European Commission

JRC SCIENTIFIC AND POLICY REPORTS

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

Synthesis of Outcomes

Authors: R. Sabes-Figuera, I. Maghiros

Editor: F. Abadie

2013

Report EUR 26355 EN

Joint Research Centre

European Commission
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

This publication is a Scientific and Policy Report by the Joint Research Centre of the European Commission.

JRC85854

EUR 26355 EN

ISBN 978-92-79-34776-4 (pdf)

ISSN 1831-9424 (online)

doi:10.2791/55646

Luxembourg: Publications Office of the European Union, 2013

Printed in Spain

Table of Contents

Executive Summary

A widespread uptake of eHealth technologies is likely to benefit European Healthcare systems both in terms of quality of care and financial sustainability and European society at large. This is why eHealth has been on the European Commission policy agenda for more than a decade. The objectives of the latest eHealth action plan developed in 2012 are in line with those of the Europe 2020 Strategy and the Digital Agenda for Europe.

This report, based on the analysis of the data from the "European Hospital Survey: Benchmarking deployment of e-Health services (2012–2013)" project, presents policy relevant results and findings in this field. The results highlighted here are based on the analysis of the survey descriptive results as well as two composite indicators on eHealth deployment and eHealth availability and use that were developed based on the survey's data. Although they are closely interrelated, these results have been grouped in four sections. They are presented in detail in this document and briefly summarised below:

- Facilitating the **deployment and use of eHealth** in European acute hospitals:
  - Based on current levels of deployment, different groups of countries display distinct trends in eHealth deployment; it is therefore recommended to develop different eHealth deployment policies addressing the specificities of each group.
  - Based on differences in availability and use between groups of eHealth functionalities, policies aiming to facilitate uptake should be differentiated:
    - a) For functionalities that allow health professionals to view or input information on Electronic Health Records (EHR) and those that provide support to clinical decisions, the efforts should be focused on increasing availability among acute hospitals.
    - b) For functionalities related to health information exchange and Telehealth, the focus on availability should be complemented with measures designed to incentivise their use by health professionals, once these functionalities are available.
- Further implementation of **Electronic Health Records systems** as a trigger for the development of eHealth functionalities:
  - So as to facilitate implementation of basic EHR view/input information functionalities further standardization is needed.
  - The increased implementation of basic EHR view/input medical information functionalities has a positive effect on the uptake of clinical decision support and Health Information Exchange systems; in other words, policy action to facilitate basic eHealth functionalities is recommended.
  - Specific and complementary approaches would be needed to further diffuse Telehealth functionalities.
- Incentivising the **sharing of information** for a more integrated care by:
  - Fostering systems that allow hospitals to share existing clinical information with other healthcare providers electronically.
  - Sharing experiences in addressing interoperability issues between systems within hospitals might help develop internal and external systems of Health Information Exchange.
  - Promoting the electronic sharing of health records across borders and the online access of individuals to their health records.

- **Security and privacy** measures in some hospitals still need to be brought up to standards and related legal issues should not be a barrier for the further development of **electronic health information exchange**.

The policy challenges reported here complement the findings of the two previous reports that analyse the project data. These findings and their implications will be refined and updated by analysing the impact of hospitals' characteristics (size, ownership, teaching status, etc.) on the composite indicators scores. This analysis will assess the relevance of these characteristics by quantifying them and take a closer look at the differences found between average country indicators' scores.

1. Background

1.1 eHealth

eHealth has been on the European Commission Information Society's policy agenda for more than a decade, from the eEurope initiative (European Commission 1999) to the i2010 Strategy (European Commission 2005), and most recently the Digital Agenda for Europe (DAE) (European Commission 2010), eHealth was also one of the Lead Market Initiatives in 2007. Today it is the focus of one of the two first pilots under the EU2020 Strategy and its Innovation Union flagship initiative –the European Innovation Partnership on Active and Healthy Ageing.

The key strategic orientations of the European Commission eHealth policy are defined in the eHealth Action Plan 2012-2020 where eHealth is referred to as "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" (European Commission 2004). The functions that this definition encompasses might be classified in the following categories (European Commission 2007):

1. Clinical information systems (specialised tools for health professionals within care institutions, tools for primary care and/or for outside the care institutions);

2. Telemedicine and homecare systems and services;

3. Integrated regional/national health information networks and distributed electronic health record systems and associated services;

4. Secondary usage non-clinical systems (systems for health education and health promotion of patients/citizens; specialised systems for researchers and public health data collection and analysis; support systems for clinical processes not used directly by patients or health care professionals).

Further, in the Digital Agenda for Europe (DAE) for the period 2010-2015 several actions, targets and objectives relate to eHealth (European Commission 2010):

Action 75a: Give Europeans secure online access to their medical health data.
Objectives: increase empowerment and quality of life for citizens while contributing to healthcare system sustainability, contribute to EIPAHA.
Target: undertake pilot actions to equip Europeans with secure online access to their medical health data by 2015.

Action 75a: achieve widespread telemedicine deployment.
Objectives: increase empowerment and quality of life for citizens while contributing to healthcare system sustainability, contribute to EIPAHA.
Target: achieve by 2020 widespread deployment of telemedicine services.

Action 76: Propose a recommendation to define a minimum common set of patient data.
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.
Objectives: unleash an EU eHealth market by overcoming local and market fragmentation.
Target: achieve the above by 2015 through stakeholder dialogue.

The focus of the European Commission on eHealth is justified by the potential benefits that it might bring to European healthcare systems (OECD 2010), namely:

- Increasing quality of care and efficiency: for instance reducing medical errors and drugs adverse events through adverse events computerised reporting systems and ePrescription. A more efficient sharing of health information through electronic health records might also have a positive impact on the quality of care and efficiency.
- Reducing operating costs of clinical services: eHealth functionalities might have a positive impact on these costs through improvement in the way tasks are performed, by saving time with data processing, and by reducing multiple handling of documents.
- Reducing administrative costs: for instance integrated computerised systems for billing, order entry and discharging might make the administration of hospitals more efficient.
- Enabling entirely new modes of care: for instance telemedicine applications combined with Picture Archiving and Communication System can reduce the impact of the shortage of physicians and improve access to care in areas with large rural or remote populations.

Indeed, the European Commission in the above mentioned eHealth Action Plan has emphasized how eHealth could not only cope with the current challenges faced by healthcare systems but also create new market opportunities (European Commission 2012).

1.2 Benchmarking

Benchmarking plays a crucial and fundamental role in enabling Member States to monitor actual performance, enhance policy learning and the on-going policy processes. Indeed the three main Information Society policy programmes – eEurope for 2000-2005 (European Commission 1999) , i2010 for 2005-2010 (European Commission 2002), and the DAE for 2010-2015 (European Commission 2010) – came with their respective benchmarking framework (European Commission 2002; i2010 High Level Group 2006; i2010 High Level Group 2009). In the eHealth field, specific surveys and studies for benchmarking have been designed and implemented in Europe. Two surveys gathering data on the use of ICT among General Practitioners have been conducted (Dobrev A 2008) (European Commission 2013), and two further surveys carried out the same exercise in European acute hospitals (Deloitte/Ipsos 2011) (PWC 2013).

These EC benchmarking activities in the eHealth field are complemented by a multi-stakeholder initiative to improve the availability and quality of health ICT data and indicators. It is led by the Organisation for Economic Co-operation and Development (OECD) with the participation of the European Commission, the World Health Organization and further stakeholders including representatives of industry and health authorities. The recommendations made by this initiative were taken into account in the design of the questionnaires for the last two EC benchmarking exercises dealing with GPs and hospitals respectively.

2. Objective

The objective of this document is to present selected results from a benchmarking exercise on the level of eHealth adoption and use in acute hospitals in all 28[1] EU Member States as well as Iceland and Norway (EU28+2). This exercise is based on information from two surveys carried out in 2010 (Deloitte/Ipsos 2011) and 2012 (PWC 2013) that gathered data on eHealth indicators in acute hospitals. Besides these raw indicators, two different composite indicators on eHealth deployment and eHealth availability and use have been developed based on the survey's data. These indicators

[1] As Croatia joined the EU in July 2013 after the data analysis had been completed, some of the graphs still refer to the average of the whole sample as EU27+3 instead of EU28+2.

are calculated at Hospital level before obtaining average country values, allowing us to build rankings of countries for both composite indicators.

The next sections describe the data and methods used for this exercise, presenting selected findings from the analysis of the survey data, as well as results about the composite indicators.

3. Data and Method

3.1 Data

Detailed descriptions of the methods of the two surveys can be found in public reports (Deloitte/Ipsos 2011; Deidda and Maghiros 2013; PWC 2013) which is why we only include a brief summary for each survey, highlighting only the issues that are most relevant for this exercise.

2010 survey (eHealth Benchmarking III):

The universe of reference was the entire population of acute hospitals in each of the EU 27 (at that time) member states plus Croatia, Iceland and Norway. The latest and most accurate information at the time was gathered to identify the full universe of acute hospitals in the 30 countries, from which the sample was extracted randomly with quota stratification by region, size (number of beds) and ownership (private/public). This sample was statistically representative of the universe[2] as previously defined and consisted of 906 hospitals. The data were collected through Computer-assisted telephone interviews (CATI) that took place between mid-July and mid-September 2010 with Chief Information Officers (CIOs) of the hospitals. The interviews included five main blocks related to:

- Characterisation of the Hospital;
- Infrastructure, availability and connectivity;
- Applications;
- Integration;
- Security and Privacy.

2012 survey (European Hospital Survey: Benchmarking deployment of eHealth services - 2012-2013):

The universe of reference was the entire population of acute hospitals in each of the EU 27 (at that time) member states plus Croatia, Iceland and Norway. However, a census strategy was used to establish the universe and to collect the data. Then a random sample of acute care hospitals, based on quotas for hospital ownership, hospital size and region (NUTS 2 level), was drawn from the universe. A relevant improvement was the use of screening criteria to determine that only acute care hospitals were included in the census and therefore in the survey. The objective was to improve comparability between sampled hospitals. Acute care or services are those that "… include all promotive, preventive, curative, rehabilitative or palliative actions, whether oriented towards individuals or populations, whose primary purpose is to improve health and whose effectiveness largely depends on time-sensitive and, frequently, rapid intervention" (Hirshon JM, Risko N et al 2013) As the definition of an acute care hospital varies across the different EU countries, the following criteria were defined to classify survey participants as acute care hospitals:

I. Respondents consider that the hospital is an acute or general hospital; or
II. The hospital has an emergency department, and *at least one* of the following:
    a. a routine and/or life-saving surgery operating room; and/or
    b. an intensive care unit.

[2] The universe for the 2010 survey was estimated as 8199 hospitals in EU27+3 countries , based on the World Health Organization list of hospitals for the countries in question.

In total 26,551 healthcare establishments were contacted and screened to define a group of hospitals that were as homogeneous as possible. In total, 5,424 qualified as acute care hospitals, and of those 1,753 completed the interview between October 2012 and January 2013. The survey targeted Chief Information Officers (CIOs) and was carried out mainly via Computer-Aided Telephone Interviewing (CATI). The interviews included seven main blocks related to:

- Characterisation of the hospital;
- ICT infrastructure;
- ICT applications;
- Health Information Exchange;
- Security and privacy;
- IT functionalities;
- Hospital statistics.

Data from the two surveys are fully comparable for the first 5 blocks of the questionnaire. The novelty[3] of the 2012 questionnaire is the inclusion of a block (IT functionalities) with questions that enable measuring and comparing the availability and use of specific eHealth functionalities. This set of questions is compatible with the OECD early guidelines, as well as with the corresponding part of the survey of European GPs mentioned earlier.

The total number of hospitals included in the samples of the surveys has almost doubled from 2010 to 2012 (*Table 1*). For almost all countries, with the exception of Malta, Norway and the Netherlands, the sample is bigger in 2012 although the increase is not homogenous, with smaller increases in some large countries such as Spain, Poland, and Germany. The two samples are very similar in relation to the main hospitals' characteristics[4].

[3] The "hospital statistics" block was also a novelty in the 2012 questionnaire. However, given the low response rate to this specific block, the data was not analysed.

[4] Hospitals in the 2012 sample are slightly larger, with a higher percentage of teaching hospitals than in 2010, the latter being most probably related to the size characteristic.

Table 1: European Hospital Surveys' sample sizes (EU28+2)

Country	Census of Acute Hospitals (2012)	Sample (2012)	Sample (2010)
EU28+2	**5424**	**1753**	**906**
Austria	132	43	15
Belgium	120	50	23
Bulgaria	109	62	15
Croatia	22	11	4
Cyprus	22	13	8
Czech Rep.	142	40	15
Denmark	54	16	8
Estonia	25	12	3
Finland	46	26	15
France	997	319	150
Germany	1295	201	150
Greece	120	68	26
Hungary	102	43	10
Iceland	10	9	3
Ireland	42	23	8
Italy	497	196	90
Latvia	32	19	3
Lithuania	63	32	10
Luxembourg	7	3	3
Malta*	3	2	3
Netherlands	114	26	29
Norway*	28	6	7
Poland	459	149	99
Portugal	73	41	20
Romania	166	85	38
Slovakia	72	33	12
Slovenia	14	6	3
Spain	478	124	90
Sweden	78	26	8
UK	102	69	38

* Countries with smaller samples in 2012 than in 2010

3.2 Method of analysis

Data on the deployment, availability and use of eHealth in European acute hospitals have been analysed in two ways. First, a descriptive analysis of the 2012 eHealth indicators in acute hospitals was carried out. Second, these indicators have been compiled into two different composite indicators on: 1) eHealth deployment and 2) eHealth Availability and Use. Deployment, in this context, is understood as the existence of infrastructure (i.e. broadband connection), applications (i.e. a computerised system for e-prescribing), systems (i.e.to exchange clinical information with other care providers electronically) and regulations (i.e. on security and privacy of medical data). Availability is understood as the level of implementation of eHealth functionalities across hospitals'

units while use is understood as the extent to which health professionals use the eHealth functionalities that have been implemented. The composite indicators are calculated at Hospital level before obtaining average country values, allowing us to build rankings of countries for both composite indicators. Given that the two surveys gathered comparable information in relation to eHealth deployment, it was possible to compute the related composite indicator for both years and therefore explore its evolution over this 2 year period. However, the questions that gathered information on availability and use of specific eHealth functionalities were introduced in the 2012 survey questionnaire which is why no comparison can be made with the 2010 survey. The construction of the composite indicators is based on standard methodologies, following recommendations from a specific handbook for this type of indicators (OECD and European Commission Joint Research Centre 2008). Nevertheless, different methodologies were used in the development of each of the indicators. This decision was grounded in the fact that the data available on each of the phenomena to explore (Deployment and Use & Availability) had different characteristics. Below is a brief summary of the methods used to develop these composite indicators[5]:

- The *indicator for eHealth Deployment* was based on 45 variables from the survey that provided information on characteristics related to the deployment of eHealth in each hospital. These variables were grouped in 4 dimensions: Infrastructure, Applications, Health Information Exchange, and Security and Privacy and factor analysis was used to weight the variables from the survey within each dimension. Each dimension was then given the same weight (0.25) in the final indicator.

- The *eHealth Availability and Use indicator* was based on information from the survey on the level of availability and use in each hospital of 39 different eHealth functionalities pertaining to 4 categories (17 to the "View/Input Information on EHR" category ; 6 to the "Clinical Decision Support on EHR" one; 12 to the "Health Information Exchange" category; and 4 to the "Telehealth" one). Scores were assigned to each of the possible answers, reflecting the information contained in these answers in relation to the levels of availability and use. Then, the indicator on eHealth Availability & Use for each hospital was calculated as the normalized sum of the multiplication of availability and use scores for each functionality. Furthermore, based on the same information, indicators that summarise the specific availability and use of a given eHealth functionality can be obtained for the whole sample and by country.

- For both indicators, the range of possible values is 0 to 1. This implies that, for instance, a hospital with positive answers to the 45 variables upon which the Deployment indicator is built would score a value of 1 in this indicator. Correspondingly, a hospital in which none of the 39 eHealth functionalities were available (or although available they were not being used) would obtain a score of zero in the eHealth Availability and Use indicator.

[5] For a more detailed description, please see the specific composite indicators report Sabes-Figuera, R. and I. Maghiros (2013). Composite Indicators on eHealth Deployment and on Availability & Use of eHealth functionalities. European Hospital Survey: Benchmarking deployment of e-Health services (2012-2013). Institute for Prospective Technological Studies (IPTS) - European Commission's Joint Research Centre (JRC).

4. Main Findings

4.1 Main Descriptive Findings

4.1.1 eHealth Profile at EU28+2 Level

Using 13 eHealth indicators derived from the specific answers to the questionnaire, an eHealth profile has been constructed for the whole sample of EU28+2 hospitals and is represented through a spider diagram. This diagram has scores ranging from 0 to 5, which respectively correspond to a 0% to 100% implementation rate. The 13 indicators cover the following 4 thematic areas:

Infrastructure: Externally connected, Broadband > 50Mbps and Single and unified wireless:

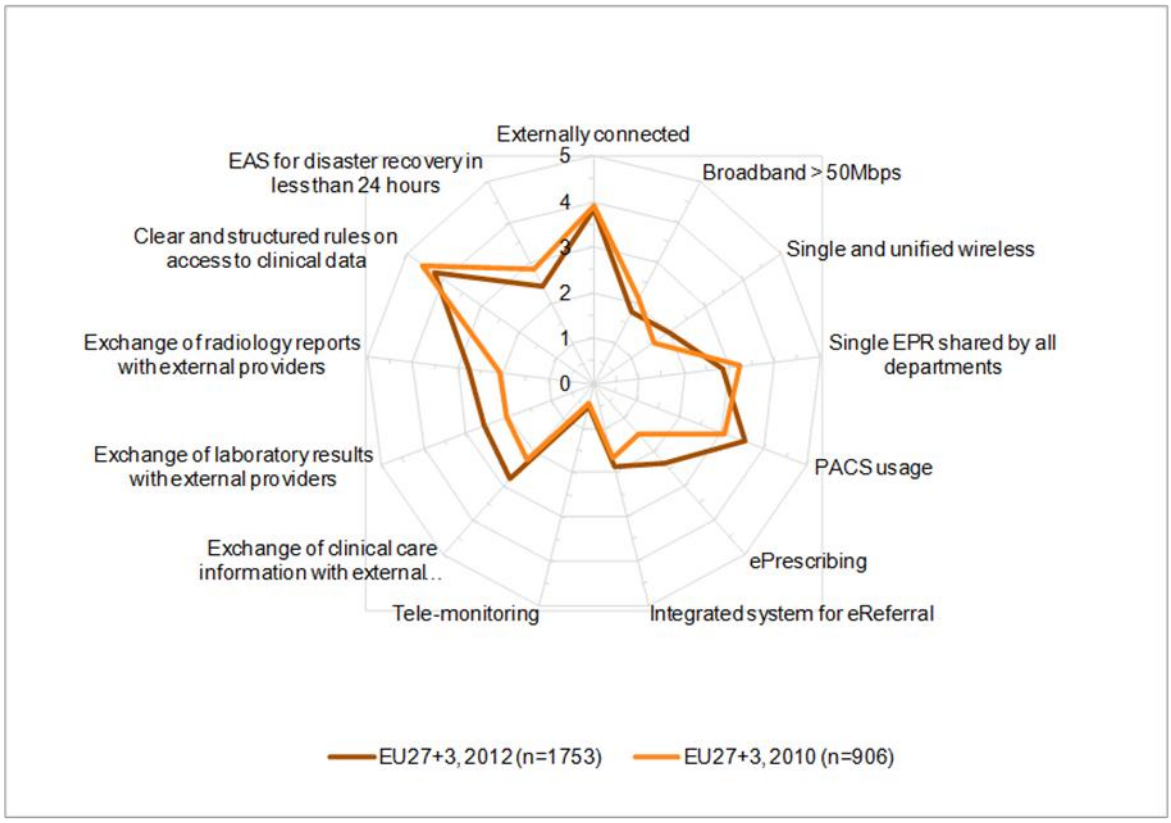
Applications: Single EPR shared by all departments, PACS usage, ePrescribing, Integrated system for eReferral and Tele-monitoring

Integration: Exchange of clinical care information with external providers; Exchange of laboratory results with external providers; and Exchange of radiology reports with external providers.

Security: Clear and structured rules on access to clinical data and EAS for disaster recovery in less than 24 hours:

Figure 1 displays the results of this exercise for both surveys, 2010 and 2012, being possible to visualize the evolution of eHealth capabilities at EU28+2 level over this 2-year period.

Figure 1: eHealth Profile of European acute Hospitals at EU28+2 level. 2012 and 2010.



4.1.2 Infrastructure and Governance

The 2012 survey collected information about relevant hospitals' characteristics in relation to specific infrastructure and governance in the eHealth field. Below there is a brief summary of some results of the descriptive analysis of this information. Detailed results are provided in the report that presents the descriptive analysis of the survey data (PWC 2013).

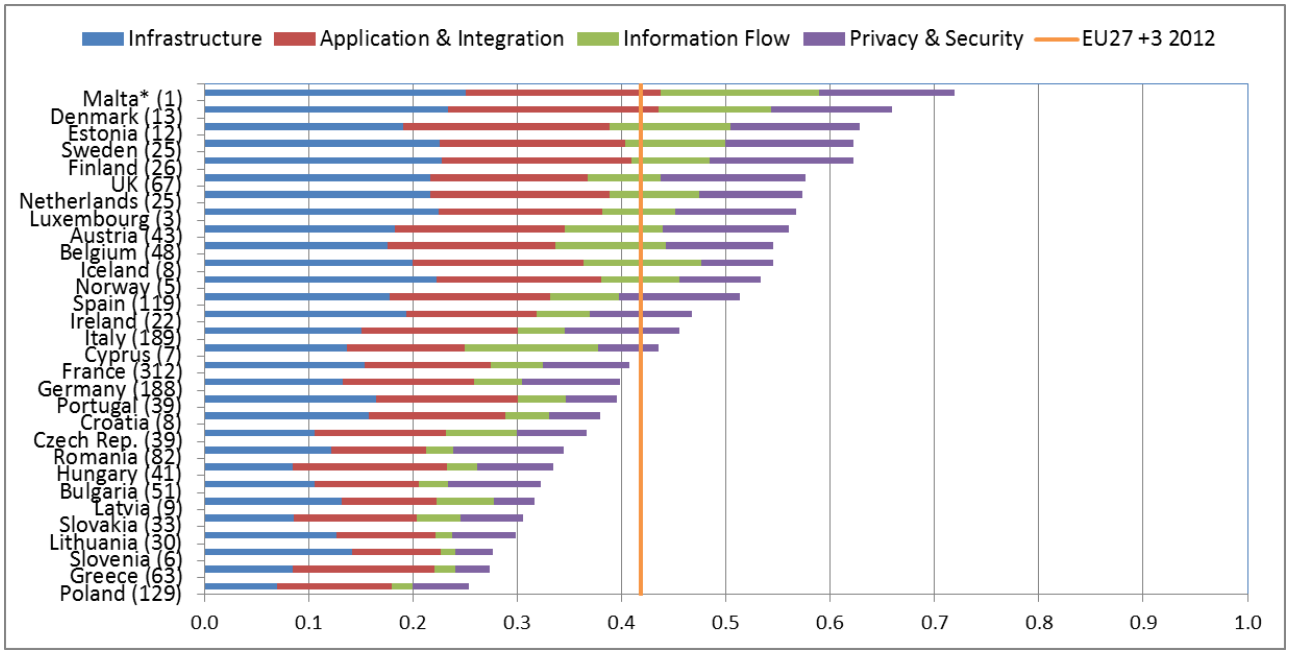
- On average, hospitals are **not yet sufficiently equipped in terms of bandwidth connectivity**, as over half (56%) have a broadband connection below 50 Mbps, and only **16% have a fast connection above 100 Mbps**. Eastern European countries generally accounted for a higher proportion of hospitals with a narrowband connection, while Nordic and Benelux countries recorded the highest proportion of hospitals with a fast broadband connection.
- Results regarding wireless communication are evenly distributed: **39% of hospitals have a single unified wireless network** able to support most applications, while **32% have no wireless communications**. The remainder have an individual wireless network.
- Almost **50%** of the surveyed hospitals have **videoconferencing facilities**. The countries where this proportion is the highest are mainly located in Northern Europe, whereas countries lagging behind are mostly located in Central and Eastern Europe.
- Most (**62%**) European acute care hospitals have **an independent hospital-wide computer system**. Among the 34% of hospitals with a computer system that is part of a network, a slight majority are connected to the systems of other hospitals, while the remainder are connected at national or regional level.
- Almost **80%** of the hospitals surveyed are **externally connected**, the majority of which use an extranet rather than a value-added network or proprietary infrastructure. Hospitals in Central and Eastern European countries are lagging behind in terms of external connections.
- A majority (**63%**) of the hospitals surveyed devote **less than 3%** of their **budget to IT**. Nordic hospitals generally allocate a higher proportion of their budget to IT than other hospitals.
- **Incentives tied to IT systems** implementation are **not very common**, as **28%** of hospitals surveyed receive such aids. Although no significant trends or differences were observed between countries, there are relevant differences between countries (9% of Hungarian hospitals received IT incentives while this figure for Croatian hospitals is 64%).
- A slight majority of hospitals (**57%**) have a **formalised strategic IT plan**. The presence of an IT plan is generally observed more often in Western and Nordic countries than in other countries.
- **73%** of hospitals have an **archive strategy for long-term storage and disaster recovery**. In some countries (Denmark, Luxembourg, Malta and Norway) all the hospitals have this strategy in place, while in countries such as Lithuania, Romania and Slovenia more than 30% of hospitals do not have it.
- **85%** of hospitals surveyed **have clear rules for accessing patients' electronic medical data**. Among the national level results, hospitals in three Nordic countries (Denmark, Finland and Norway) and Croatia stated that they have clear structured rules on accessing patients' electronic medical data. In contrast with these leaders, in Greece, Luxembourg and Lithuania, more than 30% of hospitals said they did not have any such rules.

4.2 Deployment and Use of eHealth in European Acute Hospitals

4.2.1 eHealth Deployment

2012 composite indicator result: The average score of the eHealth deployment composite indicator for the 1,643 hospitals finally included in the sample is **0.418**. As explained before, the score obtained is the result of aggregating the scores of the indicators of eHealth deployment with the same weight (i.e. 0.25) for each of the four dimensions. The average values for the whole sample of EU28+2 hospitals are 0.577 for the Infrastructure dimension, 0.532 for the Application & Integration dimension, 0.202 for the Information flow dimension and, finally, 0.361 for the Privacy & Security dimension. *Figure 2* displays the results at EU28 + 2 and country level for the indicators on the four dimensions and for the resulting composite indicator on eHealth deployment. It needs to be reminded that the country scores are the average of the scores of the hospitals of each country.

Figure 2: 2012 eHealth deployment composite indicator by country[6]



The results at country level display a significant level of variability between average country values in the four dimensions and in the global composite indicator on eHealth deployment. The top performers belong to Northern Europe, apart from Malta (the indicator for this country is based on data from one hospital only, meaning that the results might not be representative). The average scores for some of the most populated European countries, and consequently those with more hospitals in the sample (Germany, France, Italy and Spain), are situated in the middle of the ranking. Finally, countries from eastern Europe, and Greece, Latvia and Lithuania are those with the lowest average scores.

Evolution of eHealth Deployment (2010-2012): The results of the analysis show that there has been an increase in the deployment of eHealth in European acute hospitals over the period 2010-2012 of 0.03 (0.39 is the score of the composite indicator for the year 2010 vs. the value obtained for the year 2012, 0.42). *Figure 3* shows the average values of the composite indicator on eHealth deployment for each country for the year 2012 and the evolution of each country score in the

[6] The numbers in brackets next to the country names in the legend are the corresponding sample sizes (i.e. number of hospitals whose scores on the indicators have been averaged to obtain the country results).

period 2010-2012. It can be observed that only 8 countries have experienced a negative growth in their scores in eHealth deployment. A greater variability can also be observed in relation to the evolution of eHealth deployment among top performing countries (those situated in the top part of the graph) than in those with lowest scores (situated in the bottom one).

Nevertheless, when considering the results for all countries, we find slightly less variability between countries in 2012 than in 2010. In other words, **the gap between countries with acute hospitals that are more advanced with eHealth development (mostly Nordic countries) and those with hospitals that are less advanced in this respect (mostly eastern European countries and Greece) has been reduced**. This finding can be observed in Figure 3. Best performers countries (on the top of the figure) have growth less in average than countries less developed in eHealth (on the bottom of the figure)[7]. Thus this graphical representation shows that the variability between countries scores ("closing the gap") has decreased. In sum, according to the results of the composite indicator for the years 2010 and 2012:

- There has been an **increase in the deployment levels of eHealth in countries which had the lowest scores in 2010**.
- There has been a **decrease in deployment levels for the countries that achieved the highest scores** with the 2010 indicator.

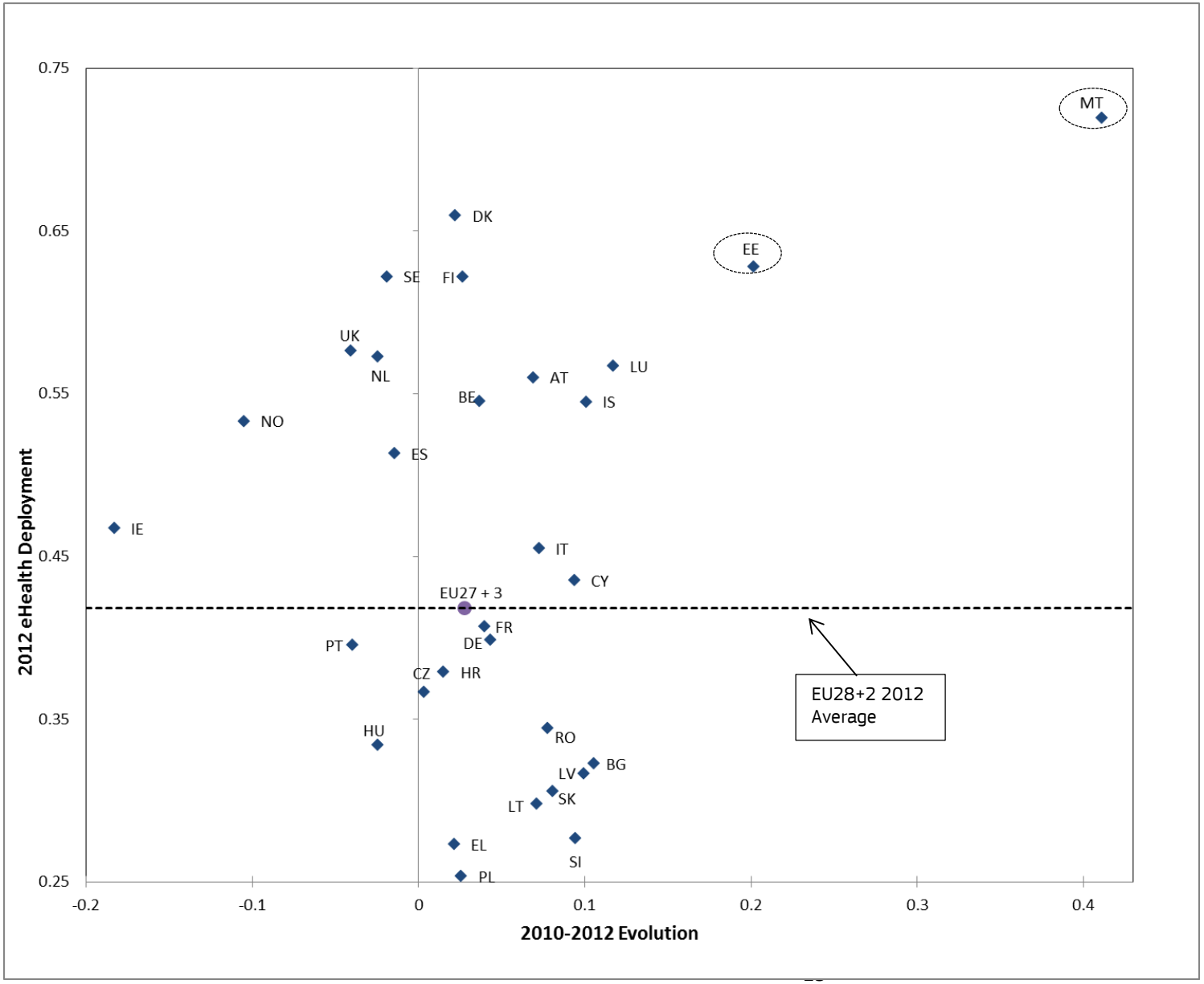
Nevertheless it should be added that most of the countries situated in the middle part of the ranking have experienced an increased in their levels of deployment in 2012.

Nevertheless, **these results should be taken with caution**. Given the variables used to build the eHealth deployment composite indicator, it is somewhat counterintuitive to observe such a decrease. Most of the eHealth functionalities and characteristics, once deployed cannot be "uninstalled". Therefore one of the reasons for this negative trend might be the higher number of hospitals included in each country sample in the second survey. In other words, although **samples are representative of the universe in each survey, they may not be totally comparable between the two years**. Further analyses and results from future surveys would be required to confirm or refute these findings.

Based on current levels of deployment, different groups of countries display distinct trends in eHealth deployment; it is therefore recommended to develop different eHealth deployment policies

[7] Results for Malta and Estonia should be taken with special caution given that Malta scores in 2012 and Estonia ones in 2010 were based on data from one hospital only in both cases.

Figure 3: eHealth Deployment in 2012 and evolution over the period 2010 2012.



Note:
Malta (MT) 2012 and Estonia (EE) 2010 scores were based on data from one hospital only in both cases, meaning that the results might not be representative.

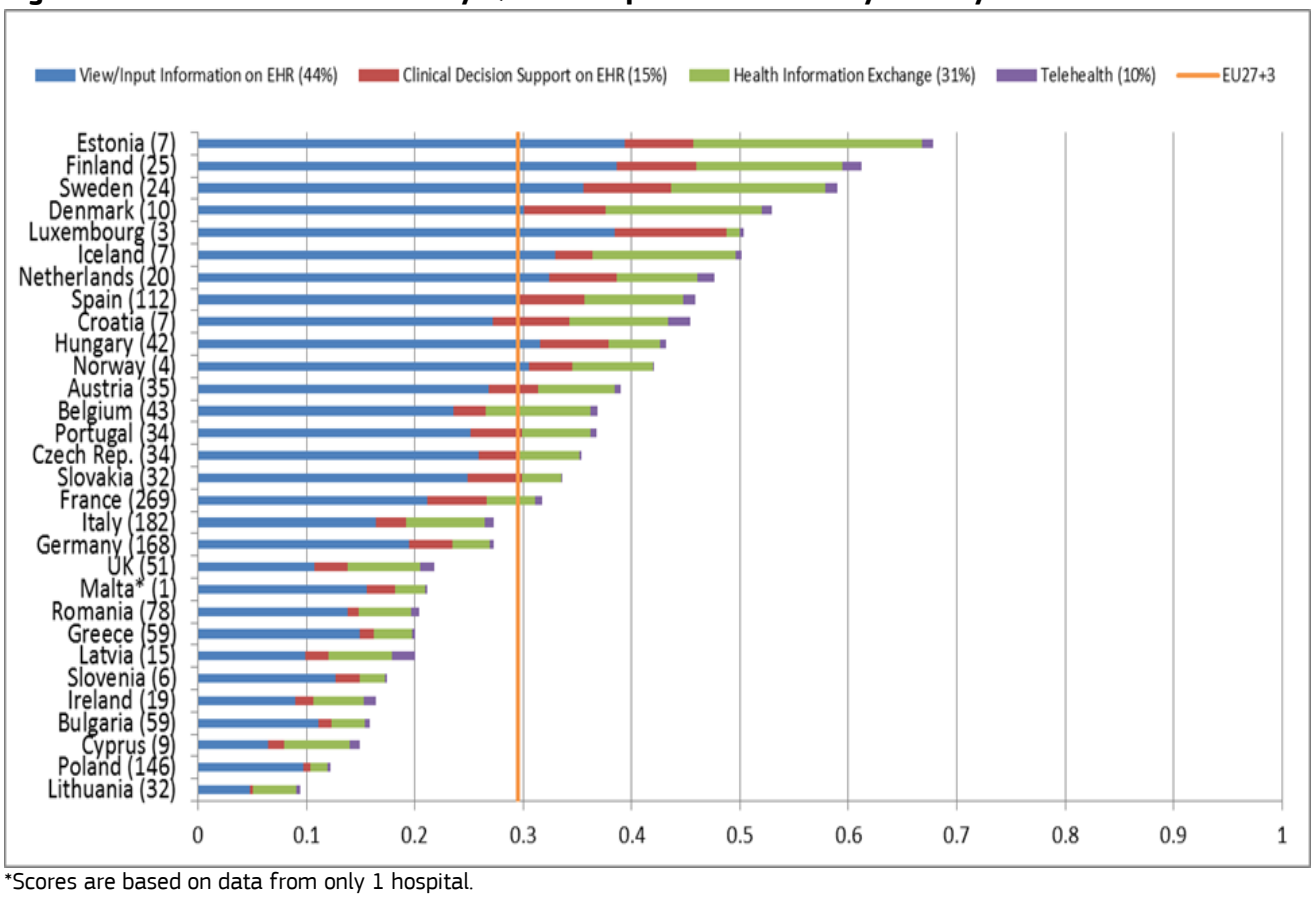
Points situated right of the vertical axis denote countries that have improved their scores between 2010 and 2012.

AT: Austria;
BE: Belgium;
BG: Bulgaria;
HR: Croatia;
CY: Cyprus;
CZ: Czech Rep.;
DK: Denmark;
EE:Estonia;
FI: Finland;
FR: France;
DE : Germany;
EL: Greece;
HU: Hungary;
IS: Iceland;
IE: Ireland;
IT: Italy;
LV: Latvia;
LT: Lithuania;
LU: Luxembourg;
MT: Malta;
NL: Netherlands;
NO: Norway;
PL: Poland;
PT: Portugal;
RO: Romania;
SK: Slovakia;
SI: Slovenia;
ES: Spain;
SE: Sweden;
UK: United Kingdom

4.2.2 eHealth Availability and Use

2012 composite indicator result: The average score of the composite indicator on eHealth Availability & Use for EU28+2 acute hospitals is **0.295** (*Figure 4*), meaning that there is still room for improvement in the availability and use of eHealth functionalities in Europe. Figure 4 displays also the composite indicator score by country, and the contribution of each category of eHealth functionalities to these values. Percentages in brackets close to the category names are the weights of each category in the composite indicator. The eHealth functionalities included in each category are displayed in *figure 5*. In terms of which categories of eHealth functionalities are developed and used in European hospitals, the one that includes functionalities allowing professionals to view or input information on Electronic Health Records has the highest score, with a value of 0.448 for availability and use. On the other hand, this indicator does not reach 0.07 when considering availability and use of Telehealth functionalities. The value, at EU28+2 level, for the category of Clinical decision support on EHR functionalities was 0.240, while for the category that includes Health Information Exchange functionalities was 0.181.

Figure 4: 2012 eHealth Availability & Use composite indicator by country[8]



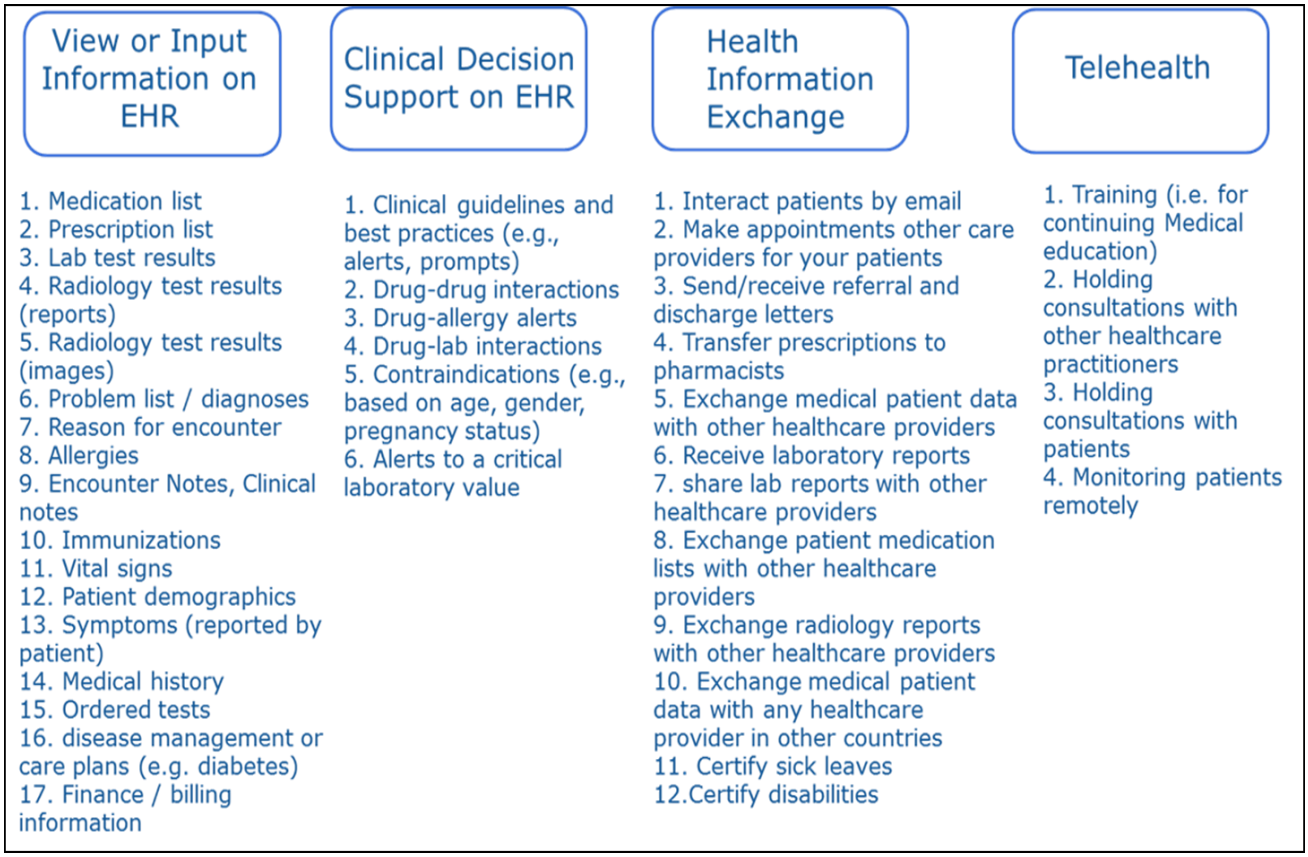
*Scores are based on data from only 1 hospital.

There is significant variability in the average scores by country and the pattern found in the results for the composite indicator on eHealth deployment in relation to country rankings is somehow replicated for eHealth Use & Availability. **Nordic countries and Estonia have the higher average scores** while **some eastern European countries as well as Greece and Poland**

[8] The numbers in brackets next to the country names in the legend are the corresponding sample sizes (i.e. number of hospitals whose scores on the indicators have been averaged to obtain the country results).

have the lowest. This result could be expected since the level of eHealth deployment conditions the level of availability and use of eHealth functionalities. In relation to hospital characteristics, bigger hospitals have on average higher scores but the type of hospital ownership does not have any impact on the levels of availability and use.

Figure 5: eHealth functionalities included in each category for the construction of the composite indicator on eHealth Availability & Use



Applications Are Being Used When Available: The potential benefits of eHealth in hospitals can only become reality if health care professionals make use of the available functionalities. Deployment or availability of eHealth is not good enough if these functionalities are not fully integrated in the day-to-day activities of care professionals and in care delivery. As mentioned earlier, our analysis found low scores, at country and EU28+2 levels, in the Availability and Use composite indicator. However, these scores are the result of aggregating information on availability and use of 39 different eHealth functionalities, i.e. a very large set of functionalities. It would therefore be useful to explore the data in a less aggregated way to draw more specific policy lessons. The level of availability was therefore calculated for each eHealth functionality and for the whole sample of the EU28+2 hospitals. The level of use was also calculated at EU28+2 level for each functionality but only including the hospitals for which the functionality was available.

Figure 6 displays the average levels of availability and use (when the functionality is available) of each of the 39 eHealth functionalities for the whole sample of European acute hospitals. The level of availability of each functionality (in a scale of 0 to 1) in hospitals is calculated for the whole sample and represented in the horizontal axis in Figure 6. Then, the average level of use of each functionality (again in a scale of 0 to 1) is obtained and represented in the vertical axis but only considering the subgroup of hospitals that reported that the specific functionality was available in

the hospital. As an illustration, in 59% of the hospitals was present the eHealth functionality of view or input medication lists. Then, the average availability value of 0.5 represented in Figure 6 (dot number 1) is obtained through weighting by the level of implementation across units within each hospital. Then, information about the use of this functionality only across hospitals and units where the functionality was available (thus including only 59% of the sample) was analysed to obtain the average level of use represented in the vertical axis of figure 6 (0.90).

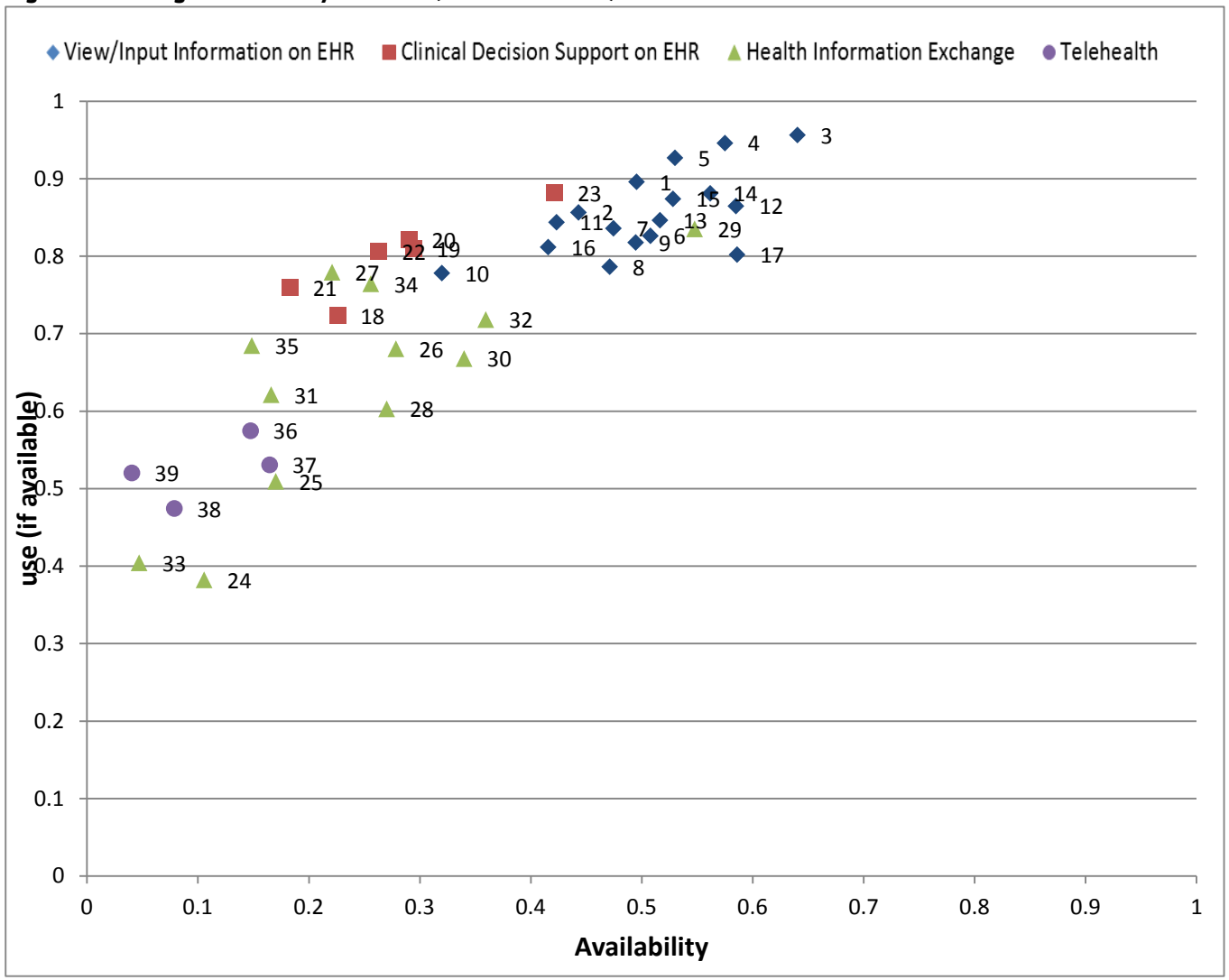
One finding highlighted through this graph is that the low scores found for the composite indicator on eHealth Availability & Use are explained by the **low levels of availability of functionalities**. The **use of these functionalities is quite high when they are available, for most of the functionalities[9]:**

- The two functionalities with the **highest availability** levels are those that allow viewing or inputting information about **laboratory test results (64%)** and about **financial or billing processes (59%**) on EHR.
- The two functionalities with the **highest usage** levels when they are available are those that allow viewing or inputting information about **laboratory test results (96%)** and about the **reports of radiology test results (95%)** on EHR**.**
- The two functionalities with the **lowest availability** levels are those that allow the **monitoring of patients remotely (4%)** and **the exchange of medical patient data with any healthcare provider in another country (5%).**
- The two functionalities with the **lowest usage** levels when they are available are those that allow the **Interaction with patients by email about health-related issues (38%)** and the **exchange of medical patient data with any healthcare provider in other country (40%)**.

The high levels found in the use scores might mean that most **healthcare professionals do integrate these eHealth functionalities in their clinical care routines**. The graph also highlights that although the use is high for almost all type of functionalities, there are still noticeable differences in use between functionalities. The availability and use of functionalities are grouped by category, and those related to view or input information on Electronic Health Records obtain the highest scores for both dimensions.

[9] The analysis by country shows that there are cases with 100% use of certain group of functionalities when they are available (Malta and Luxemburg for the Clinical Decision support functionalities and Croatia for Telehealth ones)

Figure 6: Average Availability and Use (when available) of eHealth functionalities



View/Input Information on EHR	21. Drug-lab interactions
1. Medication list	22. Contraindications
2. Prescription list	23. Alerts to a critical laboratory value
3. Lab test results	
4. Radiology test results (reports)	**Health Information Exchange**
5. Radiology test results (images)	24. Interact with patients by email about health-related issues
6. Problem list / diagnoses	25. Make appointments at other care providers on your patients' behalf
7. Reason for encounter	26. Send/receive referral and discharge letters
8. Allergies	27. Transfer prescriptions to pharmacists
9. Encounter Notes, Clinical notes	28. Exchange medical patient data with other healthcare providers and professionals?
10. Immunizations	29. Receive laboratory reports
11. Vital signs	30. Receive and send laboratory reports and share them with other healthcare professionals /providers
12. Patient demographics	31. Exchange patient medication lists with other healthcare providers
13. Symptoms (reported by patient)	32. Exchange radiology reports with other healthcare professionals / providers"
14. Medical history	33. Exchange medical patient data with any healthcare provider in other countries
15. Ordered tests	34. Certify sick leaves
16. disease management or care plans	35.Certify disabilities
17. Finance / billing information	
	Telehealth
Clinical Decision Support on EHR	36. Training
18. Clinical guidelines and best practices	37. Holding consultations with other healthcare practitioners
19. Drug-drug interactions	38. Holding consultations with patients
20. Drug-allergy alerts	39. Monitoring patients remotely

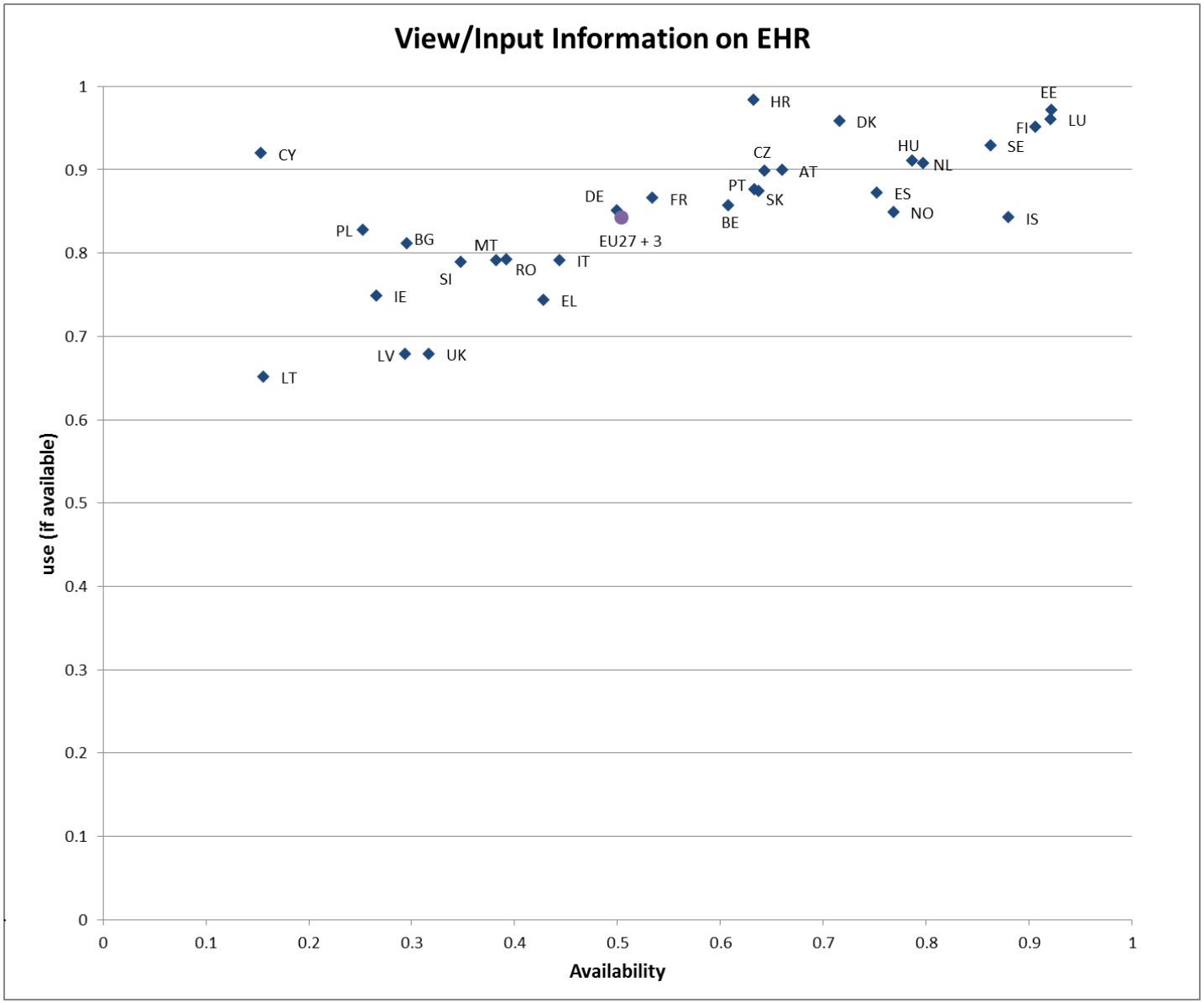
A similar variability can be observed when analysing availability vs. use by categories of functionalities and by country as shown in the graphs of *Figures 7-10*. Such analyses also reinforce the conclusion **that use is somehow independent of the levels of availability**. This finding is clearer for the functionalities allowing to **view or input information on EHR** and those that provide **support to clinical decisions** as in both cases **variability** in **use levels** between countries is **low**. For functionalities related to **health information exchange** and **Telehealth,** there is **less variability in availability levels and more in use levels**. For instance, in the case of functionalities to view or input information on Electronic Health Records, for very different levels of availability (e.g. Poland and Spain) similar levels of use can be found. However, for Telehealth functionalities, for similar levels of availability (Austria and UK) different levels of use are found.

Based on differences in availability and use between groups of eHealth functionalities, policies aiming to facilitate uptake should be differentiated:

a) For functionalities that allow health professionals to view or input information on Electronic Health Records and those that provide support to clinical decisions, the efforts should be focused on increasing availability among acute hospitals.

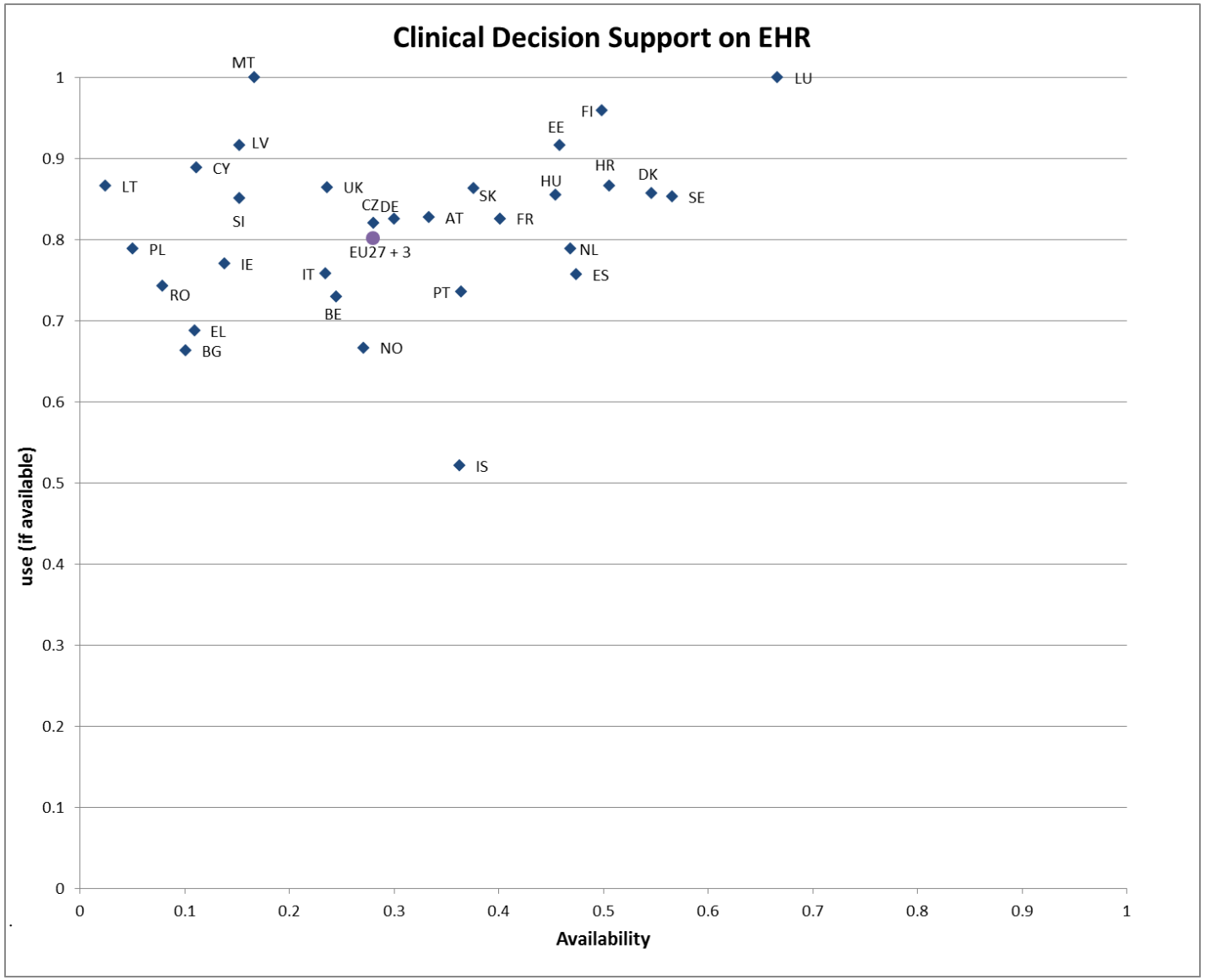
b) For functionalities related to health information exchange and Telehealth, the focus on availability should be complemented with measures designed to incentivise their use by health professionals, once these functionalities are available.

Figure 7: Availability and Use by functionalities categories and country



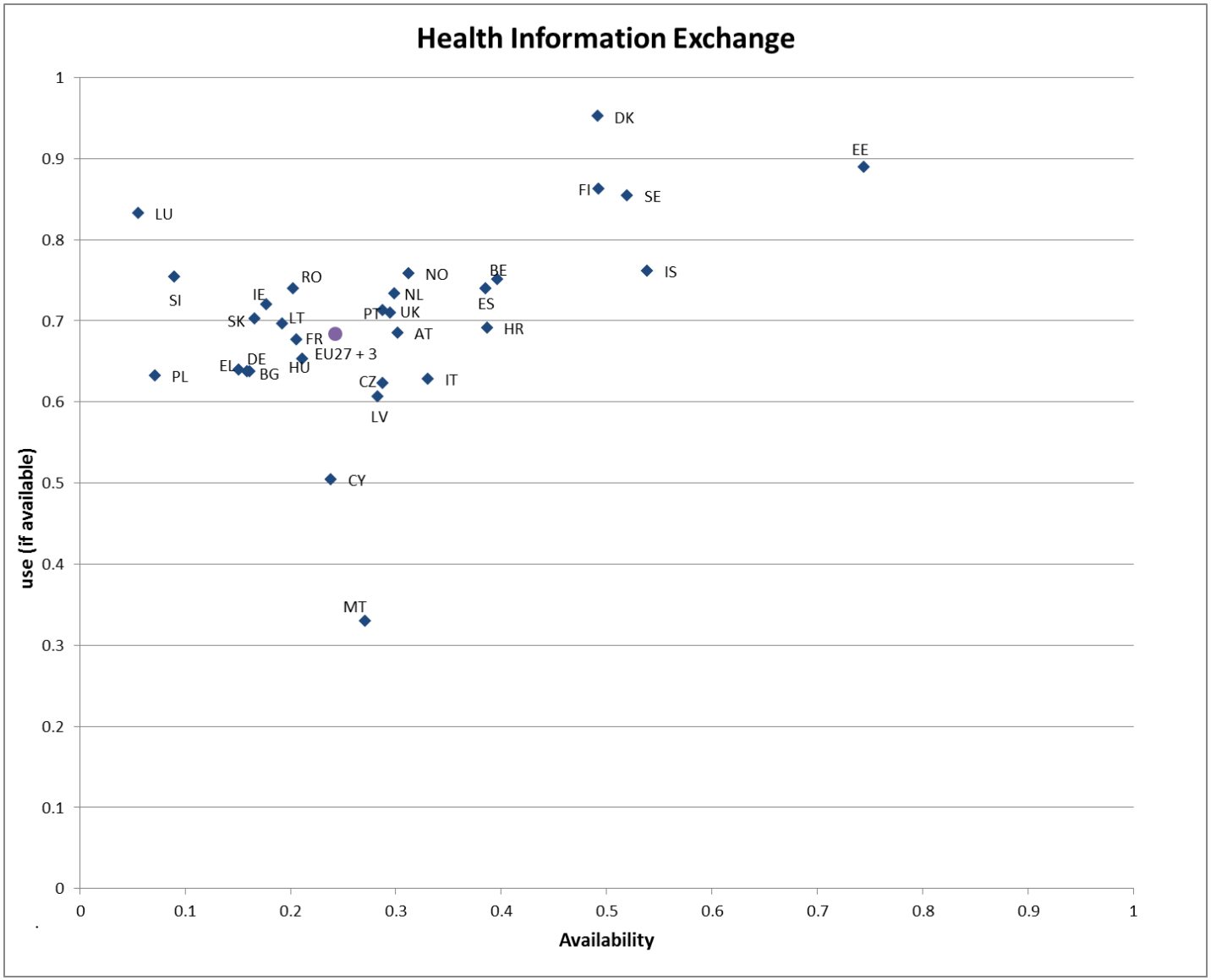
AT: Austria;
BE: Belgium;
BG: Bulgaria;
HR: Croatia;
CY: Cyprus;
CZ: Czech Rep.;
DK: Denmark;
EE:Estonia;
FI: Finland;
FR: France;
DE : Germany;
EL: Greece;
HU: Hungary;
IS: Iceland;
IE: Ireland;
IT: Italy;
LV: Latvia;
LT: Lithuania;
LU: Luxembourg;
MT: Malta;
NL: Netherlands;
NO: Norway;
PL: Poland;
PT: Portugal;
RO: Romania;
SK: Slovakia;
SI: Slovenia;
ES: Spain;
SE: Sweden;
UK: United Kingdom

Figure 8: Availability and Use by functionalities categories and country



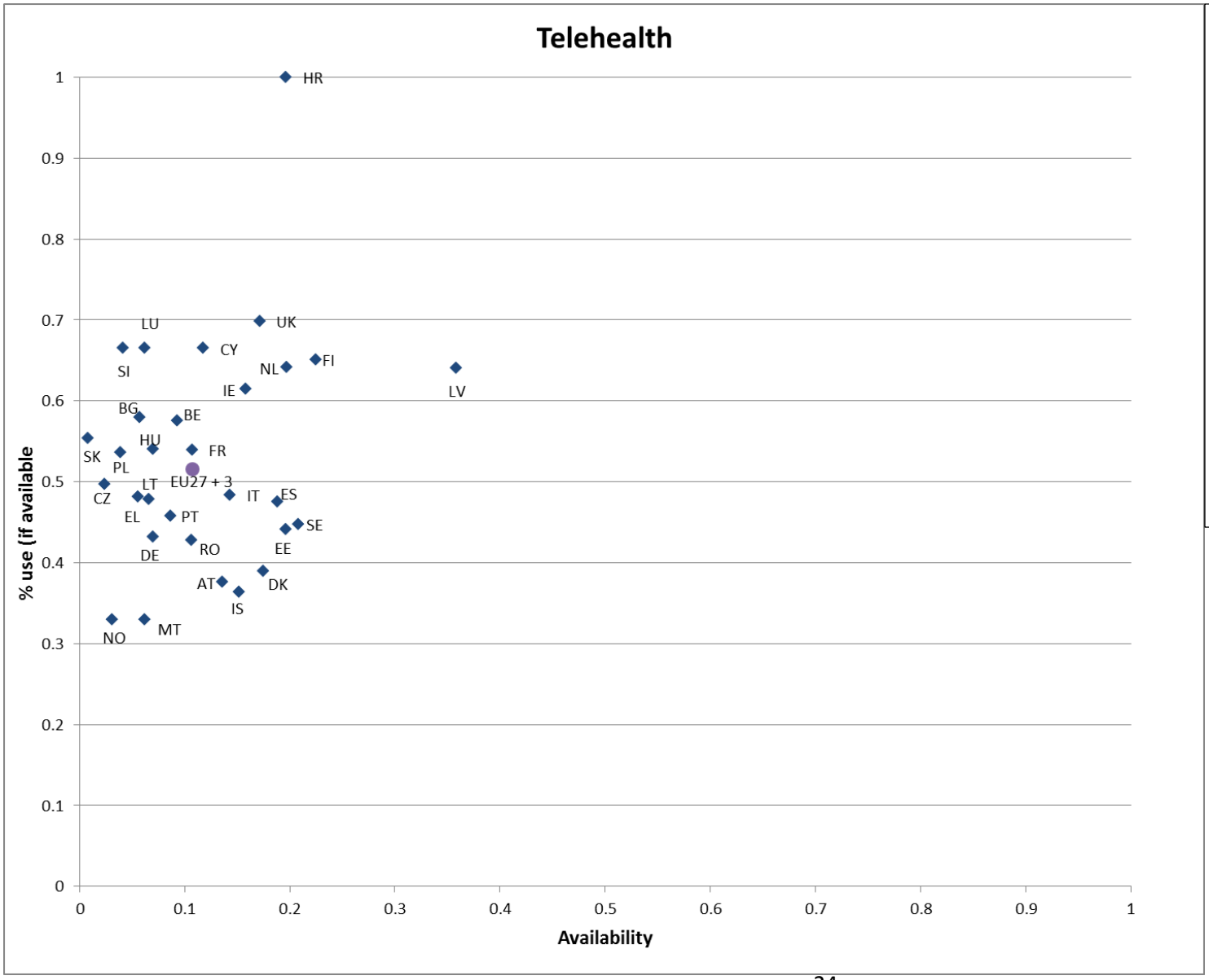
AT: Austria;
BE: Belgium;
BG: Bulgaria;
HR: Croatia;
CY: Cyprus;
CZ: Czech Rep.;
DK: Denmark;
EE:Estonia;
FI: Finland;
FR: France;
DE : Germany;
EL: Greece;
HU: Hungary;
IS: Iceland;
IE: Ireland;
IT: Italy;
LV: Latvia;
LT: Lithuania;
LU: Luxembourg;
MT: Malta;
NL: Netherlands;
NO: Norway;
PL: Poland;
PT: Portugal;
RO: Romania;
SK: Slovakia;
SI: Slovenia;
ES: Spain;
SE: Sweden;
UK: United Kingdom

Figure 9: Availability and Use by functionalities categories and country



AT: Austria;
BE: Belgium;
BG: Bulgaria;
HR: Croatia;
CY: Cyprus;
CZ: Czech Rep.;
DK: Denmark;
EE:Estonia;
FI: Finland;
FR: France;
DE : Germany;
EL: Greece;
HU: Hungary;
IS: Iceland;
IE: Ireland;
IT: Italy;
LV: Latvia;
LT: Lithuania;
LU: Luxembourg;
MT: Malta;
NL: Netherlands;
NO: Norway;
PL: Poland;
PT: Portugal;
RO: Romania;
SK: Slovakia;
SI: Slovenia;
ES: Spain;
SE: Sweden;
UK: United Kingdom

Figure 10: Availability and Use by functionalities categories and country



AT: Austria;
BE: Belgium;
BG: Bulgaria;
HR: Croatia;
CY: Cyprus;
CZ: Czech Rep.;
DK: Denmark;
EE:Estonia;
FI: Finland;
FR: France;
DE : Germany;
EL: Greece;
HU: Hungary;
IS: Iceland;
IE: Ireland;
IT: Italy;
LV: Latvia;
LT: Lithuania;
LU: Luxembourg;
MT: Malta;
NL: Netherlands;
NO: Norway;
PL: Poland;
PT: Portugal;
RO: Romania;
SK: Slovakia;
SI: Slovenia;
ES: Spain;
SE: Sweden;
UK: United Kingdom

4.3 Implementation of Electronic Health Records Systems

The implementation of electronic health records is often considered as a necessary condition for the further development of eHealth in primary and secondary care, and therefore for the full realisation of the quality of care and sustainability benefits that the use of these functionalities can bring to health care systems. **At European Level, 75 % of hospitals report having some type of electronic health records**. Further and more detailed exploration of what functionalities are available in these ICT supported systems leads to slightly different results. For instance, the functionality "view or input information **of laboratory test results on EHR"** is reported to be **available in 68%** of all hospitals, meaning that among hospitals with an EHR system, 10% do not have this functionality. Furthermore, if the availability of this functionality **is weighted by the level of implementation across units** within each hospital, the level found at EU28+2 level is equal to **64%**. And this functionality is the one with the higher implementation level across European acute hospitals. The values for another key functionality - the one that allows professionals to view or input information on EHR about the medical history of the patient - are 65% and 56% respectively, although these two basic eHealth functionalities should be available in any EHR system. The same goes for functionalities related to medication, allergies and clinical notes. The results about availability at European and country level, weighted by the level of implementation across units in each hospital for all the basic EHR functionalities, are displayed in *Table 2*. As for other findings of this analysis, there is high variability between countries in the availability of functionalities.

Table 2: eHealth functionalities: Availability percentage at EU28+2 level weighted by the level of implementation across units

View/Input Information on EHR			Drug-lab interactions	18%
Medication list	50%		Contraindications	26%
Prescription list	44%		Alerts to a critical laboratory value	42%
Lab test results	64%			
Radiology test results (reports)	58%		**Health Information Exchange**	
Radiology test results (images)	53%		Interact with patients by email about health-related issues	11%
Problem list / diagnoses	51%		Make appointments at other care providers on your patients' behalf	17%
Reason for encounter	47%		Send/receive referral and discharge letters	28%
Allergies	47%		Transfer prescriptions to pharmacists	22%
Encounter Notes, Clinical notes	49%		Exchange medical patient data with other healthcare providers and professionals?	27%
Immunizations	32%		Receive laboratory reports	55%
Vital signs	42%		Receive and send laboratory reports and share them with other healthcare professionals /providers	34%
Patient demographics	59%		Exchange patient medication lists with other healthcare providers	17%
Symptoms (reported by patient)	52%		Exchange radiology reports with other healthcare professionals / providers"	36%
Medical history	56%		Exchange medical patient data with any healthcare provider in other countries	5%
Ordered tests	53%		Certify sick leaves	26%
Disease management or care plans	42%		Certify disabilities	15%
Finance / billing information	59%			
			Telehealth	
Clinical Decision Support on EHR			Training (i.e. for continuing Medical education)	15%
Clinical guidelines and best practices	23%		Holding consultations with other healthcare practitioners	16%
Drug-drug interactions	29%		Holding consultations with patients	8%
Drug-allergy alerts	29%		4. Monitoring patients remotely	4%

Another interesting analysis is to explore the impact of the availability of key eHealth functionalities based on EHR (those within the **category "view/input information"**) on the availability of other eHealth functionalities (clinical decision support, Health Information Exchange and Telehealth). The objective is to explore the hypothesis that **higher availability** of these key functionalities **acts as a trigger**, as could be expected, **of the implementation of other types of eHealth functionalities**:

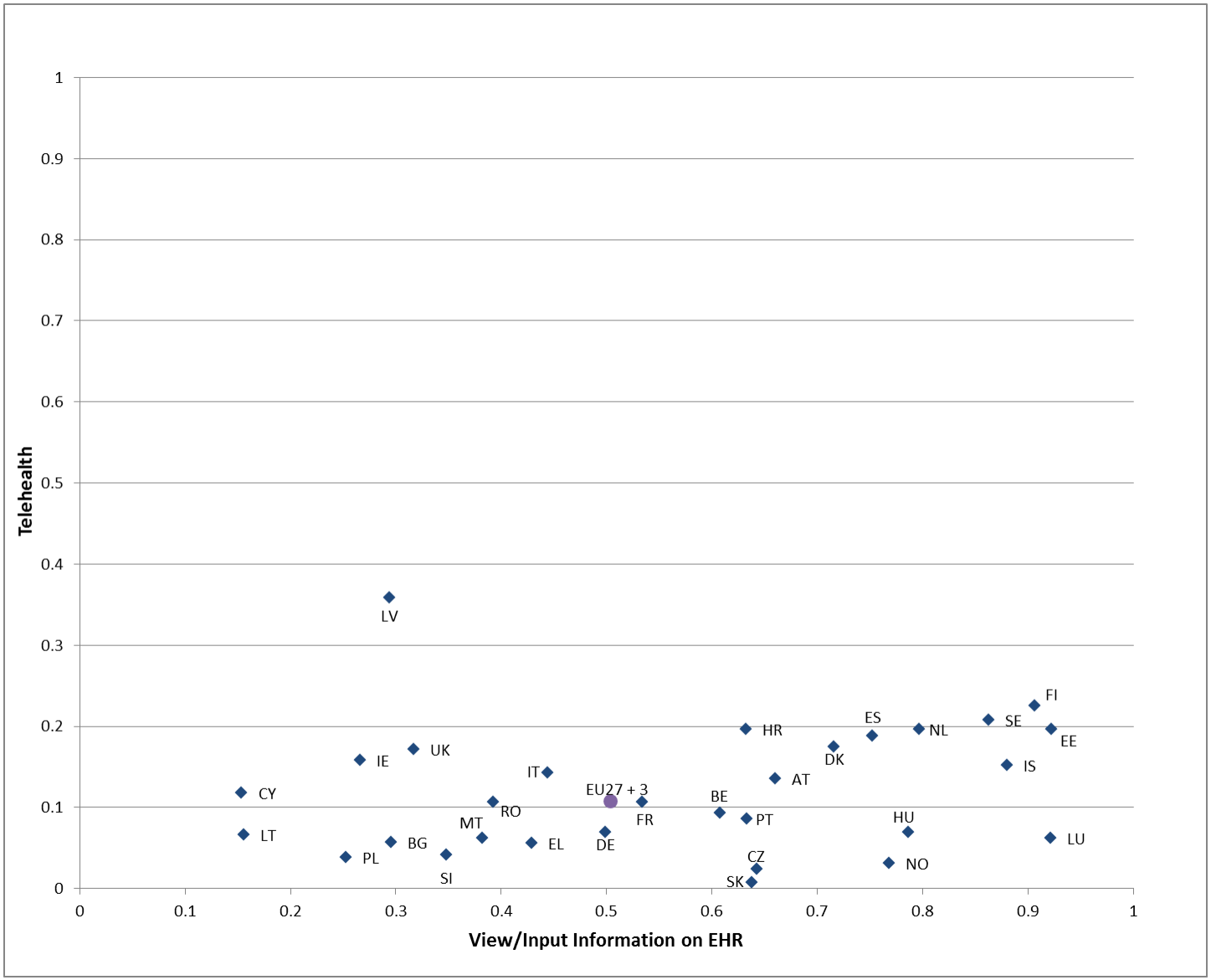
- In the case of **clinical decision support** functionalities, the above hypothesis is confirmed as the **correlation between its availability scores and those of the view/input information** is quite high, **0.68**, at hospital level.
- It is also the case, although to a lesser extent, for the **Health information exchange** category with a correlation coefficient of **0.44 between this category scores and those of the view/input information** category at hospital level.
- This pattern is not repeated for the Telehealth category. In this case, the **correlation** coefficient between the **view/input information availability scores and the Telehealth ones** is only **0.22**. This finding can be observed in *figure 11*, which shows the averages for the availability scores for these two types of functionalities per country.

To facilitate implementation of basic EHR view/input information functionalities further standardisation is needed.

The increased implementation of basic EHR view/input medical information functionalities has a positive effect on the uptake of clinical decision support and Health Information Exchange systems; in other words, policy action to facilitate basic eHealth functionalities is recommended.

Specific and complementary approaches would be needed to further diffuse Telehealth functionalities.

Figure 11: Availability of eHealth functionalities by country: View/Input information on EHR vs Telehealth



AT: Austria;
BE: Belgium;
BG: Bulgaria;
HR: Croatia;
CY: Cyprus;
CZ: Czech Rep.;
DK: Denmark;
EE:Estonia;
FI: Finland;
FR: France;
DE : Germany;
EL: Greece;
HU: Hungary;
IS: Iceland;
IE: Ireland;
IT: Italy;
LV: Latvia;
LT: Lithuania;
LU: Luxembourg;
MT: Malta;
NL: Netherlands;
NO: Norway;
PL: Poland;
PT: Portugal;
RO: Romania;
SK: Slovakia;
SI: Slovenia;
ES: Spain;
SE: Sweden;
UK: United Kingdom

4.4 Electronic Exchange of Medical Information

One of the potential benefits of eHealth is the improvement of the quality of healthcare services through more integrated care. The corresponding functionalities allow more effective and seamless communication between health professionals. This more efficient sharing of health information is likely to have a positive impact on the quality of care and on the efficiency of health care systems. Indeed care can be better coordinated and medical decisions improved through the availability to health professionals of complete medical records of patients, independently of the level of care and geographical location where these records were first created. Duplications of tests can also be avoided and the costs of complications and the risk of adverse events may be reduced. Furthermore, allowing patients to access their electronic health records and maybe enhancing these records with data on physical activity and life style could also result in better health care. In short, the objective of better information exchange is to provide patient-centred health care that departs from the traditional approach of a medical care system focussed on episodes and specific diseases.

According to the findings of the analysis of the 2012 survey data on eHealth, the level of deployment, availability and use of eHealth functionalities that allow professionals to share medical information is very low at EU28+2 level. *Table* 3 displays the percentages at European level of hospitals that share different types of medical information with other care providers electronically.

Table 3: Electronic exchange of medical information at EU28+2 level

Provider	Clinical care information	Laboratory results information	Medication lists information	Radiology images and reports
Hospital(s) outside own hospital system	39%	35%	17%	46%
External general practitioners	36%	33%	16%	26%
External specialists	33%	27%	12%	32%
Health care providers in other EU countries	4%	3%	2%	5%
Health care providers outside the EU countries	3%	2%	1%	3%
Other	3%	2%	2%	1%
None	43%	47%	70%	44%
Don't know	4%	4%	7%	3%

This information may also be aggregated to explore the electronic exchange of any type of information between the hospital surveyed and different care providers. The results from this exercise are discussed below:

- Almost **52% of the hospitals** surveyed **do not share** any medical information[10] with **external General Practitioners** electronically.
- In relation to the exchange of information between hospitals and **externals specialists**, the result is almost identical with **52% of hospitals** that **do not share** any type of information electronically.
- Electronic information exchange with **external hospitals** is not much better, with **40% of hospitals not sharing** information.

[10] Clinical care data, laboratory results, medication lists and radiology images and reports.

- When looking conjointly at these three possible types of communication between levels of care and providers, it was found that **30% of hospitals do not share** any medical information **with any external care provider.**
- The size of hospitals seems to have an impact on the sharing of information. Among **small hospitals** (less than 250 beds) **38% do not share information** with any external care provider while this figure **is 23% among bigger hospitals** (more than 250 beds).
- However, according to the data, the type of hospital ownership does not seem to affect the electronic sharing of information with similar proportions of hospitals that **do not share information** among **public hospitals (30%) and private** (non-profit and for profit) **ones (32%)**

These findings are quite surprising given that a good coordination between levels of care, especially between primary and secondary care, is thought to be essential for good clinical care. Nevertheless, it might be that the exchange of care information is done through the traditional paper way.

One could suspect that the reason for the lack of information sharing is related to the fact that such information is not produced or stored electronically. However, **almost all the hospitals (94%) that do not share information electronically** with any external care provider do **have medical information available electronically** [11] . Consequently, it does not seem to be a problem of availability of medical information in electronic format but much more a problem of having systems that allow the sharing of this information with other health care providers.

Nevertheless, the results for the same analysis at country level show a high level of variability between hospitals from different countries, which reflects the different levels of eHealth deployment between countries. As it can be observed in *Figure 12*, there are **countries where almost all hospitals share information** with external GPs and specialist (Estonia, Denmark, Belgium, Austria) while in **others** (Romania, Lithuania, Greece) the **majority of hospitals do not share information** with other healthcare professionals. *Table* 4 offers information on the percentage of hospitals by country that do not share electronically medical information but have systems to produce and/or store it. The data presented reinforces the message of the variability that exists between European countries in relation to sharing medical information between healthcare providers. It also highlights that **the challenge in all countries seems to be related to the systems** (or the lack thereof) **for sharing medical information, not for producing it**. The finding that smaller hospitals share medical information less often is also shown in Table 1. However, this analysis at country level offers further interesting results. In most of the **countries with low levels of electronic information sharing** (i.e. Greece, Romania, Poland or Bulgaria)**, there is no difference between big and small hospitals in terms of level of electronic information sharing**. However, in the majority of **countries where most of the hospitals share information electronically** (i.e. Germany, France or UK)**, the level of sharing is lower among smaller hospitals than among big ones.**

[11] Since they reported having a system of Electronic Medical or Health Records or a Picture Archiving and Communication System or other type of medical information as clinical test result etc.

Figure 12: Percentage of hospitals not sharing electronically information with external GPs and specialist by country

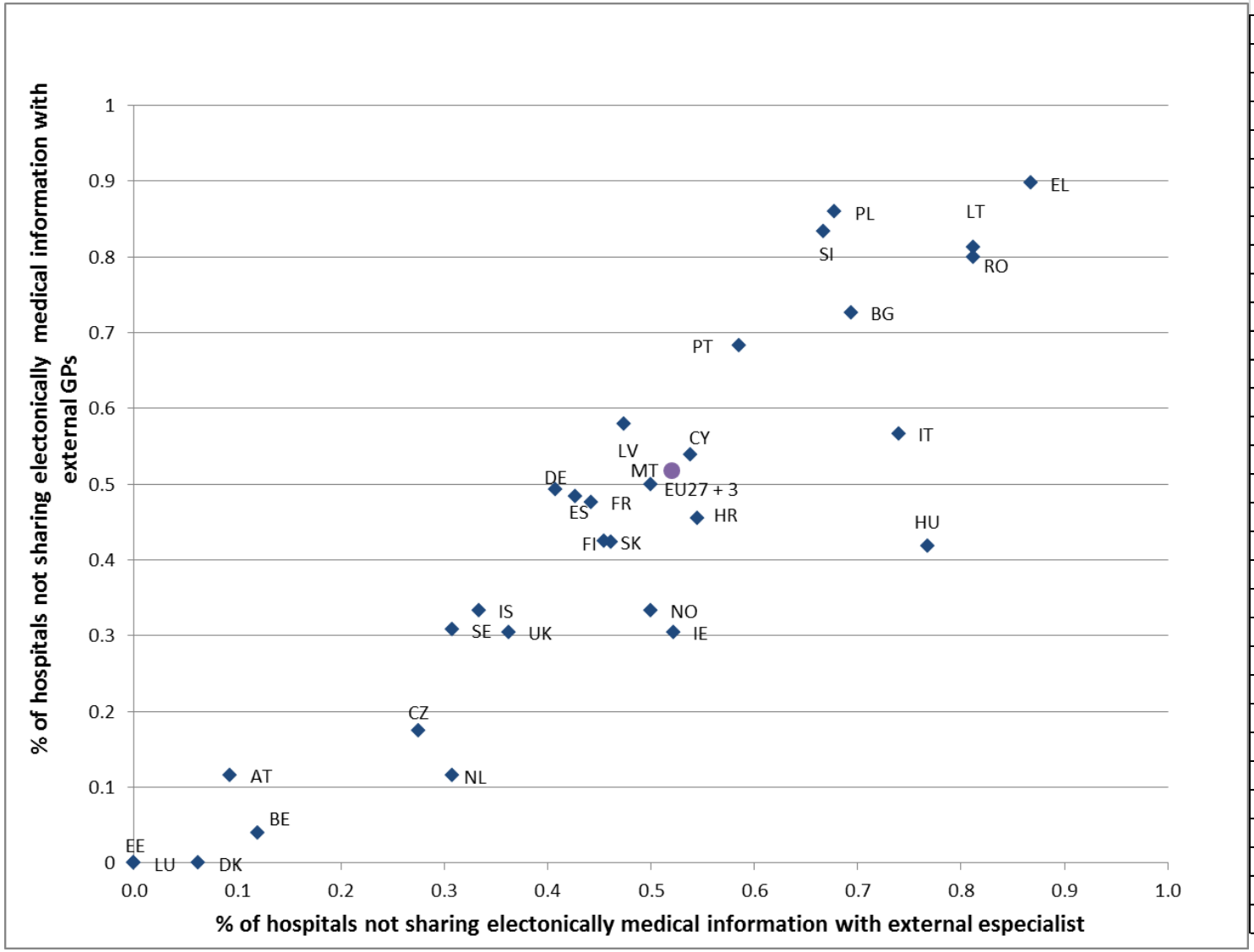
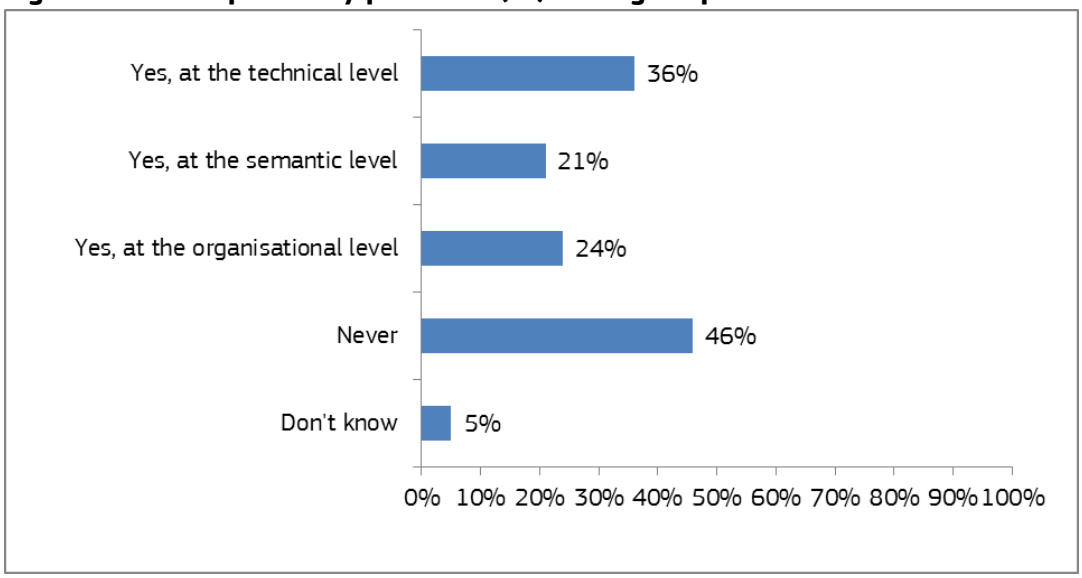


Table 4: Hospitals that do not share electronically any type of medical information and have systems to produce/storage it.

		% of	Distribution by size	
		all hospitals	<250 beds	>250 beds
AT	Austria	2.3%	0.0%	4.8%
BE	Belgium	4.1%	10.0%	2.7%
BG	Bulgaria	52.5%	54.3%	52.6%
HR	Croatia	18.2%	0.0%	25.0%
CY	Cyprus	30.8%	40.0%	0.0%
CZ	Czech Rep.	7.5%	17.6%	0.0%
DK	Denmark	0.0%	0.0%	0.0%
EE	Estonia	0.0%	0.0%	0.0%
FI	Finland	11.5%	17.6%	0.0%
FR	France	21.5%	31.6%	16.2%
DE	Germany	24.0%	34.3%	13.5%
EL	Greece	76.5%	77.8%	81.5%
HU	Hungary	30.2%	50.0%	17.9%
IS	Iceland	11.1%	12.5%	0.0%
IE	Ireland	13.6%	23.1%	0.0%
IT	Italy	25.4%	31.4%	22.9%
LV	Latvia	22.2%	18.2%	20.0%
LT	Lithuania	54.8%	70.0%	25.0%
LU	Luxembourg	0.0%	0.0%	0.0%
MT	Malta	50.0%	50.0%	50.0%
NL	Netherlands	0.0%	0.0%	0.0%
NO	Norway	33.3%	0.0%	0.0%
PL	Poland	44.1%	48.6%	46.7%
PT	Portugal	31.7%	48.0%	7.1%
RO	Romania	65.9%	70.3%	63.8%
SK	Slovakia	27.3%	30.8%	16.7%
SI	Slovenia	50.0%	66.7%	33.3%
ES	Spain	25.0%	27.6%	22.2%
SE	Sweden	0.0%	0.0%	0.0%
UK	UK	24.6%	33.3%	9.1%
EU27 + 3	EU27 + 3	28.7%	36.6%	22.3%

It is not possible to identify the reasons behind these low levels of electronic sharing of medical information from the survey data. However, it is quite likely that interoperability issues between systems at hospitals' and other health providers' might play a relevant role. Indeed**, among hospitals that use electronic patient records which share information between departments, 54% reported interoperability problems** at technical, semantic and/or organisational level as the most frequent problems (*Figure 10*). The hospitals that report interoperability problems are, as could be expected, those with higher scores in terms of eHealth deployment (according to the corresponding composite indicator).

Figure 13: Interoperability problems (%) among hospitals with EPR



Finally, in relation to eHealth and Integrated care, two noteworthy outcomes emerge from the analysis of the data, highlighting areas for policy analysis at European level. First, sharing medical information with health care providers located in other EU countries remains a challenge. **Less than 8% of the hospitals** included in the survey reported the **sharing of some medical information with other EU countries**. According to the data, it seems that hospital characteristics, size and ownership have an influence on the results. Bigger hospitals and private ones exchange medical information with health care providers located in other EU countries slightly more frequently. For instance, **13.3% of private hospitals with more than 250 beds carry out this type of medical information exchange, while only 4.7% of public hospitals with less than 250 beds** do so. There is not much variability at country level, as Cyprus, Croatia and Belgium are the only countries which report more than 20% of hospitals sharing medical information with other EU countries.

Second, healthcare systems may benefit from citizens' control over their own health, i.e. from citizens' empowerment in the field of health. Indeed citizens can also be producers of valuable data for the health care system thus contributing to the objective of achieving a more integrated care. A positive step into this direction could be to allow individuals to access their electronic patient records online. However, at European level, the **vast majority of hospitals (91%) still do not provide such access**. And those that do provide it mostly do so by only giving partial access to data with only **1.4% of the sample (24 hospitals) allowing individuals to access their complete health records online**. *Table 5* displays this information by country. These findings contrast with results from a survey done in the U.S. where 36% of individuals declared having full access to their Electronic Medical record (Accenture 2013).

Table 5: Patients' online access to their electronic patient records

	Yes, to everything	Yes, but only to certain data (e.g. results and protocols)	No
Malta	0%	100%	0%
Estonia	0%	75%	25%
Denmark	0%	62%	38%
Italy	4%	23%	73%
Spain	2%	19%	79%
Norway	17%	0%	83%
Belgium	2%	8%	90%
Hungary	2%	7%	91%
EU27+3	**1%**	**8%**	**91%**
Bulgaria	0%	8%	92%
Sweden	0%	8%	92%
France	2%	4%	93%
Romania	2%	4%	94%
Austria	0%	5%	95%
Ireland	0%	5%	95%
Latvia	0%	5%	95%
Portugal	0%	5%	95%
Finland	0%	4%	96%
Greece	0%	4%	96%
Netherlands	0%	4%	96%
Poland	0%	3%	97%
Lithuania	3%	0%	97%
United Kingdom	0%	1%	99%
Croatia	0%	0%	100%
Cyprus	0%	0%	100%
Czech republic	0%	0%	100%
Germany	0%	0%	100%
Iceland	0%	0%	100%
Luxembourg	0%	0%	100%
Slovakia	0%	0%	100%
Slovenia	0%	0%	100%

Fostering systems that allow hospitals to share existing clinical information with other healthcare providers, including those placed abroad, electronically might improve coordination of care between levels of care and providers.

Sharing experiences with addressing interoperability issues between systems within hospitals might help in developing internal and external systems of Health Information Exchange.

Promoting the online access of individuals to their health records might further improve citizens' empowerment in the field of healthcare.

4.5 Security and Privacy Measures

Security and privacy of medical information is a relevant subject given the complexity of this data and especially the confidentiality issues involved. Thus, the storing and electronic transmission of such information should be done in a secure way, respecting patients' right to maintain privacy and confidentiality over their personal health information. Nevertheless, the data protection measures taken must include considerations for timely and easy access to clinical information by the authorised healthcare professionals. Hospitals should have or should follow external regulations to guarantee the privacy and security of medical data. The survey results show that in **91% of EU28+2 hospitals** this type of **regulation**[12] is in place**.** Although 91% is a rather high value, it highlights that there is still room for improvement in this area given that in principle this type of regulations should exist in each and every hospital and should also be followed. In other words, a figure of 100% should be expected. **The lack of such regulation is more frequent in smaller** hospitals (less than 250 beds) in 13%[13] of them - compared to bigger hospitals where this percentage is 6%. Ownership characteristics do not have any influence on the existence of a security and privacy regulation.

Another way of exploring these issues in more detail is by analysing answers to two specific questions of the survey;

- First, the question of whether there are clear and structured **rules** on **accessing patients' electronic medical data**: in **85% of hospitals** such rules exist, again, **more frequently in bigger hospitals** (89%) than in smaller hospitals (81%). In **private hospitals,** the existence of these rules seems to be **more frequent** than in public ones, with 89% vs. 84% respectively.
- Second, and in relation to security measures that are taken to protect patient data, whether the **transmission** of this type of data is done in through **encryption**: in **58% of hospitals** this procedure is followed, also **more frequently in bigger hospitals**. *Table 6* displays the complete information on the security measures taken to protect patient data, at EU28+2 and by country.

These data protection issues might have an impact on the level of electronic exchange of medical information. It can be argued that these **security and privacy** regulations and measures, or specifically the **lack thereof**, may constitute a **barrier to the sharing of information** between health professionals. Analysing the results of the indicator on the level of availability & Use of health information exchange functionalities, we found that:

- **In hospitals without security and privacy regulations** in place **the level of health information exchange** availability and use is significantly **lower** (7.2%) than in hospitals where these are in place (19.1%)
- **In hospitals without clear and structured rules on accessing patients' electronic medical data**, the **level of health information exchange** is almost **half of** that found in hospitals that have these rules in place, 10.8% and 19.6% respectively.

[12] At national, regional or Hospital level.

[13] This percentage includes respondents who answered that there was no regulation and those who did not know.

Table 6: Security measures taken to protect the patient´s data

	Encryption of stored data	Encryption of transmitted data	Workstation with access through card	Workstation with access through fingerprint	Workstation with access through password	Data entry certified with digital signature	Other
EU28+2	**37%**	**58%**	**18%**	**3%**	**93%**	**30%**	**6%**
AT	40%	86%	26%	12%	95%	26%	7%
BE	28%	82%	20%	10%	92%	40%	8%
BG	37%	50%	10%	0%	92%	37%	2%
HR	36%	18%	18%	0%	82%	18%	0%
CY	38%	15%	8%	0%	69%	8%	8%
CZ	45%	50%	0%	0%	100%	15%	0%
DK	31%	44%	12%	0%	88%	88%	0%
EE	33%	83%	58%	0%	75%	58%	33%
FI	69%	77%	27%	4%	100%	31%	19%
FR	26%	62%	21%	1%	97%	37%	3%
DE	40%	69%	15%	3%	98%	25%	6%
EL	18%	16%	3%	0%	91%	10%	3%
HU	53%	51%	5%	0%	95%	5%	2%
IS	11%	56%	0%	0%	56%	11%	11%
IE	43%	70%	4%	0%	91%	22%	9%
IT	36%	57%	25%	1%	93%	53%	9%
LV	11%	21%	11%	0%	89%	16%	0%
LT	28%	34%	22%	0%	84%	38%	9%
LU	67%	33%	67%	0%	100%	33%	0%
MT	50%	50%	0%	0%	100%	0%	50%
NL	23%	69%	38%	8%	92%	23%	23%
NO	0%	50%	17%	0%	83%	17%	17%
PL	29%	38%	6%	1%	90%	7%	2%
PT	22%	24%	2%	22%	93%	5%	2%
RO	59%	85%	14%	2%	88%	59%	11%
SK	33%	52%	3%	0%	97%	9%	9%
SI	0%	0%	33%	0%	83%	0%	0%
ES	44%	68%	21%	2%	99%	38%	3%
SE	54%	62%	58%	0%	88%	42%	8%
UK	80%	62%	35%	13%	91%	12%	1%

AT: Austria; BE: Belgium; BG: Bulgaria; HR: Croatia; CY: Cyprus; CZ: Czech Rep.; DK: Denmark; EE:Estonia; FI: Finland; FR: France; DE : Germany; EL: Greece; HU: Hungary; IS: Iceland; IE: Ireland; IT: Italy; LV: Latvia; LT: Lithuania; LU: Luxembourg; MT: Malta; NL: Netherlands; NO: Norway; PL: Poland; PT: Portugal; RO: Romania; SK: Slovakia; SI: Slovenia; ES: Spain; SE: Sweden; UK: United Kingdom.

Consequently, incentivising full adoption by all hospitals of security and privacy measures is a target that might have benefits as well in the level of electronic HIE. Nevertheless, these **results should be taken with caution**. They only show that there is correlation between on the one hand lack of security and privacy regulations and rules and on the other hand lower levels of electronic health information exchange, which does not mean that the lack of security and privacy measures is the reason for the low levels of availability and use of HIE. Further analysis would be required to refute or confirm these findings.

Security and privacy measures in some hospitals still need to be brought up to standards and related legal issues should not be a barrier for the further development of electronic health information exchange

5. Conclusion

This report presents results and findings related to eHealth adoption and use in acute hospitals in all 28 EU Member States, Iceland and Norway. It is based on data from two hospital surveys that collected information on eHealth deployment and use; and on the results of composite indicators that were built based upon this data. These indicators were developed by IPTS through multivariate statistical analysis to enable benchmarking between countries, as such an exercise requires indicators on eHealth development that encompass different types of information and aggregately measure eHealth activity. Thus, the analysis of composite indicators offers aggregated and at the same time scientifically sound information to policy-makers to help them monitor and further develop eHealth policy.

The selection of areas to report results and to explore policy challenges was based on its relevance in the political agenda and on the significance of the results obtained. Nevertheless, as suggested in this report, further analysis of this hospital data combined with other sources of relevant information (macroeconomic data, health results, etc.) would help provide further knowledge that could help address the policy challenges identified in these areas as well as help identify further potential challenges.

6. References

Accenture (2013). "More than Forty Percent of U.S. Consumers Willing to Switch Physicians to Gain Online Access to Electronic Medical Records, According to Accenture Survey." Retrieved 07/10/2013, 2013, from http://newsroom.accenture.com/news/more-than-40-percent-of-us-consumers-willing-to-switch-physicians-to-gain-online-access-to-electronic-medical-records-according-to-accenture-survey.htm.

Deidda, M. and I. Maghiros (2013). European Hospital Survey: Benchmarking deployment of e-Health services (2012–2013). Methodological Report, Institute for Prospective Technological Studies (IPTS) - European Commission's Joint Research Centre (JRC).

Deloitte/Ipsos (2011). eHealth Benchmarking (Phase III): Final Report., Deloitte/Ipsos (for the European Commission): Brussels.

Dobrev A, e. a. (2008). Benchmarking ICT use among General Practitioners in Europe. , empirica (for the European Commission): Bonn.

European Commission (1999). eEurope, an Information Society for All, Communication on A Commission Initiative for the Special European Council of Lisbon, 23-24 March 2000, European Commission: COM (1999) 687 final, Brussels.

European Commission (2002). eEurope 2005, An information society for all: An Action Plan to be presented in view of the Seville European Council, European Commission: COM(2002) 263 final, Brussels.

European Commission (2002). eEurope 2005: Benchmarking Indicators., European Commission,: COM (2002) 655 final, Brussels.

European Commission (2004). e-Health - making healthcare better for European citizens: An action plan for a European e-Health Area, European Commission: COM (2004), Brussels.

European Commission (2005). i2010 - A European Information Society for growth and employment. , European Commission: COM (2005) 229 final, Brussels.

European Commission (2007). Accelerating the development of the eHealth market in Europe. eHealth Taskforce report 2007: Composed in preparation for the Lead Market Initiative, European Commission: Luxembourg.

European Commission (2010). A Digital Agenda for Europe., European Commission: COM (2010) 245 final, Brussels.

European Commission (2012). eHealth Action Plan 2012-2020 - Innovative healthcare for the 21st century. , European Commission: COM (2012) 736 final, Brussels.

European Commission (2013). SMART 2011/0033 Benchmarking deployment of eHealth Among General Practitioners II.

Hirshon JM, Risko N, Calvello E, Sarah Stewart de Ramirez S, Narayan M, Theodosis C, O'Neill J & for the Acute Care Research Collaborative at the University of Maryland Global Health Initiative (2013). Health systems and services: the role of acute care. Bull World Health Organ; 91:386–388

i2010 High Level Group (2006). i2010 Benchmarking Framework., Brussels.

i2010 High Level Group (2009). Benchmarking Digital Europe 2011-2015 a conceptual framework., Brussels.

OECD (2010). Improving Health Sector Efficiency: The Role of Information and Communication Technologies. Paris, OECD.

OECD and European Commission Joint Research Centre (2008). Handbook on Constructing Composite Indicators: Methodology and User Guide, OECD, Paris.

PWC (2013). European Hospital Survey: Benchmarking deployment of eHealth services (2012-2013).

Sabes-Figuera, R. and I. Maghiros (2013). Composite Indicators on eHealth Deployment and on Availability and Use of eHealth functionalities. European Hospital Survey: Benchmarking deployment of e-Health services (2012-2013). Institute for Prospective Technological Studies (IPTS) - European Commission's Joint Research Centre (JRC).

European Commission

EUR 26355 – Joint Research Centre – Institute for Prospective Technological Studies

Title: European Hospital Survey: Benchmarking Deployment of eHealth Services (2012 – 2013). Synthesis of Outcomes

Authors: R Sabes-Figuera, I Maghiros

Luxembourg: Publications Office of the European Union

2013 – 36 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN 1831-9424 (online)

ISBN 978-92-79-34776-4 (pdf)

doi:10.2791/55646

Abstract

A widespread uptake of eHealth technologies is likely to benefit European Healthcare systems both in terms of quality of care and financial sustainability and European society at large. This is why eHealth has been on the European Commission's policy agenda for more than a decade. The objectives of the latest eHealth action plan developed in 2012 are in line with those of the Europe 2020 Strategy and the Digital Agenda for Europe.

This report, based on the analysis of the data from the "European Hospital Survey: Benchmarking Deployment of e-Health Services (2012–2013)" project, presents policy-relevant results and findings in this field. The results highlighted here are based on the analysis of the survey's descriptive results as well as two composite indicators on eHealth deployment and eHealth availability and use that were developed using the survey's data. Although they are closely interrelated, these results have been grouped in four sections. They are presented in detail in this document.

LF-NA-26355-EN-N

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.

Publications Office

ISBN 978-92-79-34776-4

9 789279 347764