**Does the Personal Health Records (PHR) system or any other ICT system in your office allow patients to do any of the following tasks and, if so, do patients actually use it online?** **Please indicate the extent to which they are implemented in your hospital and the extent to which health professionals use them. If a feature is C, D or E skip the related "usage" question** If a feature is D, E or F skip the related "usage" question					
	AVAILABILITY					
	(A) Fully Implemented Across All Units	(B) Fully Implemented in at least 75% of units	(C) Fully implemented in at least 25% of units	(D) Beginning to Implement	(E) Not in Place and Considering Implementing	(F) Not in Place and not Considering Implementing
	USAGE					
	YES, routinely		YES, occasionally	No	DK/NA	
	1	Request referrals				
	2	Request appointments				
	3	Request renewals or prescriptions				
	4	View their medical records				
	5	Supplement their medical records				
	6	View test results use				

BLOCK G. Barriers and Impact						
Q48	**Please tell me whether you agree strongly, agree somewhat, disagree somewhat or disagree strongly with the following barriers related to the implementation and utilisation of IT systems by health professionals in your hospital.**					
	Totally Agree		**Somewhat Agree**	**Somewhat Disagree**	**Totally Disagree**	**DK/NA**
	1	Lack of financial incentives				
	2	Lack of financial resources				
	3	Lack of access to the technology				
	4	Lack of technical support				
	5	Lack of inter-operability and standards				
	6	Lack of sufficient resilience (ICT systems can fail)				
	7	Lack of sufficient security and risk control				
	8	Lack of framework (regulatory, legislative, ethical) on confidentiality and privacy issues				
	9	Lack of time / additional workload				
	10	Lack of sufficient ICT skills on the side of healthcare professionals				
	11	Lack of sufficient training for healthcare professional				
	12	Lack of clear motivation to use ICT (not clear its usefulness)				
	13	Increased patients expectation				
	14	Lack of framework on using e-mail between doctors and patients (i.e. standards for response time)				
	15	Lack of remuneration for additional work answering patients' e-mails				
	16	Difficult to use				

Q49	As a result of IT implementation and use does your hospital identify and/or prove any of the following impacts?				
	Totally Agree	Somewhat Agree	Somewhat Disagree	Totally Disagree	DK/NA
	1	Reduce medical errors			
	2	Improvement in the quality of diagnosis decisions			
	3	Improvement in the quality of treatment			
	4	Enhance self-evaluation			
	5	More data for clinical research and public health			
	6	Facilitate patients' education and adherence to prescriptions			
	7	Improvement in patients' satisfaction			
	8	Increased patients' access to healthcare (i.e. booking online appointment, viewing their data)			
	9	Avoid unnecessary tests and duplications			
	10	Increase average number of patients receiving help during one day			
	11	Reduce pharmaceutical expenditure			
	12	Shorter waiting lists			
	13	Allow more efficient consultations			
	14	Improvement in coordination between the different levels of the health system			
	15	Expedite workflow due to the availability of patients clinical data			
	16	Improvement in the efficiency of the whole health system			

Q50	To what extent do you agree or disagree with the following statements about the introduction of innovation supported by IT systems (i.e. EHR, or related) in your hospital?				
	Totally Agree	**Somewhat Agree**	**Somewhat Disagree**	**Totally Disagree**	**DK/NA**
	1	Innovation is a priority in my hospital			
	2	Innovation is well embedded in key plans of my hospital			
	3	I'm aware of my practice/ health centre overall approach to innovation			
	4	The approach of my hospital to foster innovation is appropriate			
	5	My hospital dedicates sufficient resources to innovation			
	6	Foster innovation improves quality of care			
	7	Foster innovation improves efficiency			

Q51	The implementation of IT systems within the Hospitals allows the transition from paper-based systems to a fully electronically-based systems. Please select what is the position of your hospital in this transition
	1 Totally paper based
	2
	3
	4
	5 Hybrid model
	6
	7
	8
	9
	10 Totally electronically-based

5. New survey procedure

5.1 The new universe and sampling estimation

The methodology utilised to define the appropriate sample in each of the 30 countries being surveyed has followed a four step approach:

1. Estimation of the overall universe;
2. Implementation of a census strategy;
3. Determination of sample approach per country;
4. Calculation of error margins and confidence intervals.

The following paragraphs will describe each of the steps, highlighting the advantages and the shortcomings related to their implementation.

5.1.1 Estimation of the overall universe

To estimate the overall universe, a number of sources were consulted and analysed. The starting point was the sources provided in the previous version of the eHealth survey from 2010. The sources for each individual country were provided within the overall universe of 12,230 hospitals.

Therefore, the first step for the 2012 version of the study was to update the estimated universe by initially validating the sources used in the previous study. This validation demonstrated that while many of the sources were no longer available or accessible, others used commercial list brokers, which could not be considered reliable for the definition of any universe.

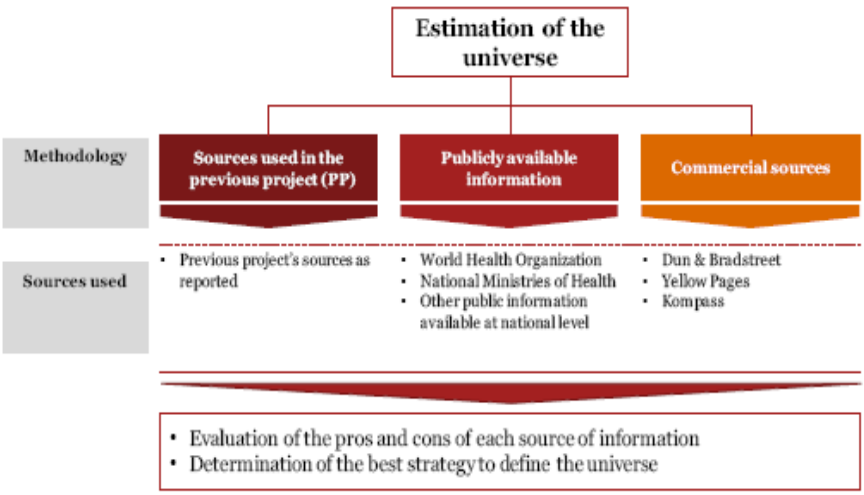
In addition, two other major sources were consulted during the validation process:

- The list of hospitals from WHO for the selected 30 countries;
- National Ministry of Health of each country.

In our analysis, we found out that the list of National Ministries of Health was better updated than those of the WHO. As a consequence, these lists were most suitable to be used as reference for the universe estimation.

Figure 8 below illustrates the process for defining the universe.

Figure 8 - Estimation of the acute care hospitals universe



The established universe according to this analysis led to 8,199 acute care hospitals. As for the definition of "acute care hospital" it differs according to the country. In order to have a homogeneous definition across EU27+3, all the hospitals have been screened during the census phase.

5.2 Implementation of a census strategy

5.2.1 Rationale

The validation of the sources of the previous study demonstrated that the previously estimated universe of 12,230 acute hospitals was not based on official/reliable statistical information. Due to this reason, a census strategy was proposed as the best approach for estimating the universe and collecting the data.

The census has been recognized as one of the most viable methods to ensure that we reach every entity within the universe. Moreover, it is also the best way to implement a proportional sampling methodology that requires the knowledge of the following elements: distribution of bed size, ownership and region at NUTS 24 level.

5.2.2 Methodology

The census methodology consists in contacting absolutely every hospital in each country within the universe. All entities contacted during the census will be asked for ownership and size, whether it is an acute hospital according to the agreed definition. Their postal code will also be recorded so the region can be defined.

The census methodology can be described as follows:

1. Define and select hospitals (not only acute) through commercial sources, official listings and business directories, such as Yellow pages, Dun & Bradstreet, hospital guides and the PwC network;
2. Dedupe sample based on phone number and addresses to avoid calling the same entities more than once;
3. Screen visually, where a native speaker goes through the whole list;
4. Stratify on a country level.

As a consequence, the census will reveal the correct distribution of size class and ownership per country and region as well as information not obtainable for all countries from reliable sources prior to fieldwork. In addition, this can be used for future surveys as reliable reference. Also, non-response rate corrections at the end of data collection will guarantee representativeness.

5.2.3 Determination of the sample approach per country

Although every hospital within each country has been contacted, we have defined the universe and the sample approach per country for the purpose of this report, based on the estimation of the universe of 8,199 acute care hospitals, as explained previously. It is important to note, however, that sample values will be recalculated after the actual universe number per country has been unveiled by our census strategy.
Therefore, based on the established universe of 8,199 acute care hospitals, a sample of 1232 was calculated when considering a response rate of 15%, whereas a sample of 1681 was calculated with a response rate of 20%.

5.2.4 Stratification process

51 Countries were divided in 4 different clusters that took into consideration the geographical representation:

1) **Cluster A:** France, Germany, UK, Netherlands, Ireland, Belgium, Austria, Luxembourg;

2) **Cluster B:** Italy, Portugal, Spain, Greece, Malta, Cyprus;

3) **Cluster C:** Iceland, Sweden, Norway, Finland, Denmark, Estonia, Latvia, Lithuania;

4) **Cluster D:** Poland, Bulgaria, Hungary, Romania, Slovakia, Slovenia, Croatia, Czech Republic.

This cluster division aimed at having the representativeness of the countries per geographic area, such as Western Europe, Southern Europe, Nordic countries, Central and Eastern Europe[28].

In addition to the cluster, the following elements are envisaged to be part of the stratification of the sample:

- Location (Country, NUTS2 classification)
- Ownership (Public, private, other)
- Size class (number of beds)
- Acute hospital (according to the definition in the questionnaire).

The process followed to stratify the sample per country is made of four steps:

1. Call all hospitals within a country and ask them whether they are acute or not (based on screener criteria). Acute care hospitals are defined as follows:
    a. Respondents considers that the hospital is an acute or general hospital; and/or
    b. The hospital has an emergency department, plus a routine and/or life-saving surgery operating room and/or an intensive care unit;
2. Ask the number of beds;
3. Ask the ownership (public vs. Private);
4. Record the postal code.

5.3 Calculation of error margins and confidence intervals

For the countries in each of the clusters, an initial sample figure was calculated as well as the related error margins. Table 3 shows the sampling and error margins per country.

These error margins represent a measure of the variability of estimates due to sampling error and so enable data users to measure the range of uncertainty around each estimate. Two error margins were calculated for each country, based on answer characteristics of 30% and 50% (corresponding to different assumed levels of accuracy or, in other words, sampling errors).

The confidence interval is instead corresponding to the range of values of sample observations that contain the true parameter (here, the sample figure) value within a given probability of 95%.

[28] However, once the census is finished and the actual universe defined, these 4 clusters may be modified according to the actual needs.

Table 3 - Sampling and error margins per country

Cluster	Country	Population	Sample	Error margin finding 30%	Error margin finding 50%
A	France	1513	303	4	5
	Germany	2064	413	4	4
	UK	187	37	12	13
	Netherlands	105	21	16	17
	Ireland	50	12	20	22
	Belgium	141	28	14	15
	Austria	177	35	12	13
	Luxembourg	6	1	90	98
Sub-total Cluster A		**4243**	**850**	**2**	**3**
B	Italy	1093	219	5	5
	Portugal	104	26	13	15
	Spain	494	98	7	8
	Greece	313	63	9	10
	Malta	5	1	90	98
	Cyprus	33	7	28	30
Sub-total Cluster B		**2040**	**414**	**4**	**4**
C	Iceland	2	1	90	98
	Sweden	60	19	14	15
	Norway	27	9	21	23
	Finland	51	16	15	17
	Denmark	21	7	25	27
	Estonia	19	6	26	28
	Latvia	22	7	24	26
	Lithuania	62	20	14	15
Sub-total Cluster C		**264**	**85**	**7**	**7**
D	Poland	540	108	7	8
	Bulgaria	267	53	10	11
	Hungary	117	23	15	17
	Romania	394	79	8	9
	Slovakia	118	24	15	16
	Slovenia	30	7	27	29
	Croatia	27	6	30	32
	Czech Republic	159	32	13	14
Sub-total Cluster D		**1652**	**332**	**4**	**4**

5.4 Adaptation of the approach

The sample approach and the error margin calculation needed to be adapted for several countries.

Particularly, the following adaptations need to be undertaken when necessary:

- Revise the final universe of acute hospitals after the census. However, the sample size will ultimately depend on the response rate, meaning the number of completed interviews in regards to the universe.
- The sample approach and error margin calculation need to be adapted per country

As for the sample size, based on survey experience with comparable studies, 15-20% of the available universe is expected to be sampled. However, we need to distinguish between larger and medium-smaller countries:

- Sample size for larger countries: France, Germany and Italy all have more than 1,000 hospitals in the universe; we will set a maximum of 300 interviews for those countries at the start of fieldwork to avoid oversampling for those countries in the beginning;
- Sample size for medium and smaller countries: increased focus on efforts in the fieldwork period on countries with smaller universe to increase sample size/response rate and therefore representativeness.
- Error margins and confidence levels for the sampling will be recalculated based on the final size of the universe from the census results. Moreover, error margins will be calculated at individual cluster, country and regional level, based on a confidence interval of 95%.

6. Questionnaire development

The design of the questionnaire was based on a mix of sources: the previous study provided the overall framework of questions, to ensure continuity of analysis. Advice from a steering group composed of the project team (PwC and GDCC) and IPTS was also taken into account for the updated version. Some of the questions were also aligned with the OECD.

Several versions of the questionnaire were developed, in order to fulfil with several problems that have arised during the pilot phase.

The first version of the questionnaire has been finalized 18 September. Here are the main steps followed to pass from the first to the last version of the questionnaire[29]:

Version 2

- Increase precision of the screening question S1
- Deletion of two questions in block A, and modification of questions Q26 in order to decrease questionnaire length.
- Minor adjustments (rephrasing, modification to question wording, reorganization) were done to questions Q41, Q42, Q43, Q43 and Q44

Version 3

- Addition of possible answers in S1 to increase the response rate
- Addition of possible answers in Q27 and Q34 in order to obtain more detailed information on hospitals
- Addition of question S6 (to get more detailed information) and Q14 (to obtain more information on hospitals)
- Reorganization of question Q45

Version 4

- Reorganization of questions Q14 (better view on IT budget use and decrease questionnaire length) and Q22 (get more detailed information on outsourcing of activities)
- Rephrasing questions Q25 and Q44 in order to increase precision, and a question in block G
- Adding of condition to ask question Q32 (better questionnaire flow)
- Change of question Q33 (increase quality of questions)

Version 5

- Question Q33 has been moved after in order to guarantee a better questionnaire flow

Version 6

- Modification of the screening criteria (question S2b)

[29] The question numbering refers to the last version of the questionnaire.

- In order to enhance respondent flexibility, question Q45 has been reorganized. Multiple answers possible per line have been allowed, and the column "don't know" has been removed.

Version 7

- A condition after question Q44 has been added, in order to allow for a better questionnaire flow

Version 8

- Change in the screening criteria (add the option "none of the above", in order to increase the response rate)

Version 9

- Questions Q41, Q42, Q43 and Q44 have been simplified in order to decrease the questionnaire length

Version 10

- Screening questions have been reorganized in order to increase the response rate
- Addition of questions Q2a and Q2b
- Increase of the flexibility of answers in questions Q6, Q7 and Q8.

Version 11

- Condition removed for question Q34
- Conditions adjusted for questions Q41, Q42, Q43 and Q44

Version 12

- Answer added for questions Q26 and Q27 (minor adjustment to facilitate interview flow)

Version 13

- Deletion of two questions in block B in order to decrease the questionnaire length
- Deletion of two questions in block F in order to decrease the questionnaire length
- Question in block F moved to block D in order to get a better questionnaire flow

Version 14

- Modification of screening criteria to increase the response rate
- Deletion of question in screener to increase the response rate
- Deletion of condition after question Q8 in order to get more detailed information
- Re-insertion and simplification of question Q26 in order to increase the relevance of the information requested and to decrease the questionnaire length
- Deletion of one question in block B
- Deletion of block G (3 questions have been deleted, Q33 has been moved to block D and Q45 has been moved to block F)

Version 15 (pilot)

- Deletion of one question in block D in order to decrease the length of the questionnaire

Version 16

- Increase the precision in the wording of question Q9
- Questions Q46, Q47, Q48 and Q49 have been moved to the end (block G)
- Improvement of the flexibility in questions Q10, Q11, Q18, Q28, Q29, Q30 and Q31.
- Increase the precision of wording in answers of questions Q36 and Q40
- Questions Q22, Q41, Q42, Q43 and Q44 have been reorganized

7. The first field pilots

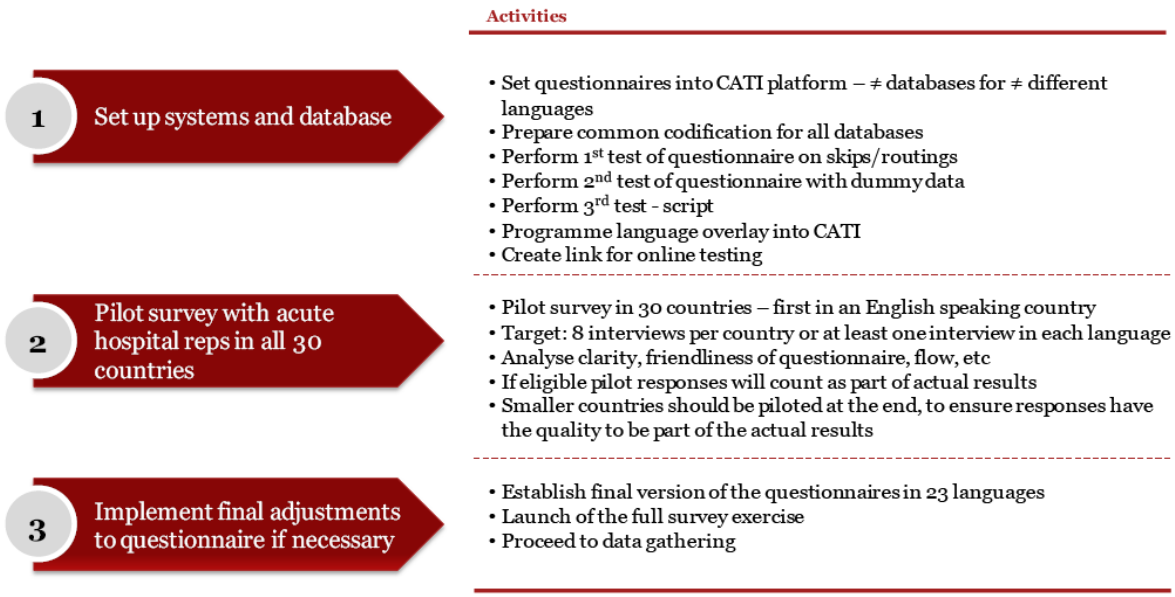
7.1 Process used to carry out the pilot interviews

The draft questionnaire (English version) was ready on Monday 24 September 2012 (version 6) which was programmed in a Computer Assisted Telephonic Interviewing (CATI) application. Translations were initiated on 26 September 2012. The sample was acquired from the Yellow Pages, commercial sources, i.e. Dun & Bradstreet, online database and official sources and listings. In total 24,613 hospital numbers were uploaded in the system.

After completion of the programming and test link approval, translations were uploaded into the CATI application. The pilot phase started on the 2 October 2012 for English, followed by the other languages on the 4 October 2012. Calling started at 8.30am each day until 5pm (excluding following appointments made with respondents outside these hours[30]. 73 The translations have been adapted several times, due to numerous changes in the questionnaire. All were cross-checked by a native speaker once adapted.

Figure 9 below presents an overview of the pilot process.

Figure 9 - Process for pilot interviews



7.2 Pilot statistics

122 interviews have been conducted during the period of 2 October to 22 October 2012. Responses varied for the different countries. Some countries such as Bulgaria, Poland, Italy, Hungary and Spain presented a very good rate of response, and a large number of interviews were achieved. In some cases it was easy to book appointments and call CIOs at a convenient time for them. Therefore, to take advantage of CIOs willingness to collaborate to the survey, interviews were conducted even if they were above pilot targets.

In the case of Belgium, Cyprus, Denmark, France, Iceland, Malta, Norway, Slovenia and UK no interviews were achieved yet. Reasons for this are either a small number of hospitals (e.g. Malta,

[30] There is the possibility to accommodate calling before and after the stated dialling hours.

Cyprus, Iceland, Norway) or respondents did not have time to answer the questionnaire during the period (e.g. France, UK). However, a number of floating or fixed appointments have been made.

As for the language coverage, all languages except Slovenian, Norwegian and Danish have been covered. For these languages, pilot interviews are planned between 25 October and 30 October 2012.

In order to make the phone calls during the pilot phase a database with 24,663 records was utilised, and so far 122 complete interviews were achieved. A large number of contacts did not meet screener criteria (1,784) due to the fact that the database does not include only acute hospitals, but a number of other medical institutions that do not classify as acute. A high number of refusals was also encountered, as well as a large number of unusable numbers.

The calls were made based on the following number of records per country present in the database. The census strategy will be applied on these numbers of records.

Table 4 - Average length interview per country

Country	Records	Country	Records
Austria	241	Italy	2,517
Belgium	433	Latvia	138
Bulgaria	388	Lithuania	219
Croatia	75	Luxembourg	5
Cyprus	30	Malta	10
Czech Republic	470	Netherlands	609
Denmark	271	Norway	100
Estonia	109	Poland	2,509
Finland	620	Portugal	149
France	7,649	Romania	549
Germany	3,846	Slovenia	186
Greece	290	Slovakia	391
Hungary	492	Spain	676
Iceland	14	Sweden	246
Ireland	492	United Kingdom	889
Total: 24,613			

The expected duration of the interview has been 30 – 35 minutes. During the first few days of piloting the average duration of the interviews was over an hour. This issue was raised with IPTS and some of the questions were cut and reformulated. There was some improvement in the average length to around 50 minutes. However this is still a long duration, which brings risks of drop out or respondent fatigue.

In the following sections some issues and potential risks that were identified during the pilot interviews have been highlighted, as well as some suggestions to reducing the duration of the interviews.

As for the interview duration, it was much longer than the expected 30 – 35 minutes. During the first few days of piloting the average duration of the interviews was over an hour. This issue was raised with IPTS and some of the questions were cut and reformulated. There was some improvement in the average length to around 50 minutes. However this is still a long duration, which brings risks of drop out or respondent fatigue.

Interview duration varies per country, without a specific pattern. Czech Republic was the country with the quickest average interview time (39:12), whilst Greece, followed by Finland, are the countries where it takes longer to complete an interview.

Table 5 below shows the average interview length per country

Table 5 – Average interview length per country

Country	Completes	Average length in minutes	Country	Completes	Average length in minutes
Austria	1	40:17	**Italy**	14	54:43
Belgium	*0*	*n/a*	**Latvia**	3	*n/a*
Bulgaria	22	63:23	**Lithuania**	4	58:07
Croatia	1	50:14	**Luxembourg**	1	60:00
Cyprus	0	*n/a*	**Malta**	*0*	*n/a*
Czech Republic	3	39:12	**Netherlands**	1	51:40
Denmark	*0*	*n/a*	**Norway**	*0*	*n/a*
Estonia	3	56:53	**Poland**	29	41:52
Finland	5	70:44	**Portugal**	3	52:50
France	*0*	*n/a*	**Romania**	2	53:59
Germany	2	48:54	**Slovenia**	*0*	*n/a*
Greece	1	99:09	**Slovakia**	7	56:29
Hungary	8	47:49	**Spain**	8	44:34
Iceland	*0*	*n/a*	**Sweden**	2	62:40
Ireland	2	48:33	**United Kingdom**	*0*	*n/a*

Table 6 below illustrates the sample performance per country.

Table 6 - Sample performance per country

Country	Records	Completes	Finished numbers[9]	Screenouts	Incidence rate[10]	Burn rate[11]
Austria	241	1	5	3	25,0%	5
Belgium	433	0	28	7	0,0%	-
Bulgaria	388	22	94	34	38,6%	4
Croatia	75	1	14	7	12,5%	14
Cyprus	30	0	6	5	0,0%	-
Czech Republic	470	3	154	73	3,7%	51
Denmark	271	0	19	4	0,0%	-
Estonia	109	3	43	26	10,3%	14
Finland	620	5	339	242	2,0%	68
France	7,649	0	81	34	0,0%	-
Germany	3,846	2	261	102	1,9%	131
Greece	290	1	29	14	6,3%	29
Hungary	492	8	123	75	9,5%	15
Iceland	14	0	0	0	-	-
Ireland	492	2	18	13	13,3%	9
Italy	2,517	14	699	249	5,3%	50
Latvia	138	3	43	5	37,5%	14
Lithuania	219	4	104	37	7,5%	26
Luxembourg	5	1	0	0	100,0%	0
Malta	10	0	0	0	-	-
Netherlands	609	1	73	37	2,6%	73
Norway	100	0	20	7	0,0%	-
Poland	2,509	29	496	189	13,2%	17
Portugal	149	3	44	8	27,3%	15
Romania	549	2	383	314	0,6%	192
Slovenia	186	0	54	48	0,0%	-
Slovakia	391	7	113	43	14,0%	16
Spain	676	8	157	53	11,6%	20
Sweden	246	2	47	15	9,1%	24
United Kingdom	889	0	55	31	0,0%	-
Total	**24,613**	**122**	**3,502**	**1,675**	**6,8%**	**29**

Table 7 shows the average interview length per block of the questionnaire.

Table 7 - Average interview length per block of the questionnaire

Block A-E	Block F	Block G	Q25-28
34 minutes	19 minutes	14 minutes	6 minutes

As for the time of the day where the incidence of interviews is higher, it is between 2pm and 3pm. The morning hours, between 10 and 12 are also favourable.

Progressing during the pilot phase, higher incidence rates were obtained because of an improvement of the screener utilised in the first days, familiarity of the callers with the survey and repeated attempts to achieve the acute care hospitals, including appointments booked.

7.3 Issues and potential risk identified during the pilot interviews

In the beginning of the fieldwork two main problems have arisen:

- a big difference between the expected and actual incidence rate. This is related to the screener questions[31].
- The interview duration was much longer than the expected 30 – 35 minutes. The first interviews took between 48 and 70 minutes.

Since call centre agents have to stick closely to the script (in regards to comparability of answers and exclusion of interviewer bias), there was immediate need for changes especially for the questions related to the screening part. In a call on Tuesday 9 October 2012, problems were discussed together with GDCC, PwC and IPTS.

Question S1 and S2 were exchanged in order and an additional question was added (S2a)

Table 8 summarize the issues and risks that have been encountered during the pilot phase of the survey. Indeed, thy can be classified in three categories:

- Wording of the question or the answers: identified misunderstandings or requests for details by the interviewee;
- Inability to answer: respondents did not have the answer, searched in their files in their computer or called their colleagues. These issues largely impacted the length of the questionnaire;
- Structuring of the questionnaire: improvements that could be brought to the questionnaire to ensure a better flow of the questions during the interview.

Table 8 - Issues and potential risks identified

Question number	Question	Type of issue	Comment	Solutions
S1	Does this organisation have...?	Wording	Screener questions seem to pose no problem anymore. GDCC listens to EVERY screener and monitors the answers given in combination of those questions.	No solution needed
S2a	And is this organisation an acute or general hospital?	Wording		
S2b	So, is this organisation mainly... ?	Wording		
Q1	What is your current position in the hospital?	Wording	54% of all respondents classify themselves under "other specify".	Recode/categorize at the end of fieldwork
Q6	Total number of full time employees and/or in FTE (Full-time equivalent)	Inability to answer	Respondents give approximate numbers or are not able to answer.	IPTS to accept uncertainty
Q7	Total number of full time physicians and/or in FTE (Full-time equivalent)			
Q8	Total number of full time nurses and/or in FTE (Full-time equivalent)			
Q9	What is the catchment area of this hospital?	Wording	In some languages the translation to catchment area may not be well understood. The definition provided in the glossary solves the issue	Add instruction: "in number of inhabitants".

[31] The problems for the screener questions were found during the first calls. This was immediately reported to IPTS on Friday 5 October 2012.

Question number	Question	Type of issue	Comment	Solutions
		Inability to answer	Some physicians need time to answer (not able to answer or need to consult another colleague). The Medical Direction department would be able to answer	Add option "Don't know"
Q10	Number of hospital discharge during 2011 (or latest data available)	Inability to answer	Some physicians need time to answer (not able to answer or need to consult another colleague). The Medical Direction department would be able to answer	• Add option "Don't know" • Place this at the end of the questionnaire • Allow to be answered by another department, if proposed • Look at different sources (if available)
Q11	Average length of stay in days in this hospital during 2011 (or latest data available)	Inability to answer		
Q12	Number of emergency visits during 2011 (or latest data available)	Inability to answer		
Q13	Number of outpatient consultations during 2011 (or latest data available)	Inability to answer		
Q14	Number of Computed Axial Tomography scanners (CAT scanners)	Inability to answer	Some physicians need time to answer (not able to answer or need to consult another colleague). The Medical Direction department would be able to answer	Add option "Don't know"
Q15	Number of Magnetic Resonance Imaging Units (MRI units)	Inability to answer		
Q22	Is your hospital computer system externally connected…?	Wording	Difficulties to understand answers Q22.1 "extranet" and Q22.2 "value added network"	Add definition in the glossary: – Extranet: "a system of computers that makes it possible for a company and people outside the company to communicate and share information over the Internet. Extranets also allow employees who work away from the office to connect to the office computers – Value-added network: "private network provider (sometimes called a turnkey communications line) that is hired by a company"
		Structure	Depending on the application or service, the system was connected either through an extranet or a proprietary infrastructure	Allow respondent to answer both Q22.1 and Q22.2, if needed

Question number	Question	Type of issue	Comment	Solutions
Q26	How are you currently managing or plan to manage the following services?	Structure	The answer Q26.9 "other" only partially resolved Q26.8 "Managed services" which gathers many different services	• Remove "hosting of e-mails, website" in the answer • Change "Other: please specify" by "hosting of e-mails and website"
Q32	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?	Structure	A respondent wished to answer "Ministry of Health"	Add the option: "Other"
Q33	Does your hospital exchange electronically laboratory results information about patients with any of the following providers?			
Q34	Does your hospital exchange electronically medication lists information about patients with any of the following providers?			
Q35	Does your hospital exchange electronically radiology images and reports about patients with any of the following providers?			
Q40	Which of the following security measures are taken to protect the patient data stored and transmitted by the hospital's IT system?	Wording	A respondent wanted to ensure that the answers Q40.1 and Q40.2 refer to encryption of **all** data	Remove "all"
Q44	"Electronic Medical Records" (EMRs) or "Electronic Health Records" (EHRs) or "Electronic Patient Records" (EPRs) are terms which refer to systems that are used by healthcare professionals (doctors and nurses) to enter, store, view, and manage patient health and administrative information and data. Does your office have this type of ICT-supported systems?	Wording	Respondents want to make sure the question refers to ICT department office or the hospital. For ethical reasons, ICT departments usually do not have access to EPRs, EHRs, EMRs.	Change "office" by "hospital"
Q47	Health Information Exchange (HIE) is electronically transferring / sharing / enabling access to patient health information and data. Do your EHRs or any other ICT systems in place in your hospital allow health professionals to engage into any of the following forms of HIE?	Wording	• Answer Q47.4 refers to external or internal pharmacists? Transfers of prescriptions to external pharmacists would negatively impact on the hospital pharmacy • Do answers Q47.5, Q47.6, Q47.7, Q47.8, Q47.9 refer to external and/or internal providers?	Keep the question as it is
• Q45 • Q46 • Q47 • Q48	• Do your EHRs or any other ICT system allow health professionals to view and/or to input the following types of information? • Do your EHRs or any other ICT system have any of the clinical decision support functionalities listed below (such as real-time alerts or	Inability to answer	There are difficulties in responding to some of the items in the question regarding availability. Regarding Usage, it is also difficult for IT directors to say how the departments are actually using the applications	Add option "Don't know" in availability

Question number	Question	Type of issue	Comment	Solutions
	prompts) • Health Information Exchange (HIE) is electronically transferring / sharing / enabling access to patient health information and data. Do your EHRs or any other ICT systems in place in your hospital allow health professionals to engage into any of the following forms of HIE? • This is a question about "telehealth" which is the use of broadband-enabled information and communication technology to deliver health services, medical education, and health education remotely. It includes both clinical elements of the health care system such as remote consultations with patients and remote monitoring of their vital signs and health status, and non-clinical elements such as distance training.	Structure	Respondents have difficulties with so many labels (even with the reduced number).	• Rename labels (D) "Not in place but considering implementing" with "Not in place" • If respondent answer (D) "Not in place", ask label (E) which becomes "Considering implementing" • Rename option (B) as "Fully implemented in at least 50% of the units" • Rename option (C) as "Fully implemented in less than 50% of the units"

Annex 1 – Draft questionnaire

BLOCK A. CHARACTERISATION		
	Gender of the respondent: __ Female __Male	
Q1*	**What is your current position in the hospital? (Only one answer possible)**	
	1	Chief information officer
	2	ICT manager/director
	3	Chief operational officer (COO)/ Operation Manager
	4	Other: specify
Q2*	**Is this hospital…? (Only one answer possible)**	
	1	Public
	2	Private for profit
	3	Private not for profit
	4	Other: specify
Q3*	**And is this hospital …? (Only one answer possible)**	
	1	An independent hospital on one site
	2	An independent hospital on multiple sites
	3	Part of a group of different hospitals
	4	Part of a group of care institutions
	5	Other: specify
Q4*	**Is this hospital a university hospital? (Only one answer possible)** IF CODE 2 IN Q4: ASK Q5	
	1	Yes
	2	No
Q5*	**Is this hospital a non-university teaching hospital? (Only one answer possible)**	
	1	Yes
	2	No
Q6*	**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
Q7	**How many inhabitants are covered by this hospital?**	
	Number _____	
Q8	**Number of hospital discharge during 2011**	
	Number _____	
Q9	**Average length of stay in this hospital during 2011**	
	Number _____	
Q10	**Number of Computed Axial Tomography scanners (CAT scanners)**	
	Number _____	
Q11	**Number of Magnetic Resonance Imaging Units (MRI units)**	
	Number _____	

BLOCK B. ICT infrastructure		
Q12*	**Do you have a computer system in your hospital?**	
	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
Q13*	**Is your hospital computer system externally connected…?**	
	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
Q14*	**What type of Internet connection does your hospital have?**	
	1	Narrowband (Dial-up/PSTN) ISDN (128 kbit/smax)
	2	Broadband (below 30 MBps)
	3	Broadband (from 30 MBps to 49 MBps)
	4	Broadband (from 50 MBps to 100MBps)
	5	Broadband (above 100 MBps)
	6	No Internet connection (DO NOT READ)
Q15*	**How does your hospital support wireless communications?**	
	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
Q16*	**Does your hospital have videoconferencing facilities?**	
	1	Yes
	2	No

BLOCK C. ICT Applications		
Q17*	**Which type of Electronic Medical Records (EMRs) / Electronic Health Records (EHRs) / Electronic Patient Records (EPRs) does your hospital mainly use? By this type of application I mean a computer-based patient record system which contains patient-centric, electronically-maintained information about an individual's health status and care .** IF CODE 1 or 2 or 3 IN Q17: ASK Q265	
	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
Q18*	**Do patients have online access to their electronic patient records?** IF CODE 1 or 2 IN Q18: ASK Q30	
	1	Yes, to everything
	2	Yes, but only to certain data (e.g. results and protocols)
	3	No
Q19*	**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**	
	1	Yes
	2	No
Q20*	**Which of the following computerised systems has the hospital integrated?**	
	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 let 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 form 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.
Q21*	**Does the hospital have the following computer-based system or applications…**	
	1	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.
	2	An electronic transmission of results of clinical tests? (e.g. laboratory results)
	3	An electronic service order placing? (e.g. test/diagnostic results)?
	4	An electronic appointment booking system?
	5	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.

BLOCK D. Health Information Exchange		
Q22*	**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?**	
	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
Q23*	**Does your hospital exchange electronically laboratory results information about patients with any of the following providers?**	
	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
Q24*	**Does your hospital exchange electronically medication lists information about patients with any of the following providers?**	
	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
Q25*	**Does your hospital exchange electronically radiology reports about patients with any of the following providers?**	
	1	1 With a hospital or hospitals outside your own hospital system
	2	2 External general practitioners

	3	3 External specialists
	4	4 Health care providers in other EU countries
	5	5 Health care providers outside the EU countries
	6	6 None

BLOCK E. Security and privacy		
Q26*	**Is there any regulation in use that guarantees the security and privacy of electronic patient medical data?**	
	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
Q27*	**Which of the following security measures are taken to protect the patient data stored and transmitted by the hospital's IT system?**	
	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

BLOCK F. IT functionalities						
Q28	**Does your hospital have a Electronic Medical Records (EMRs) / Electronic Health Records (EHRs) / Electronic Patient Records (EPRs) for storing electronically the following kinds of patient identifiable data? For the following items, please indicate the extent to which they are implemented (fully implemented means it has completely replaced paper record for the function) in your hospital and the extent to which health professionals use them. If a feature is C, D or E skip the related "usage" question.** IF CODE 1 or 2 or 3 IN Q17: ASK Q26, Q27 and Q28					
	AVAILABILITY					
	(A) Fully Implemented Across All Units	(B) Fully implemented in At Least One Unit	(C) Beginning to Implement	(D) Not in Place and Considering Implementing	(E) Not in Place and not Considering Implementing	
	USAGE					
	YES, routinely	YES, occasionally	No	DK/NA		
	1	Symptoms or the reason for encounter				
	2	Medical history				
	3	Basic medical parameters such as allergies				
	4	Vital signs measurements				
	5	Diagnoses				
	6	Medications				
	7	Laboratory results				
	8	Ordered examinations and results				
	9	Radiological images				
	10	Treatment outcomes				
	11	Problem list				
Q29	**EHR are systems which also include functionalities that support the delivery of care. If you answered that your hospital has an EHR in place, please tell us whether this system (or any other IT system) allows health professional to perform the following the following items. Please indicate the extent to which they are implemented (fully implemented means it has completely replaced paper record for the function) in your hospital and the extent to which health professionals use them. If a feature is C, D or E skip the related "usage" question**					
	AVAILABILITY					
	(A) Fully Implemented Across All Units	(B) Fully implemented in At Least One Unit	(C) Beginning to Implement	(D) Not in Place and Considering Implementing	(E) Not in Place and not Considering Implementing	

	USAGE				
	YES, routinely		YES, occasionally	No	DK/NA
	1	Conduct clinical audits			
	2	Create/update disease management plan (e.g., diabetes)			
	3	View imaging results			
	4	View lab results			
	5	Create/view clinical notes			

Q30	**As explained EHR are system including also functionalities that support the delivery of care. If you answered that your hospital has an EHR in place, please tell us whether this system (or any other IT system) has ever provided health professionals real time alert or prompt in relation to the following….** **Please indicate the extent to which they are implemented (fully implemented means it has completely replaced paper record for the function) in your hospital and the extent to which health professionals use them. If a feature is C, D or E skip the related "usage" question**				
	AVAILABILITY				
	(A) Fully Implemented Across All Units	(B) Fully implemented in At Least One Unit	(C) Beginning to Implement	(D) Not in Place and Considering Implementing	(E) Not in Place and not Considering Implementing
	USAGE				
	YES, routinely		YES, occasionally	No	DK/NA
	1	Diagnosis			
	2	Prescribing (drugs-drugs interaction)			
	3	Patient-specific advice			
	4	Adverse event and follow-up			
	5	Reminders for guideline-based interventions or screening test			
	6	Order a critical laboratory test			
	7	Provide preventive care			
	8	Be alerted to a critical laboratory value			

Q31	**This is a question about Health Information Exchange (HIE). This expression refers to the process of electronically transferring / sharing (by aggregating and enabling access to) patient health information and data. Exchange may take place between different types of entities – for example between your hospital and other health care providers such or laboratories.** **Please indicate the extent to which they are implemented (fully implemented means it has completely replaced paper record for the function) in your hospital and the extent to which health professionals use them. If a feature is C, D or E skip the related "usage" question**				
	AVAILABILITY				
	(A) Fully Implemented Across All Units	(B) Fully implemented in At Least One Unit	(C) Beginning to Implement	(D) Not in Place and Considering Implementing	(E) Not in Place and not Considering Implementing

		USAGE			
		YES, routinely	YES, occasionally	No	DK/NA
	1	Interact with patients by email about health related issues			
	2	Make appointments at other care providers for your patients			
	3	Send/ receive electronically referral and discharge letters			
	4	Order supplies for your practice			
	5	Transfer prescriptions electronically to dispensing pharmacists			
	6	Exchange medical patient data with other health care providers and professionals?			
	7	Receive laboratory reports electronically			
	8	Receive and send laboratory reports electronically and share them with other healthcare professionals /providers			
	9	Exchange patient medication lists electronically with other healthcare professionals / providers"			
	10	Exchange radiology reports electronically with other healthcare professionals / providers"			
	11	Exchange medical patient data with any health care provider in other countries			

Q32	**This is a question about "telehealth" which is the use of broadband-enabled information and communication technology to deliver health services, expertise and information remotely. It includes both clinical elements of the health care system such as remote consultations with patients and remote monitoring of their vital signs and health status, and non-clinical elements such as remote training.** **Please indicate the extent to which they are implemented in your hospital and the extent to which health professionals use them. If a feature is C, D or E skip the related "usage" question**				
	AVAILABILITY				
	(A) Fully Implemented Across All Units	(B) Fully implemented in At Least One Unit	(C) Beginning to Implement	(D) Not in Place and Considering Implementing	(E) Not in Place and not Considering Implementing

	USAGE			
	YES, routinely	YES, occasionally	No	DK/NA
	1 Training			
	2 Holding consultations with other healthcare practitioners			
	3 Holding consultations with patients			
	4 Monitoring patients remotely (at their homes)			

Q33	**PHR are systems allowing patients to have secure access to, and manage their health information. If you answered that your practice/health centres has PHR system in place, please tell us whether this system (or any other IT system) allows patient to do the following?** **Please indicate the extent to which they are implemented in your hospital and the extent to which health professionals use them. If a feature is C, D or E skip the related "usage" question**				
	AVAILABILITY				
	(A) Fully Implemented Across All Units	(B) Fully implemented in At Least One Unit	(C) Beginning to Implement	(D) Not in Place and Considering Implementing	(E) Not in Place and not Considering Implementing

	USAGE			
	YES, routinely	YES, occasionally	No	DK/NA
	1 Request appointments online			
	2 Request for prescriptions online			
	3 View their medical records online			
	4 Make changes to or update their medical records online			

BLOCK G. Barriers, Impact and Attitudes						
Q34	**Please tell me whether you agree strongly, agree somewhat, disagree somewhat or disagree strongly with the following sentences related with the usage of ICT by health professional in your hospital.**					
	Totally Agree		**Somewhat Agree**	**Somewhat Disagree**	**Totally Disagree**	**DK/NA**
	1	Useful for job (or task)				
	2	Increases the number of patients they can see on average during working hours				
	3	Enhances effectiveness of their job				
	4	Allows tasks to be accomplished more quickly				
	5	Makes it easier to do their job/work				
	6	Increases quality of care				
	7	Easy to use				
	8	Clear and understandable				
	9	Easy to become skilful with system				
	10	Easy to get it to do what they want				
	11	Easy to learn to operate				
	12	Flexible to use/interact with				
	13	Health professionals think they should use IT system				
	14	Managers at work think health professionals should use IT system				
	15	Medical Director who influence health professionals' behaviour think they should use system				
	16	Medical Director who influence health professionals' clinical behaviour think they should use system				
	17	Health professionals have necessary resources to use IT system				
	18	Health professionals have knowledge to use IT system				
	19	Health professionals have technical assistance available				
	20	Use of IT systems by health professionals at work is wise				
	21	Health professionals use IT systems entirely under their control				

Q35	Please tell me whether you agree strongly, agree somewhat, disagree somewhat or disagree strongly with the following barriers related to the implementation and utilisation of IT systems by health professionals in your hospital.					
		Totally Agree	**Somewhat Agree**	**Somewhat Disagree**	**Totally Disagree**	**DK/NA**
	1	Lack of financial incentives				
	2	Lack of financial resources				
	3	Lack of access to the technology				
	4	Lack of IT support				
	5	Lack of inter-operability and standards				
	6	Lack of ethical, confidentiality and privacy issues				
	7	Lack of legislation				
	8	Lack of time and additional workload				
	9	Lack of coordination between workflow and process of medical practice and ICT				
	10	Lack of leadership				
	11	Lack of change management related with the diffusion and utilisation of ICT within medical practice				
	12	Lack of IT knowledge and competences				
	13	Lack of training				
	14	Lack of motivation to use ICT				
	15	Lack of easy of use				
	16	Lack of usefulness				
Q36	**Please tell me whether you agree strongly, agree somewhat, disagree somewhat or disagree strongly with the following impact (positive effects) potentially deriving from the implementation and utilisation of IT systems by health professionals in your hospital.**					
		Totally Agree	**Somewhat Agree**	**Somewhat Disagree**	**Totally Disagree**	**DK/NA**
	1	Reduce medical errors				
	2	Improvement in the quality of diagnosis decisions				
	3	Improvement in the quality of treatment				
	4	Facilitate patients' treatment adherence				
	5	Improvement in patients' satisfaction				

	6	Increased patients' access to health care
	7	Avoid unnecessary tests and duplications
	8	Increased average number of patients receiving help during one day
	9	Reduce pharmaceutical expenditure
	10	Shorter waiting lists
	11	More efficient working processes among health professionals
	12	Allow more efficient consultations
	13	Improvement in the coordination between the different levels of health system
	14	Speed up working process due to the availability of clinical information about patients
	15	Improvement in the efficiency of the whole health system

Q37	**To what extent do you agree or disagree with the following statements about the introduction of innovation supported by IT systems (i.e. EHR, or related) in your hospital?**				
	Totally Agree	**Somewhat Agree**	**Somewhat Disagree**	**Totally Disagree**	**DK/NA**
	1	Innovation is a priority in my hospital			
	2	Innovation is well embedded in key plans of my hospital			
	3	I'm aware of my practice/ health centre overall approach to innovation			
	4	The approach of my hospital to foster innovation is appropriate			
	5	My hospital dedicates sufficient resources to innovation			
	6	Foster innovation improves quality of care			
	7	Foster innovation improves efficiency			

Q38	**The implementation of IT systems within the Hospitals allows the transition from paper-based systems to a fully electronically-based systems. Please select what is the position of your hospital in this transition**
	1 Totally paper based
	2
	3
	4

	5	Hybrid model
	6	
	7	
	8	
	9	
	10	Totally electronically-based

Annex 2 – Workshop

AGENDA

09:30 – 10.00	Registration and coffee
10.00 – 11.00	Welcome and presentation of European Hospital Survey (EHS): Benchmarking deployment of e-Health services (2012 – 2013): • Welcome • Objective • Benchmarking exercises 2010 – 2013 • New module: Compatibility with OECD approach • Current challenges and benefits
11:00 – 12:30	Preliminary results of the qualitative pre test surveys and Discussion
12:30 – 13:30	Lunch Break and Coffee
13:30- 14:00	Validation of the research strategy: • Universe • Target • Field work Discussion
14:00 – 14:45	Validation of the main blocks of the questionnaire: • Characterisation of acute hospitals • eHealth deployment Infrastructure; Applications; Health Information Exchange; Privacy and Security: • - Functionalities (EHR; HIE; Telemedicine; PHR) • - Barriers Attitudes and Impact Discussion
14:45 – 16:00	Validation and discussion about the items and indicators
16:00 – 16:30	Conclusions and Actions

EXTERNAL PARTICIPANTS

1. Lea Coulet
COCIR
Belgium
coulet@cocir.org

2. Luca Gastaldi
Politecnico di Milano
Italy
luca.gastaldi@polimi.it

3. Silvia Gómez
European Federation of Nurses Associations (EFN)
Belgium
efn@efn.be

4. Janko Grassere
INTEL
Belgium
janko.grassere@intel.com

5. Gabor Karai
Advance Medical
Hungary
karaig@advance-medical.com

6. Werner B. Korte
Empirica
Germany
Werner.Korte@empirica.com

7. Véronique Lessens
Agfa Health Care
France
Veronique.Lessens@agfa.com

8. Corinne Marsolier
Cisco Systems
Belgium
marsolie@cisco.com

9. Konstanty Radziwill
CPME
Spain
secretariat@cpme.eu

10. Martin Richter
Universität Hohenheim
Germany
Martin.Richter@uni-hohenheim.de

11. Philip Scott
University of Portsmouth
UK
Philip.Scott@port.ac.uk

12. Panagiotis Stafylas
HTA Expert
Greece
panstafylas@gmail.com

EC PARTICIPANTS

13. Paola Bucciarelli
EC DG INFSO
Belgium
Paola.BUCCIARELLI@ec.europa.eu

14. Francisca García Lizana
EC DG INFSO
Belgium
francisca-rosario.garcia-lizana@ec.europa.eu

15. Francisco Lupiáñez
EC JRC IPTS
Spain
francisco.LUPIANEZ-VILLANUEVA@ec.europa.eu

16. Ioannis Maghiros
EC JRC IPTS
Spain
Ioannis.maghiros@ec.europa.eu

Annex 3 – Final questionnaire

SCREENER

Country code				
NUTS2 code				
Hospital number				

Good morning/Good afternoon,

I am ..... calling from GDCC, a leading market research and consultancy agency. We are currently conducting an important survey for the European Commission on the deployment of ICT services in the European hospitals. I would have some questions regarding your hospital:

S1. Does this organisation have…?

Multiple possible answers

☐ S1.1. An emergency department

☐ S1.2. A routine and/or life-saving surgery operating room

☐ S1.3. An intensive care unit

☐ S1.4. Don't know **(do not read)**

☐ S1.5. None of the above

-> If S1.4, ask to be redirected to a more adequate person and repeat.

S2a. And is this organisation an acute or general hospital?

Only one answer possible

☐ S2a.1. Yes

☐ S2a.2. No

☐ S2a.3. Don't know **(do not read)**

->If S2a.3, ask to be redirected to the most adequate person and repeat.

If S2a.1, go to S3.

If [S2a.2 AND (S1.1 AND (S1.2 and/or S1.3))], go to S3

If any other case, go to S2b.

S2b. So, is this organisation mainly… ?

Only one answer possible

☐ S2b.1. A psychiatric hospital

☐ S2b.2. A military hospital

☐ S2b.3. A police hospital

☐ S2b.4. A prison hospital

☐ S2b.5. A non-hospital primary care centre (by this, I mean an establishment gathering mainly general practitioners and eventually nurses and few specialists)

☐ S2b.6. A family planning centre

☐ S2b.7. A facility focusing on plastic surgery

☐ S2b.8. A hospice

☐ S2b.9. A mobile emergency care provider

☐ S2b.10. A fertility clinic

☐ S2b.11. A diagnostic imaging clinic

☐ S2b.12. Other: *Please specify*

☐ S2b.13. Don't know **(do not read)**

-> If any of these answers, close the interview.

S3. Could you tell me how many beds there are in your hospital?

Only one answer possible

☐ S3.1. Fewer than 101 beds

☐ S3.2. Between 101 and 250 beds

☐ S3.3. Between 251 and 750 beds

☐ S3.4. More than 750 beds

☐ S3.5. Don't know **(do not read)**

S4. Is this hospital…?

Only one answer possible

☐ S4.1. Public

☐ S4.2. Private

☐ S4.3. Private not for profit

☐ S4.4. Don't know **(do not read)**

Could you please transfer me to the person responsible for information and technical applications inside your hospital? It can be the Chief information officer, the ICT director/manager or the Operation manager for instance.

S5. Are you the CIO / IT director/manager and would you describe yourself as the person with the most knowledge on ICT related matters in {name organisation}?

Only one answer possible

☐ S5.1. Yes, that is me

☐ S5.2. No, that is someone else

-> if S5.2, ask to be redirected to the most adequate person and repeat.

-> Once in contact with the CIO, explain the survey purpose.

-> Send the letter (if necessary) and the electronic version of the questionnaire (if necessary). Inform on the possibility of answering the survey through internet **SURVEY**

Block A. Characterisation

Q1. What is your current position in the hospital?

Only one answer possible

☐ Q1.1. Chief information officer

☐ Q1.2. ICT manager/director

☐ Q1.3. Chief operational officer (COO)/ Operation Manager

☐ Q1.4. Other: specify

Q2a. Could you please confirm that this hospital has…[answer question S3]

Only one answer possible

☐ Q2a.1. Yes

☐ Q2a.2. No

-> If Q2a.1, then go to Q3. If Q2a.2, then go to Q2b.

Q2b. Then, could you tell me how many beds there are in your hospital?

Only one answer possible

☐ Q2b.1. Fewer than 101 beds

☐ Q2b.2. Between 101 and 250 beds

☐ Q2b.3. Between 251 and 750 beds

☐ Q2b.4. More than 750 beds

☐ Q2b.5. Don't know **(do not read)**

Q3. And is this hospital …?

Only one answer possible

☐ Q3.1. An independent hospital on one site

☐ Q3.2. An independent hospital on multiple sites

☐ Q3.3. Part of a group of different hospitals: *specify how many hospitals in the group*

☐ Q3.4. Part of a group of care institutions: *specify how many care institutions in the group*

☐ Q3.5. Other: specify

Q4. Is this hospital a university hospital?

Only one answer possible.

☐ Q4.1. Yes

☐ Q4.2. No

-> If Q4.2, then ask Q5

Q5. Is this hospital a non-university teaching hospital?

Only one answer possible

☐ Q5.1. Yes

☐ Q5.2. No

Q6. Total number of full time employees and/or in FTE (Full-time equivalent)

Multiple possible answers

☐ Q6.1. Number _____

☐ Q6.2. FTE _____

☐ Q6.3. Don't know

-> If Q6.1 and/or Q6.2, go to Q9. If Q6.3, go to Q7.

Q7. Total number of full time physicians and/or in FTE (Full-time equivalent)

Multiple possible answers

☐ Q7.1. Number _____

☐ Q7.2. FTE _____

☐ Q7.3. Don't know

-> If Q7.1 and/or Q7.2, go to Q9. If Q7.3, go to Q8.

Q8. Total number of full time nurses and/or in FTE (Full-time equivalent)

Multiple possible answers

☐ Q8.1. Number _____

☐ Q8.2. FTE _____

☐ Q8.3. Don't know

Q9. What is the catchment area of this hospital, in number of inhabitants?

☐ Q9.1. Number _____

☐ Q9.2. Don't know **(do not read)**

Q10. Number of Computed Axial Tomography scanners (CAT scanners)

☐ Q10.1. Number _____

☐ Q10.2. Don't know **(do not read)**

Q11. Number of Magnetic Resonance Imaging Units (MRI units)

☐ Q11.1. Number _____

☐ Q11.2. Don't know **(do not read)**

Q12. Number of full time employees in IT Department

☐ Q12.1. Number _____

Q13. What part of the total Hospital's Budget does the IT budget represent?

Only one answer possible

☐ Q13.1. Less than 1%

☐ Q13.2. Between 1% and 3%

☐ Q13.3. Between 3,1% and 5%

☐ Q13.4. More than 5%

☐ Q13.5. Don't know **(do not read)**

Q14. What part of the IT budget is dedicated to outsourced services?

☐ Q14.1. 0% (no service outsourced)

☐ Q14.2. Less than 25%

☐ Q14.3. Between 25% and 49%

☐ Q14.4. Between 50% and 74%

☐ Q14.5. At least 75%

☐ Q14.6. Don't know **(do not read)**

Q15. Does your IT Department have a formal IT Strategic Plan?

Only one answer possible

☐ Q15.1. Yes

☐ Q15.2. No

☐ Q15.3. Don't know **(do not read)**

Q16. Does your Hospital receive any financial incentives from health plans and other organisations that are tied to the types of information technology systems (e.g., electronic health records or electronic prescribing systems) it adopts?

Only one answer possible

☐ Q16.1. Yes

☐ Q16.2. No

☐ Q16.3. Don't know **(do not read)**

Block B. ICT infrastructure

Q17. Do you have a computer system in your hospital?

Only one answer possible

☐ Q17.1. We do not have any computer system but only personal computers that are not part of a hospital-wide system

☐ Q17.2 We have an independent hospital-wide computer system

☐ Q17.3 Our computer systems are part of a network of different hospitals or hospital sites

☐ Q17.4 Our computers systems are part of a regional or national network

☐ Q17.5. Don't know **(do not read)**

Q18. Is your hospital computer system externally connected…?

Allow multiple anwers for Q18.1 and Q18.2 only

☐ Q18.1 Yes, through an extranet i.e. using a secure Internet connection over the Internet

☐ Q18.2 Yes, through an value added network or proprietary infrastructure

☐ Q18.3 Our computer system is not connected

☐ Q18.4. Don't know **(do not read)**

Q19. What type of Internet connection does your hospital have?

Only one answer possible

☐ Q19.1. Narrowband (Dial-up/PSTN) ISDN (128 kbit/smax)

☐ Q19.2. Broadband (below 30 MBps)

☐ Q19.3. Broadband (from 30 MBps to 49 MBps)

☐ Q19.4. Broadband (from 50 MBps to 100MBps)

☐ Q19.5. Broadband (above 100 MBps)

☐ Q19.6. No Internet connection **(do not read)**

☐ Q19.7. Don't know **(do not read)**

Q20. How does your hospital support wireless communications?

Only one answer possible

☐ Q20.1. There is a single, unified wireless infrastructure capable of supporting most of the applications

☐ Q20.2. There are individual wireless networks for discrete applications

☐ Q20.3. There is no wireless infrastructure

☐ Q20.4. Don't know **(do not read)**

Q21. Does your hospital have videoconferencing facilities (for home monitoring of patients, contact with other institutions for administrative, medical or education purposes)?

Multiple possible answers

☐ Q21.1. Yes

☐ Q21.2. No

☐ Q21.3. Don't know **(do not read)**

Q22. How are you currently managing the following services?

Multiple answers possible per line

	Currently managed in-house	Currently outsourced	Don't know **(do not read)**
Q22.1. Recording and storage of patient's medical digital data or other clinical data	☐	☐	☐
Q22.2. Archiving of patient's medical digital record	☐	☐	☐
Q22.3. Recording and storage of staff digital data (personal data, position/grade, contact details, availability, remuneration, etc.)	☐	☐	☐
Q22.4. Archiving of staff digital records (personal data, remuneration slips, etc.)	☐	☐	☐
Q22.5. Storage of digital financial data	☐	☐	☐
Q22.6. Issue of invoices	☐	☐	☐
Q22.7. Supplier invoice management	☐	☐	☐
Q22.8. Managed services (i.e. system support and system maintenance)	☐	☐	☐
Q22.9. Hosting of e-mails and website	☐	☐	☐

Block C. ICT applications

Q23. Which type of Electronic Medical Records (EMRs) / Electronic Health Records (EHRs) / Electronic Patient Records (EPRs) does your hospital mainly use? By this type of application I mean a computer-based patient record system which contains patient-centric, electronically-maintained information about an individual's health status and care.

Only one answer possible

☐ Q23.1. A hospital-wide EMR/EHR/EPR shared by all the clinical service departments

☐ Q23.2. Multiple local/departmental EMR/EHR/EPR systems, which share information with a central EMR/EHR/EPR system

☐ Q23.3. Multiple local/departmental EMR/EHR/EPR systems, but they do not share information

☐ Q23.4. None, we do not use EMR/EHR/EPR systems in our hospital

☐ Q23.5. Don't know **(do not read)**

Q24. Do patients have online access to their electronic patient records?

Only one answer possible

☐ Q24.1. Yes, to everything

☐ Q24.2. Yes, but only to certain data (e.g. results and protocols)

☐ Q24.3. No

☐ Q24.4. Don't know **(do not read)**

Q25. 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. Examples of PACS include Radiology Information System (RIS) or cardiology IT (Cardiology and Visualisation Information System (CVIS) and cardiology PACS availability).

Only one answer possible

☐ Q25.1. Yes

☐ Q25.2. No

☐ Q25.3. Don't know **(do not read)**

Q26. Which of the following computerised systems has the hospital integrated?

Multiple possible answers

☐ Q26.1. An integrated system for billing management

☐ Q26.2. An integrated system to send or receive electronic referral letters

☐ Q26.3. An integrated system to send electronic discharge letters

☐ Q26.4. An integrated system for tele-radiology

☐ Q26.5. A computerised system for ePrescribing

☐ Q26.6. A medical decision support system

☐ Q26.7. Don't know **(do not read)**

☐ Q26.8. None of the above **(do not read)**

Q27. Does the hospital have the following computer-based system or applications…

Multiple possible answers

☐ Q27.1. An adverse health events reporting system?

☐ Q27.2. An electronic transmission of results of clinical tests? (e.g. laboratory results)

☐ Q27.3. An electronic service order placing? (e.g. test/diagnostic results)?

☐ Q27.4. An electronic appointment booking system?

☐ Q27.5. Tele-homecare/tele-monitoring services to outpatients (at home)?

☐ Q27.6. A critical care information system (anaesthesia, emergency, operating room, intensive care unit information system)?

☐ Q27.7. A medical/nursing document management system?

☐ Q27.8. A business intelligence information system (clinical and administrative)?

☐ Q27.9. Don't know **(do not read)**

☐ Q27.10. None of the above **(do not read)**

Block D. Health Information Exchange

Q28. 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

☐ Q28.1. With a hospital or hospitals outside your own hospital system

☐ Q28.2. External general practitioners

☐ Q28.3. External specialists

☐ Q28.4. Health care providers in other EU countries

☐ Q28.5. Health care providers outside the EU countries

☐ Q28.6. Other: please specify

☐ Q28.7. None

☐ Q28.8. Don't know **(do not read)**

Q29. Does your hospital exchange electronically laboratory results information about patients with any of the following providers?

Multiple possible answers

☐ Q29.1. With a hospital or hospitals outside your own hospital system

☐ Q29.2. External general practitioners

☐ Q29.3. External specialists

☐ Q29.4. Health care providers in other EU countries

☐ Q29.5. Health care providers outside the EU countries

☐ Q29.6. Other: please specify

☐ Q29.7. None

☐ Q29.8. Don't know **(do not read)**

Q30. Does your hospital exchange electronically medication lists information about patients with any of the following providers?

Multiple possible answers

☐ Q30.1. With a hospital or hospitals outside your own hospital system

☐ Q30.2. External general practitioners

☐ Q30.3. External specialists

☐ Q30.4. Health care providers in other EU countries

☐ Q30.5. Health care providers outside the EU countries

☐ Q30.6. Other: please specify

☐ Q30.7. None

☐ Q30.8. Don't know **(do not read)**

Q31. Does your hospital exchange electronically radiology images and reports about patients with any of the following providers?

Multiple possible answers

☐ Q31.1. With a hospital or hospitals outside your own hospital system

☐ Q31.2. External general practitioners

☐ Q31.3. External specialists

☐ Q31.4. Health care providers in other EU countries

☐ Q31.5. Health care providers outside the EU countries

☐ Q31.6. Other: please specify

☐ Q31.7. None

☐ Q31.8. Don't know **(do not read)**

-> If Q23.1 or Q23.2, ask Q32.

Q32. You said that your hospital uses electronic patient records (EPRs) which share information. Do you encounter interoperability problems between the different departmental EPR systems? By interoperability problems, I mean that the systems are not connected and fail to talk to each other.

Multiple possible answers

☐ Q32.1. Yes, at the technical level.

☐ Q32.2. Yes, at the semantic level.

☐ Q32.3. Yes, at the organisational level.

☐ Q32.4. Never

☐ Q32.5. Don't know **(do not read)**

-> If Q23.3, ask Q33

Q33. You said that your hospital uses electronic patient records (EPRs) which does not share information. Considering your technical skills in relation to hospital system interoperability, do you think you need additional training?

Only one answer possible

☐ Q33.1. Yes

☐ Q33.2. No

☐ Q33.3. Don't know **(do not read)**

Q34. Which standards does your system support or comply with?

Multiple possible answers

☐ Q34.1. HL7

☐ Q34.2. IHE integration profiles

☐ Q34.3. CEN/ISO EN 13606

☐ Q34.4. DICOM

☐ Q34.5. OpenEHR

☐ Q34.6. Don't know **(do not read)**

Block E. Security and privacy

Q35. Is there any regulation in use that guarantees the security and privacy of electronic patient medical data?

Multiple possible answers

☐ Q35.1. Yes, at national level

☐ Q35.2. Yes, at regional level

☐ Q35.3. Yes, at hospital level

☐ Q35.4. Other **(do not read)**

☐ Q35.5. No, there is no regulation

☐ Q35.6. Don't know **(do not read)**

Q36. 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

☐ Q36.1. Encryption of stored data

☐ Q36.2. Encryption of transmitted data

☐ Q36.3. Workstations with access only through health professional cards

☐ Q36.4. Workstations with access only through fingerprint information

☐ Q36.5. Workstations with access only through a password

☐ Q36.6. Data entry certified with digital signature

☐ Q36.7. Other: .....

☐ Q36.8. Don't know **(do not read)**

☐ Q36.9. None of the above **(do not read)**

Q37. Are there clear structured rules on accessing (reading-writing) patients' electronic medical data?

Only one answer possible

☐ Q37.1. Yes

☐ Q37.2. No

☐ Q37.2. Don't know **(do not read)**

Q38. 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

☐ Q38.1. Yes

☐ Q38.2. No

☐ Q38.3. Don't know **(do not read)**

Q39. 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

☐ Q39.1. Immediate (we have a fully redundant data centre)

☐ Q39.2. Less than 24 hours

☐ Q39.3. Less than 2 days

☐ Q39.4. Less than 1 week

☐ Q39.5. Less than 1 month

☐ Q39.6. More than 1 month

☐ Q39.7. Don't know **(do not read)**

Block F. IT functionalities

Q40. "Electronic Medical Records" (EMRs) or "Electronic Health Records" (EHRs) or "Electronic Patient Records" (EPRs) are terms which refer to systems that are used by healthcare professionals (doctors and nurses) to enter, store, view, and manage patient health and administrative information and data. Does your hospital have this type of ICT-supported systems?

Only one answer possible

☐ Q40.1. Yes

☐ Q40.2. No

☐ Q40.3. I don't know **(do not read)**

-> if Q40.1, go to Q41. If Q40.2, go to Q43

Q41. Do your EHRs or any other ICT system allow health professionals to view and/or to input the following types of information?

Please indicate the extent to which they are implemented (fully implemented means it has completely replaced paper record for the function) in your hospital and the extent to which health professionals use them.

If feature D, ask (E). If a feature is D or E skip the related "usage" question. One answer per line.

	Availability						Usage (if A, B or C)			
	(A) Fully implemented across all units	(B) Fully implemented in at least 50% of units	(C) Fully implemented in less than 50% of units	(D) Not in place	(E) Considering implementing	Don't know **(do not read)**	YES, routinely	YES, occasionally	No	Don't know **(do not read)**
Q41.1. Medication list	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.2. Prescription list	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.3. Lab test results	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.4. Radiology test results (reports)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.5. Radiology test results (images)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.6. Problem list / diagnoses	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.7. Reason for encounter	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.8. Allergies	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.9. Encounter Notes, Clinical notes	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.10.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Immunizations										
Q41.11. Vital signs	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.12. Patient demographics	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.13. Symptoms (reported by patient)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.14. Medical history	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.15. Ordered tests	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.16. disease management or care plans (e.g. diabetes)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q41.17. Finance / billing information	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q42. Do your EHRs or any other ICT system have any of the clinical decision support functionalities listed below (such as real-time alerts or prompts)?

Please indicate the extent to which these are implemented (fully implemented means it has completely replaced paper record for the function) in your hospital and the extent to which health professionals use them.

If feature D, ask (E). If a feature is D or E skip the related "usage" question. One answer per line.

	Availability						Usage (if A, B or C)			
	(A) Fully implemented across all units	(B) Fully implemented in at least 50% of units	(C) Fully implemented less than 50% of units	(D) Not in place	(E) Considering implementing	Don't know **(do not read)**	YES, routinely	YES, occasionally	No	Don't know **(do not read)**
Q42.1. Clinical guidelines and best practices (e.g., alerts, prompts)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q42.2. Drug-drug interactions	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q42.3. Drug-allergy alerts	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q42.4. Drug-lab interactions	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q42.5. Contraindications (e.g., based on age, gender, pregnancy status)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q42.6. Alerts to a critical laboratory value	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q43. Health Information Exchange (HIE) is electronically transferring / sharing / enabling access to patient health information and data. Do your EHRs or any other ICT systems in place in your hospital allow health professionals to engage into any of the following forms of HIE?

Please indicate the extent to which these are implemented (fully implemented means it has completely replaced paper record for the function) in your hospital and the extent to which health professionals use them.

If feature D, ask (E). If a feature is D or E skip the related "usage" question. One answer per line.

	Availability						Usage (if A, B or C)			
	(A) Fully implemented across all units	(B) Fully implemented in at least 50% of units,	(C) Fully implemented in less than 50% of units	(D) Not in place	(E) Considering implementing	Don't know **(do not read)**	YES, routinely	YES, occasionally	No	Don't know **(do not read)**
Q43.1. Interact with patients by email about health-related issues	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q43.2. Make appointments at other care providers on your patients' behalf	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q43.3. Send/receive referral and discharge letters	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q43.4. Transfer prescriptions to pharmacists	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q43.5. Exchange medical patient data with other healthcare providers and professionals	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q43.6. Receive laboratory reports	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q43.7. Receive and send laboratory reports and share them with other healthcare professionals /providers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q43.8. Exchange patient medication lists with other healthcare professionals / providers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q43.9. Exchange radiology reports with other healthcare professionals / providers"	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q43.10. Exchange medical patient data with any healthcare provider in other countries	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q43.11. Certify sick leaves	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q43.12.Certify disabilities	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q44. This is a question about "telehealth" which is the use of broadband-enabled information and communication technology to deliver health services, medical education, and health education remotely. It includes both clinical elements of the health care system such as remote consultations with patients and remote monitoring of their vital signs and health status, and non-clinical elements such as distance training.

Please indicate the extent to which these are implemented (fully implemented means it has completely replaced paper record for the function) in your hospital and the extent to which health professionals use them.

If feature D, ask (E). If a feature is D or E skip the related "usage" question. One answer per line.

	Availability						Usage (if A, B or C)			
	(A) Fully implemented across all units	(B) Fully implemented in at least 50% of units	(C) Fully implemented in less than 50% of units	(D) Not in place	(E) Considering implementing	Don't know **(do not read)**	YES, routinely	YES, occasionally	No	Don't know **(do not read)**
Q44.1. Training (i.e. for continuing Medical education)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q44.2. Holding consultations with other healthcare practitioners	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q44.3. Holding consultations with patients	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Q44.4. Monitoring patients remotely (ie. transmission of vital signs from patients' homes)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q45. The implementation of IT systems within the hospitals allows the transition from paper-based systems to a fully electronically-based system. Please select what is the position of your hospital in this transition

Only one answer possible

Q45.1 Totally paper based	Q45.2	Q45.3	Q45.4	Q45.5 Hybrid model	Q45.6	Q45.7	Q45.8	Q45.9 Totally electronically-based
☐	☐	☐	☐	☐	☐	☐	☐	☐

Block G. Hospital statistics

Q46. Number of hospital discharge during 2011 (or latest data available)

☐ Q46.1. Number _____

☐ Q46.2. Don't know **(do not read)**

Q47. Average length of stay in this hospital during 2011 (or latest data available)

☐ Q47.1. Number _____

☐ Q47.2. Don't know **(do not read)**

Q48. Number of emergency visits during 2011 (or latest data available)

☐ Q48.1. Number _____

☐ Q48.2. Don't know **(do not read)**

Q49. Number of outpatient consultations during 2011 (or latest data available)

☐ Q49.1. Number _____

☐ Q49.2. Don't know **(do not read)**

Glossary

Question S1:

- S1.1. Emergency department: area of a hospital especially equipped and staffed for emergency care
- S1.2. Operating room: room equipped for performing surgical operations
- S1.3. Intensive care unit: unit in which is concentrated special equipment and specially trained personnel for the care of seriously ill patients requiring immediate and continuous attention

Question S2:

- S2.5. Primary care centre: medical facility focusing on the initial treatment of medical ailments that are not life-threatening
- S2.6. Family planning centre: medical facility focusing on regulating the number and spacing of children in a family (e.g. contraception and aborts)
- S2.8. Hospice: Facility where care is provided for free or at very cheap price, most often for elderly people or terminally ill patients
- S2.9. Mobile emergency care provider: mobile units providing care outside the hospital

Questions Q6, Q7 and Q8:

- FTE (Full-Time Equivalents): unit indicating the workload of an employed person in a way that makes workloads comparable across various contexts. For instance, 1 FTE means that a person works full-time worker or two people work half-time.

Question Q9:

- Catchment area: number of inhabitants covered by the hospital

Question Q18:

- Extranet: “a system of computers that makes it possible for a company and people outside the company to communicate and share information over the internet. Extranets also allow employees who work away from the office to connect to the office computers”
- Value-added network: “private network provider (sometimes called a turnkey communications line) that is hired by a company”

Question Q23:

- EMR: The electronic record of health-related information on an individual that is created, gathered, managed, and consulted by licensed clinicians and staff from a single organization who are involved in the individual's health and care.
- EHR: The aggregate electronic record of health-related information on an individual that is created and gathered cumulatively across more than one health care organization and is managed and consulted by licensed clinicians and staff involved in the individual's health and care.
- EPR: record about an individual patient stored in a healthcare provider's computer, in a database that is typically the property of the provider. It will usually contain the patient's demographic data and medical information collected only when the patient visits that provider.

Question Q26:

- Q26.1. Billing management: system that produces automated electronic/paper bills and invoices hospital-wide
- Q26.2. Referral letter: 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

- Q26.3. Discharge letter: 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
- Q26.4. Tele-radiology system: system that sends and views radiological images from one location to another for the purposes of interpretation and/or consultation by a radiologist form outside the hospital
- Q26.5. ePrescribing: system that enables the prescriber to send an accurate, error-free and understandable prescription electronically directly to a pharmacy

Question Q27:

- Q27.1. Adverse health events reporting system: 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.
- Q27.5. Tele-homecare/tele-monitoring services: either the provision of social care from a distance – to a patient in his/her home – supported by means of telecommunications and computerised systems or a telemedicine service aimed at monitoring the health status of patients at a distance
- Q27.8: Business Intelligence information system: Reporting applications and analysis tools including a variety of components such as tabular reports, spreadsheets, charts and dashboards.

Block D: Health Information Exchange (HIE)

HIE is transferring/sharing/enabling access to patient health information and data. Exchange may take place between different types of entities, such as care organisations within a country/region/community/or network of hospitals.

Question Q32:

- Q32.1. Technical level: at the level of technical standards, architectures or platforms
- Q32.2. Semantic level: in terms of the use of terminologies and classifications for clinical, medical or statistical purposes.
- Q32.3. Organisational level: between the different organisations or departments

European Commission

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Abstract

The European Hospital Survey: Benchmarking deployment of e-Health services (2012–2013) project is the continuation of eHealth benchmarking Phase III survey. This survey funded and managed by Unit F4 of DG CONNECT, gathered data from a statistically representative sample of European acute hospitals in order to benchmark their level of eHealth deployment. IPTS researchers were part of the steering board of this project and were given the opportunity to access and use the data as soon as they were ready. In 2011 as a result of this collaboration between IPTS and DG CONNECT/F4 "A composite index for the benchmarking of eHealth Deployment in European acute Hospitals. Distilling reality in manageable form for evidence based policy" was published.

The aim of the European Hospital Survey: Benchmarking deployment of e-Health services (2012–2013) Project is to design, gather and analyse eHealth deployment in European acute Hospitals to develop a follow up of the composite indicator carried out by IPTS and to identify the trends among the other benchmarking exercises.

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