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Executive Summary

The conclusion form the literature review is that eHealth evaluation has not assigned a high priority to measuring or dealing with the economic and productivity factors. Most evaluations address only the cost side of applications and usually from the perspective of a single stakeholder. Few studies have tried to measure the benefits, direct gains, from using ICT in health and healthcare provision. The methodologies of these studies are very specific to the application they have been designed for. No generic methodologies for economic assessment of eHealth could be identified.

eHealth IMPACT developed such a generic methodology for economic assessment and evaluation of eHealth applications. It is a context adaptive model, so it fits a wide diversity of applications, from clinical settings to supply chain solutions. The model relies on the concept of cost-benefit analysis. Costs include the initial and continuous eHealth investments, such as those in ICT and change management, as well as healthcare running costs. Special attention has been paid to identifying the benefits to, and impact on, citizens. At the same time, benefits to all potential stakeholders can be analysed. The concept of cost-avoidance is important in identifying benefits. This is the cost for achieving the ICT-based performance without ICT, which is often prohibitive, i.e. such performance cannot be achieved without ICT.

Citizens want, and ageing societies will need, more and better healthcare, but public funds are limited, and many citizens cannot afford, or do not want to pay, more for it. For healthcare providers in modern healthcare systems, this is a challenge. The right approach to developing, implementing and using effective eHealth can help address this challenge. Healthcare providers can use eHealth to improve quality and expand their capacity to meet this increasing demand within available resources.

This is derived from findings of the eHealth Impact study, from applying the methodology of economic assessment to ten sustained eHealth services across Europe. These show that across a wide spectrum of applications, benefits from effective eHealth investment are indeed better quality and improved productivity, which in turn liberate capacity and enable greater access. Once development and implementation stages have been successfully realised, the value of these benefits, for what we have called a 'virtual health economy' consisting of the 10 evaluated cases, rises each year and exceeds the costs, usually very significantly. Annual costs are broadly stable once implementation has been completed, whereas net benefits tend to grow each year, showing that eHealth can contribute increasingly to satisfying citizens' needs and wants for healthcare.

Several factors have to be right for eHealth to succeed. The eHealth applications must focus on meeting particular needs, and change a particular clinical or operational process. Smart people and multi-disciplinary teams must be in place to drive the process of change needed to realise the benefits from eHealth. It is not enough to replicate the ICT component of a proven eHealth investment; the organisational component must be addressed too. eHealth applications should be part of an evolving series of investments to create a sustained eHealth dynamic.

Policy makers should ensure the effectiveness, and the right mix, of eHealth applications in order to achieve the goal of increasing benefits at broadly stable costs, as in our virtual health economy. To achieve this, they must support investment in eHealth, directly and indirectly, steer the mix of applications, and provide an appropriate legal and economic investment framework and environment that facilitates innovation.

Part IV:
Deliverable Content

1. Introduction

1.1 Objectives of the study

Despite the general availability of eHealth systems and services, they are not widely used in medical or healthcare environments across the EU. A major reason why European and national policy goals for eHealth applications have not been achieved so far is that very little reliable evidence is available on the economic impact of using ICT in delivering high quality healthcare. The impact is potentially enormous, but has been difficult to measure, especially some of the benefits. Evaluations often have only one perspective, such as financial, or the view of a single stakeholder.

eHealth IMPACT (eHI) addressed these shortcomings by:

- developing a generic, adaptable assessment and evaluation framework and method for eHealth applications and services, focusing on economic performance and measurement tools for quantitative indicators
- identifying good practice examples of eHealth applications across Member States and across the whole eHealth domain, integrating the experience and lessons learned from these examples into the method
- applying the method and measurement tools at ten sites, each with proven eHealth applications and reflecting the regional and health system diversity of the Union.

1.2 Study Description / Methodology

With the aim of providing an overview of eHealth activity across the EU Member States, within Workpackage (WP) 2 this study gathered and analysed information about good practice examples in eHealth. Despite various complications along the process, notably the moderate quality of secondary information and success in contact efforts, a good practice database with about 70 case descriptions is available online, on the project website, http://www-ehealth-impact.org, set up as part of WP5. The good practice cases were selected according to the criteria developed, described in deliverable D2.1, focusing on the economic aspects of using ICT in providing health, and a shortlist of 20 cases was selected.

After discussions with the Advisory Board of the study, 10 out of the 20 eHealth applications on the shortlist were selected for a detailed economic analysis, with the purpose to tests and refine the initial, context-adaptive, evaluation and assessment methodology developed in WP1. The selection was deliberately made so that it represents a wide range of applications, from eHealth in clinical settings to eHealth in the supply chain of consumables for healthcare institutions. This ensured that the final version of the evaluation methodology is indeed generic and context adaptive.

Within WP3, the method was first applied to two applications. These were NHS Direct Online in the UK and Kind en Gezin's vaccination database and Vaccinet applications in Flanders, Belgium. The model was then refined, based on the experience at the first two sites and used for evaluating the remaining eight sites. Deliverable D3.1 shows the performance of each individual site.

The eHI methodology was not created in isolation. Rather, through an iterative, stepwise approach it has been developed by the study team, applied, tested, adapted and improved

based on concrete experience and lessons learned together with the many colleagues and professionals involved at the local level at each site. The process of evaluating the ten sites and simultaneously continuously improving the eHI evaluation methodology proved to be much more demanding than initially anticipated. In many cases, data was hardly available, and it cost the study team significant effort to receive the trust of the people on-site and convince them of the merits of the evaluation. The efforts on behalf of the teams at each site were no less significant. The eHI evaluation turned out to be a time consuming activity, because data was often not readily available, and in none of the cases in a form suitable for direct use in the analysis. In two cases, these efforts were perceived as too demanding given other priorities of day-to-day business, and the cases had to be exchanged. This led to a considerable delay in the progress of the eHI study. We are extremely grateful to all who were involved in the eHI evaluations at the sites, as well to all members of the Advisory Board and the EC for their support and patience.

The diversity of applications came at the cost of having a limited quantity of data and information about each specific application field. This made drawing robust conclusions and transferable lessons out of the evaluations a challenging task. Ideally, at least five cases of eHealth use along the health and healthcare chain, including supporting services like logistics, and healthcare financing themes should be evaluated in order to analyse similarities and differences, general, and context specific lessons learned. Nonetheless, the results from all ten sites were analysed into a synthesis report (WP4). The results from each case show the - sometimes unexpectedly high - positive economic impact of eHealth systems and services. Aggregating them indicates a positive, sustainable economic impact in a virtual health economy over fifteen years, illustrating the potential of eHealth.

The next section of this deliverable summarises the findings from the focused review of the state-of-the-art in economic assessment of eHealth and the final methodological framework and approach of study, what we call the eHI method of evaluation. Section 4 deals with the economic findings of the ten detailed evaluations, including a 'virtual health economy' in which the ICT supported health services provided at all ten sites are put together. The importance of the findings in terms of economic potential of eHealth is illustrated and explained in Section 5. Section 6 addresses the core observations from the evaluations, including critical success factors, lessons learned, and the potential of transferability of eHealth applications. Some policy recommendation for medium and long run action, and suggestions for immediate first steps towards supporting and encouraging investments in effective eHealth are set out in Section 7. Annex 1 consists of short summaries of the ten cases evaluated in detail, while Annex 2 summarises the terms of reference of the eHealth Impact study.

2. Approach and methodology of economic assessment

2.1 State-of-the-art in economic assessment of eHealth applications

As a first step towards the development of a generic, context adaptive assessment and evaluation methodology for eHealth applications, this section summarises the results from a focused review of the state-of-the-art in eHealth economic assessment. The purpose was to describe, analyse and synthesise both the theoretical status and the application problems of assessment methods for eHealth systems and services. The aim was to provide a focused, pragmatic, and operations-oriented review of the state-of-the-art, guided by the requirements for developing the eHealth Impact model.

In line with the eHealth IMPACT (eHI) approach of being open to a vide range of services to health, and not just focusing on a concrete setting, such as hospital care, the definition of eHealth that best fits the purpose and goals of the study has been developed by the eHealth ERA project: "eHealth encompasses applications of ICT providing benefits to health". Health is "a state of complete physical, mental and social well-being and not merely the absence of

disease or infirmity"[1], thus allowing for a broader scope of applications than healthcare for already ill patients to fall under eHealth.

The soundest approach to evaluating the economics of eHealth will involve an economic model of health 'production'. The ultimate goal of healthcare is to maximise health, subject to environmental constraints. In order to solve this optimisation problem, one has to know exactly a) how health is 'produced', i.e. the health production function, and b) what exactly the constraints are. Constraints include the classical resources, labour and capital, budget constraints, political constraints, time constraints, the obligation to serve all, etc. ICT can relax the constraint on information flow. Danzon and Furukawa propose a production function including a range of interdependent variables, including medical services, patient's time, nutrition and lifestyle, the genetic makeup, and the social and environmental factors.[2] Taking their approach, the optimisation problem can be further developed to a dynamic form, allowing for ex-post evaluations, as well as ex-ante appraisals.

This theory-based approach is indeed intellectually sound, but unfortunately not constructive for practical purposes, because neither the position of ICT and eHealth, nor the way of measurement of all the variables of the production function can be agreed on. ICT can potentially affect all variables and sub-variables of the production function to different extents. Also, there is anything but a consensus on the actual shape of the function itself. Still, any pragmatic evaluation approach should draw its conceptual and analytical rigour out of this type of theoretical modelling. For example, productivity and productive efficiency will have to be measured in terms of unit costs, output-input, and cost-benefit ratios, but the underlying idea is to find out whether ICT can change the form of the production function.

Most of the evaluation studies in the literature focus on evaluating the impact of eHealth on a single stakeholder. However, using ICT in health-related services is most likely to affect several actors, such as citizens, healthcare providers, and insurances. For a true analysis of the overall impact of eHealth, it is important to design the eHI methodology from what the economic literature has labelled 'the social planner's perspective', i.e. accounting for the positive and negative impact on all possible stakeholders.

The conclusion form the literature review is that eHealth evaluation has not assigned a high priority to measuring or dealing with the economic and productivity factors. Methods to provide decision-makers with the kind of clear comparable present value or return-on-investment data on which they can reliably act are only just beginning to emerge. It has also been shown recently[3] that many evaluation studies are of limited value to others because they lack sufficient information to enable others to adopt the approach or test the conclusion. It is unclear how evaluations of this quality can generate knowledge that is of value to others.

Another problem with transferability is that assessments of health, including eHealth, investments are usually retrospective. Current evaluation research into eHealth has provided a very limited pool of evaluation knowledge from which to draw, in taking future investment decisions on applications of eHealth. A key source of methodological input is contained in

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1 Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948.

2 Danzon PM, Furukawa M (2000) e-Health: Effects of the Internet on Competition and Productivity in Health Care. The E-Business Transformation: Sector Developments and Policy Implications, A conference co-organized by BRIE, IGCC, & the Fisher Center at the University of California; Brookings-the Internet Policy Institute; the US Department of Commerce; and the OECD, 26-27 September 2000, Washington D.C.

3 Ammenwerth et al Visions and strategies to improve evaluation of health information systems Reflections and lessons based on the HIS-EVAL workshop in Innsbruck. International Journal of Medical Informatics (2004) 73, 479_491

recent additions to the UK Green Book[4]. The Green Book contains a longstanding protocol for investment decisions around public sector business cases, which includes health services. The approach has been recently enhanced with a five case model for eHealth[5] to ensure that decision taking about investment in eHealth is as robust as in other domains of public service. The methodology relies on the integration of several dimensions of investment, including strategic, economic, financial, commercial, and management. It should be emphasised that the Green Book does not offer the complete solution to evaluation and assessment of eHealth. In particular it provides no model to evaluate previous eHealth decisions on the false assumption, that ex-post evaluations are non-problematic because data is available. Nevertheless, the Green Book is a key starting point for the approach of the eHI study.

The literature provides a range of tools and supporting techniques for economic assessments of eHealth applications. The main economic tools are Cost benefit analysis (CBA), Cost utility analysis (CUA), Cost effectiveness analysis (CEA), and Cost minimisation analysis (CMA). Supporting techniques include Marginal Net Present Value calculation (MNPV), Discounting (Present Value calculations), Payback period and breakeven point, Affordability gap analysis (AGA), Utilisation review (UR), Value chain analysis (VCA), eHealth utilisation (EHU), Different types of costing, and Contingencies.

The appropriate mix of techniques for the purposes of eHI has been identified to include Cost benefit analysis, Payback period / Break even point, Total absorption costing, including activity based costing where appropriate, eHealth utilisation, Discounting (PV), Value chain analysis, Utilisation review, and Contingencies.

There are serious limitations to the availability and quality of the information required for rigorous evaluations of eHealth. The clinical impact is seldom evaluated with before and after studies that adopt the rigour of prospective clinical randomised controlled trials. The cause and effect of eHealth is seldom disentangled from other factors, such as new clinical and scientific techniques and working practices. Few before and after studies in productivity, utilisation and operational performance are completed. Some imprecision on definitions and identification of eHealth users is inevitable. Most eHealth applications are ongoing in their development and need to be frozen at a point in time for the evaluation to be completed. This forces evaluations to rely to some, often large, extent on estimates and proxy data.

2.2 Recommendation for common assessment approaches – the eHealth IMPACT methodology

The methodology needed for the eHealth IMPACT study was identified from of the focused review of the state-of-the-art of economic evaluation techniques and assessments of ICT applications in healthcare. Cost benefit analysis (CBA) became the preferred economic concept. Each eHealth application is approached from an economic perspective, identifying, in a comprehensive manner, all relevant costs and benefits for all stakeholders: citizens, healthcare provider organisations (HPOs), eHealth providers, and third party payers. The method focuses on measuring net economic gains, the difference between the economic values of direct benefits minus the identified costs; eHealth utilisation, defined as the usage of the service that is supported by ICT; and productivity. Productivity is measured by changes in the unit cost of the service provided. Economic variables are followed through three periods in the life-cycle of the eHealth application: planning and development, implementation, and routine operation. The method can be used both for ex-post evaluation and ex-ante assessment

[4] HM Treasury (2003): The Green Book, Appraisal and Evaluation in Central Government. Treasury Guidance, London: TSO, January 2003, http://www.hm-treasury.gov.uk/media/785/27/Green_Book_03.pdf

[5] Capital Investment Manual www.doh.gov.uk, Making Sense of Public Sector Investments: The 'five-case mode' in decision making C A Smith and J Flanagan, Abingdon, Radcliffe Press, 2001

based on past experience and expert forecasts of future values. In our case studies, forecasts were obtained up to 2008.

Costs are divided into two main categories: investment costs and costs of running the healthcare related service. eHealth investment includes initial and replacement costs for ICT hardware and software, and costs of process and organisational change. Operational costs include mainly staff costs, for professionals and support staff, and related other healthcare process costs. Benefits are identified from the respective stakeholder groups involved. They cover three main categories: quality, access and efficiency. Quality includes the following subcategories: informed citizens and carers, information designed around the citizen, timeliness of care, safety, and effectiveness.

To allow for an economic assessment, all benefits are assigned a monetary value. Where estimations are required, these are based on conservative assumptions. Willingness to pay (WTP), inferred from behaviour, is the main estimation method used in eHI evaluations for the monetary value of intangible benefits that have no market price. All monetary values are converted into comparable measures by presenting them in present values.

The extensive use of estimated values, indispensable for a pragmatic approach to measuring the impact of eHealth, requires adjustments for optimism bias and contingencies. The size of the adjustment depends on the availability and quality of the actual estimates. A sensitivity analysis further helps test and verify the results for possible weakness of the available data.

Technical tools of the methodology are a spreadsheet data collection and analysis model and a text-based description template to facilitate data collection and results presentation.

2.3 Proven eHealth applications

The eHI methodology was not created in isolation. Rather, through an iterative, stepwise approach it has been developed by the study team, applied, tested, adapted and improved based on concrete experience and lessons learned together with the many colleagues and professionals involved at the local level at each site. Across the European Union, ten sites with proven eHealth applications were selected to be evaluated in detail, and thus demonstrate the economic impact of effective eHealth services.

All ten sites show a positive economic impact on citizens and healthcare providers by providing information to support a direct healthcare activity, or for associated administrative and operational services. The overall economic costs and benefits, and the timing of realising positive net benefits, were not known until they were identified as part of the eHealth Impact evaluation.

3. Summary of findings

3.1 Economic impact

All ten cases show a positive economic impact, measured as a net benefit at present values. High-level measures are listed in Table 1. The ranges of the results are very wide, reflecting the material differences between each type of eHealth application.

TABLE 1: SUMMARY OF ECONOMIC FINDINGS ACROSS 10 SITES UP TO 2008

	average	min	max	range
Distribution of benefits				
Citizens	43%	1%	96%	95%
HPOs	52%	4%	99%	95%
Third party payers	5%	53%	53%	0%
First year of annual net benefit	4	2	7	5
First Year of cummulative net benefit	5	2	8	6
Decrease in unit costs	51%	9%	97%	88%

3.1.1 First year of net annual benefit

For the ten cases together, the present value of annual benefits exceeds annual costs, also in present value terms, for the first time in year four, on average. The earliest achieved annual net benefit is in year two, and was achieved by three of the ten cases: the teleradiology consultation service between Sweden and Spain supported by Sjunet, the electronic Gesundheits [Health] Card Europe (GCE) service of AOK Rhineland and the storage and supply chain support system delivered by Medical Order Centre (MOC). Cases with the longest timescales to the first year of net benefit are Institut Curie's Elios and Prométhée, its electronic patient record and search meta-engine, and IZIP's Internet-based, nation-wide citizens' health record systems. These took seven years for the benefits to exceed costs for the fist time. Longer time scales are largely due to the complexity of the eHealth settings and the lack of experience to draw from when addressing the complex challenges in such a new and innovative way, during the 1990s. In cases where the eHealth application is upgrading or modifying an already existing service, expenditure on eHealth investment is usually needed during the development stage, in addition to the running costs of the existing service without eHealth. Benefits can only be realised after the application has been implemented, or it is in routine operation. For the ten cases, benefits were realised very shortly after implementation was completed and utilisation was underway.

With respect to utilisation, different patterns have been observed: sometimes the service reaches a high to very high usage rate within a short period of time, particularly when supporting or expanding an already existing service. In cases where a new service is introduced, it may take quite some time to gain ground, and only after a critical mass has been achieved and effects of network economics start to work.

3.1.2 First year of cumulative net benefit

When the present values of annual costs and benefits are accumulated, the time needed for total benefits to exceed total costs associated with an eHealth application can be identified. For the ten cases, this is in year five, on average. The fastest achieved cumulative net benefit is Sjunet teleradiology application, in year two. This is due to pre-existing ICT applications, which allowed teleradiology between Sweden and Spain to be implemented without substantive investments. Institut Curie and IZIP needed eight years to realise a cumulative net benefit. Differences are mainly due to the nature of the eHealth investment, its healthcare setting, the time taken to reach high utilisation volumes, or the duration of development.

Once the cumulative benefits exceed the costs, the gap between them is sustainable. This is the most distinctive, common feature of the economic impact of all ten proven eHealth applications.

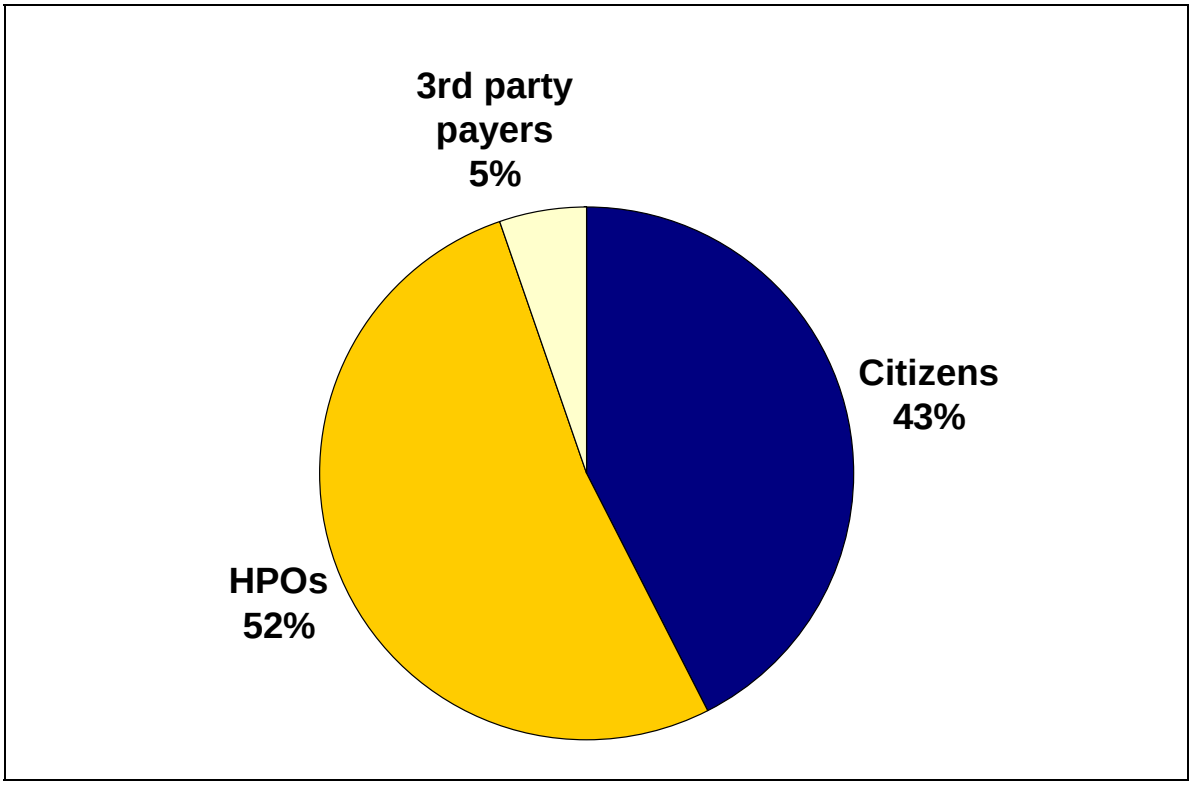
3.1.3 Distribution of benefits

Citizens and HPOs are the two main beneficiaries, as shown in Chart 1. There is a wide range of benefit distribution. On average, citizens receive about 43% of the eHealth benefits

directly. HPOs receive about 52%, which supports an economic case for the role of HPOs in investing in eHealth.

Direct benefits in terms of positive gains or cost avoidance to insurance companies and other third party payers occur at a substantial level in one of the ten cases only, IZIP, which explains the low proportion of summary benefits credited to these stakeholders. Third party payers sometimes experience direct expenditure savings and indirect, second order, effects, which show up on the cost side of the evaluation. These are not included in the distribution of benefits shown in Chart 1.

CHART 1: AVERAGE DISTRIBUTION OF BENEFITS ACROSS 10 SITES FROM 1994 TO 2008



3.1.4 Utilisation

Utilisation is a core determinant of benefits. The cases revealed two types of utilisation curves:

- Steady increase over a longer period of time, either gradual, or at an increasing rate
- Rapid surge in a short time period as implementation moves into operation.

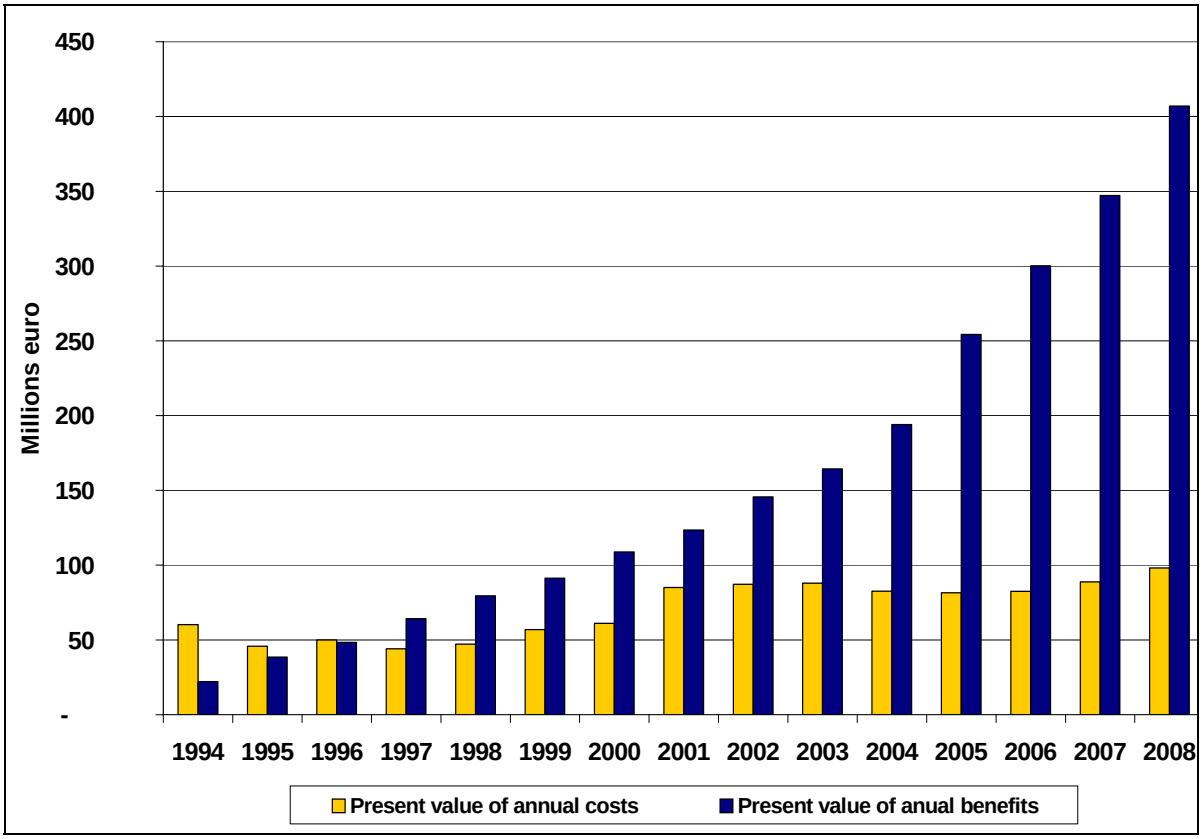
A steady increase reflects the gradual roll out of an eHealth solution. These were found in NHS Direct Online, Danish Health Data Network, eRecept, Elios and Prométhée, and IZIP. Rapid surges tend to reflect a comprehensive, swift change in some central process. DISPEC is a good example, as the electronic ambulance dispatching system replaced the old paper-slip based procedures within days.

3.2 Economic impact on a virtual health economy

When all ten cases are, in summary, are regarded as part of an eHealth dynamic in the equivalent of a virtual health economy, the combined results illustrate very impressively the potential of the economic impact of eHealth, as shown in Chart 2. Over the period 1994 to 2008, the summarised annual present value of benefits grows continuously from below €20m

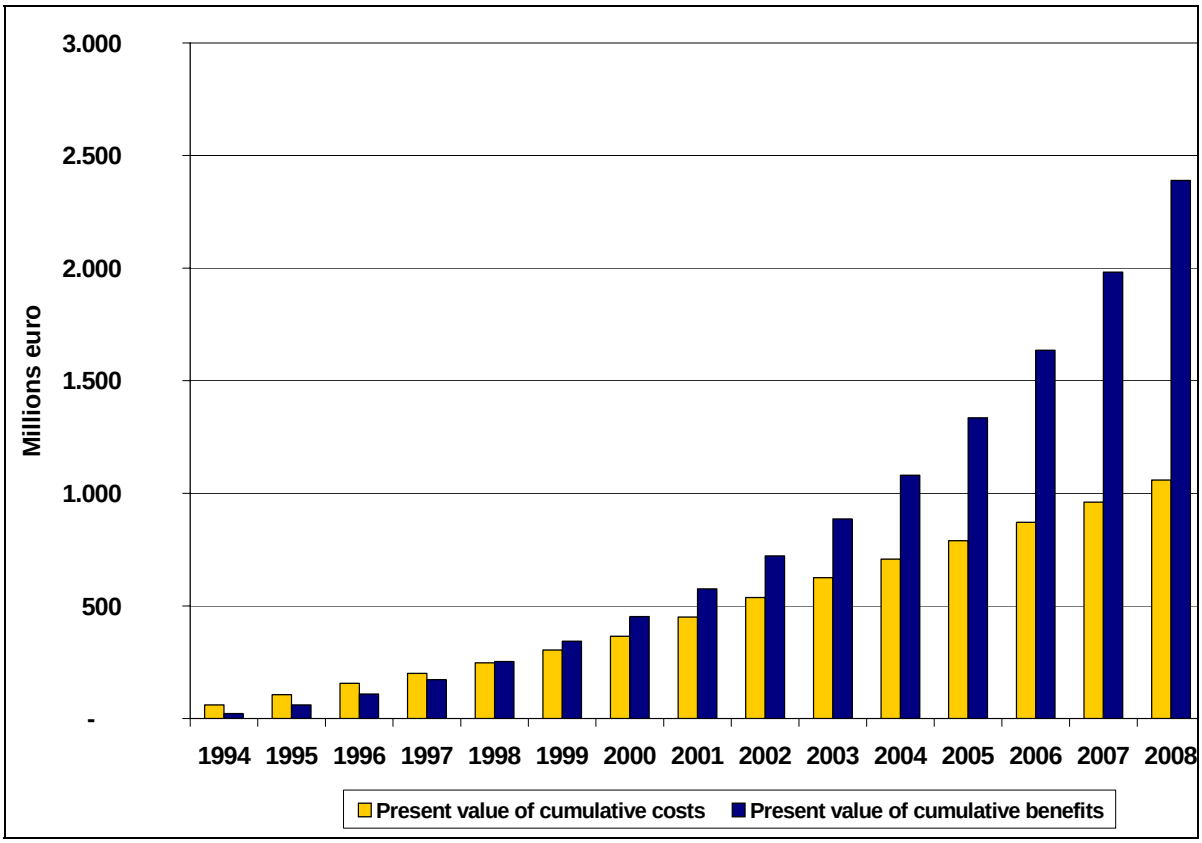
in 1994 to about €200m in 2004 and estimated €400m in 2008. Conversely, the associated costs stay broadly stable after the initial planning and implementation phases, and do not reach beyond €100m per year, as can also be seen in Chart 2.

CHART 2: ESTIMATED PRESENT VALUES OF ANNUAL COSTS AND BENEFITS OF EHEALTH FOR A VIRTUAL HEALTH ECONOMY OF 10 SITES FROM 1994 TO 2008



This surge in net benefits is also reflected in the cumulative present values of costs and benefits in Chart 3. Cumulative costs rise in a linear curve, despite the different individual investments having different peak years of investment expenditure. In contrast, the cumulative benefits increase exponentially during this time period, and at a faster rate than costs.

CHART 3: ESTIMATED PRESENT VALUES OF CUMULATIVE COSTS AND BENEFITS OF EHEALTH FOR A VIRTUAL HEALTH ECONOMY OF 10 SITES FROM 1994 TO 2008



These findings are drawn from ten successful, proven eHealth applications and are therefore exemplary. None of the ten applications on its own shows such an impressive performance, but these results may be taken as an indication of the potential overall benefits to be expected from a wide diffusion of successful eHealth applications across the European Union.

These virtual health economy findings cannot be used to infer that all proposed eHealth investments would follow the same economic pattern because the sites were not selected at random; they were all proven eHealth investments.

3.3 Benefits to the quality and capacity of healthcare

Information on its own seldom provides direct benefits. It is when it is used in decision taking, new actions and new processes that benefits can be realised. The benefit categories below emerged from the synthesis of the evaluation of the ten sites. They are similar to, but it not the same as, the quality aims for a 21st century healthcare system defined by the USA Institute of Medicine (IOM). They are also consistent with the eHI specifications of quality, access and cost-effectiveness. Each of the first five categories contributes to improvements in healthcare quality: a goal of eHealth investment identified in each case. Efficiency and access can also have an impact on the quality of healthcare provision, yet they can be affected without a necessary change in quality as well.

In the following, the benefit categories are defined briefly, followed by a summary qualitative evaluation.

3.3.1 Informed patients and carers

Patients and carers have direct access to data, information and knowledge about health issues and the impact of life styles and behaviour on health and wellness, prevention, their

conditions and vital parameters, diagnoses, treatment options and healthcare facilities, to enable them to take effective decisions about their health and lifestyles.

3.3.2 Information designed around the patient

When healthcare professionals share and have access to this type of information, they can be more patient focused and so add to the benefits for patients.

3.3.3 Timeliness

Information is used to enable all types of healthcare to be scheduled and provided at the right time, to meet patients' needs.

3.3.4 Safety

Information enables risk, potential injuries and possible harm to patients to be minimised.

3.3.5 Effectiveness

Information enables healthcare to be developed, planned, scheduled and derived from evidence and provided consistently to patients who can, or may, benefit, and not provided to those who can not; and healthcare professionals are enabled to work effectively in multidisciplinary teams which share responsibility for the patient.

3.3.6 Efficiency

Information enables productivity to be improved, waste to be avoided, resource utilisation optimised and costs contained to budgets.

3.3.7 Access

Information ensures that healthcare is available and accessible at the same standard to all those in need.

3.3.8 Fit to the benefit categories

For each of the ten eHealth applications, its fit to the benefit categories has been rated subjectively using a three star method. No stars is no fit; one star is some, but not a good fit; two stars is a good, but not comprehensive fit; three stars is a good, comprehensive fit. The ratings reflect the performance of each individual application against the benefit category. As the applications are quite different, the ratings cannot be used to compare the scope of the impact, as shown in Table 2.

TABLE 2: THE BENEFITS FROM EHEALTH ACCORDING TO THE IDENTIFIERS CATHEGORIES

	Informed patients and carers	Information designed around the patient	Timeli-ness	Safety	Effective-ness	Efficiency	Access
AOK GCE	**	**	***		**	***	***
eRecept		**	***	***	***	***	
DISPEC		***	***	**	***	***	*
Institut Curie		***	***	**	***	***	
IZIP	***	***	**	**	***	***	*
Kind en Gezin	*	**	***	**	***	***	***
MedCom		**	***	**	***	***	
MOC			***	*	***	***	
NHSDO	***	*	***		**	***	*
Sjunet – radiology		**	***		***	***	**

Three benefits categories are prevalent across all ten eHI cases. They all contribute extensively to improved timeliness, effectiveness and efficiency. Two benefit categories, informed patients and carers and access, are not prevalent at all eHI sites. Where they are, they are specific functions of the eHealth application.

4. The potential of eHealth – facing the challenges of modern healthcare

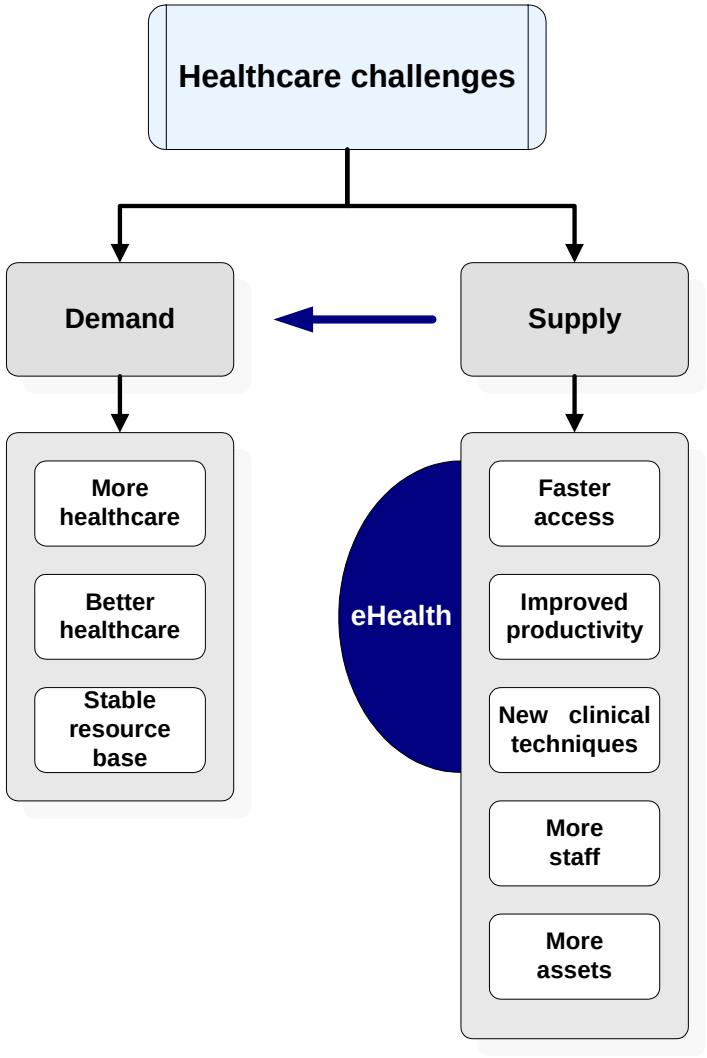
The economic performance of all ten cases confirms the, potentially, potent role of effective eHealth as an important strategic resource in helping to solve the problems of modern healthcare. Our results show that eHealth applications, taken together, as in our virtual health economy aggregation, can help to meet growing demand, improve quality and expand capacity. This is at an increasing rate, as shown in Chart 2.

Healthcare providers can use eHealth to effectively expand their capacity and performance to meet increasing demand by using their resources to better effect.

It takes about four years, on average, to reach a level of benefits that exceed the costs. This means that spending on eHealth must be dealt with as an investment in healthcare resources alongside, or perhaps as an alternative to, other investments in staff and assets, over a medium to long-term strategic horizon.

eHealth supports the supply side in meeting the increasing demand for healthcare. The interaction of supply and demand in healthcare can be summarised as illustrated in Figure 1:

FIGURE 1: SUPPLY AND DEMAND IN MODERN HEALTHCARE SYSTEMS



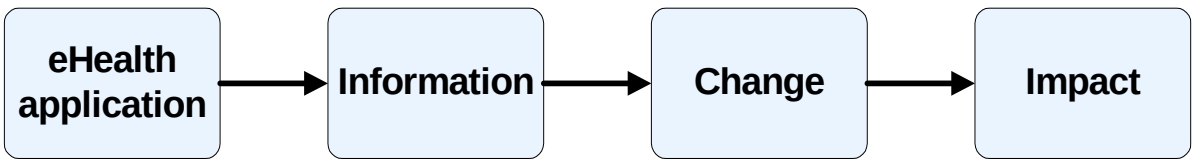
The demand for better quality is an inevitable consequence of the advances in medical science and technology and the expectations for future opportunities. The continuous expansion in demand is associated, among other things, with the ageing population in developed countries. The growth in benefits from eHealth can contribute to meeting this increase in demand. On the other side, eHealth can also help cope with resource limitations by adding capacity to the supply side, at a broadly stable cost.

5. Core observations on success factors and lessons learnt

5.1 Process change and benefit realisation

Information is part of a process of benefits realisation as expressed and simplified in Figure 2.

FIGURE 2: THE PROCESS TO BENEFIT REALISATION



Neither ICT applications, nor information by itself bring benefits. The gains in all ten sites come from changes in processes or working practices that are more substantial than replacing paper with an electronic document, which may have been the trigger to benefit realisation.

The implementation of ICT leads some sort of changed information. This can be, for example, a different information flow; more information; less information; more or less appropriate information; faster access to information; different form and structure of presentation of information.

This gives an impetus to some more substantial changes in, for example, clinical processes, working practices and workflow in healthcare, administrative or support services. The change can also be in the form of much faster, or slower execution of familiar procedures.

It is this change that brings about the impact seen at the end. The impact for the 10 eHI sites was realisation of benefits. This was the expected outcome for these proven eHealth application sites. It must be stressed, however, that the impact can also be negative. Not every eHealth application will lead to realisation of substantial benefits, let alone sustainable net benefits. The process summarised in Figure 2 applies just as well for application of ICT with a negative impact.

5.2 The importance of multi-disciplinary teams

A critical success factor is the multi-disciplinary nature of the teams involved in the planning, development, implementation, and operation of eHealth applications. This is because:

- They facilitate change in clinical and working practices
- Multi-disciplinary people in the teams improve communication and decisions
- Can deal with healthcare, ICT, procurement, project management, change management, training
- Have the backing from the top to drive the process of change.

Adequate and sustained effort to support change was essential to achieving benefits from an effective eHealth application. This requires people with highly developed skills, who work in effective, stable, multi-disciplinary teams. For more complex applications, several members of the teams need multi-disciplinary skills in order to coordinate and drive the team members with specific expertise. For larger eHealth applications, each person may be a member of several such teams. Team profiles may include both a breadth and depth of knowledge and experience of:

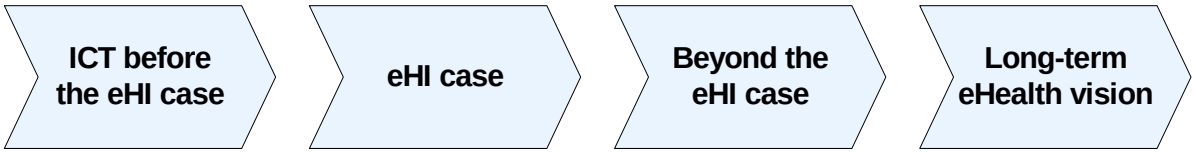
- The potential of ICT for applications in health-service related contexts
- When to use external and when internal skills and resources
- How to procure and manage services from ICT suppliers and in-house teams
- How healthcare functions, and how the various process elements need to interact as a healthcare chain
- How specific ICT and eHealth applications can make a difference to various points and interactions of the healthcare chain
- Clinical knowledge of healthcare practices
- Multi-disciplinary team-working
- How to achieve organisational change in complex settings.

This knowledge and experience, alone, was not enough. All teams, especially at Institut Curie, were integrated with the corporate vision for eHealth and the executive decision makers, who know and see eHealth benefits. It is seldom possible to find all these attributes in one person, but the team seems to perform as though it was. Successful multi-disciplinary teams also have considerable personal credibility with stakeholders through one or more of the team members, and so can engage users, especially doctors, from the initial eHealth stages through to securing their commitment and acceptance for routine use.

5.3 eHealth dynamic

Each case included activities that preceded the eHealth application. These were essential to achieve a critical mass of expertise and experience needed to drive the dynamic into the direction of a longer-term goal. Continuous investment and development on a corporate level, not a single eHealth solution on its own, is the norm at all ten sites. The subject of each case study was not a final goal. These processes, together, represent the eHealth dynamic, a continuous chain of ideas, developments and realisation of benefits from numerous individual eHealth investments, as shown in Figure 3.

FIGURE 3: SIMPLIFIED STRUCTURE OF AN EHEALTH DYNAMIC BASED ON AN EHI EVALIATION



A series of planning and development steps before, during and after the point in time of the eHI evaluation of 2005, were identified in all studies. In many of the cases, progress was reviewed by stakeholders and new short-term goals and directions were set that meet stakeholders' needs. At Institut Curie, a regular comprehensive review of progress and the planned next steps are reviewed every two years. In the Czech Republic, representatives of IZIP's stakeholders meet twice a year to discuss and review achievements and further steps. These performance reviews enable the eHealth focus and goals to be updated and reset to reflect the need for new solutions, new opportunities and changes in relative priorities, and also to adapt to a changing regulatory environment and new priorities of national health systems. In this way, the eHealth dynamic is responsive to changing information needs and drives the continuous realisation of benefits. Another feature of all ten cases is that the goals set reflected pragmatic considerations rather than a drive towards perfectionism from the very start and realising a long-term vision. Exemplary here are Danish Health Data Network and IZIP, the Czech national patient record system, which were set up with the goal to facilitate communication.

The conclusion for practical purposes is that the appropriate to successfully implementing effective eHealth applications is of a pragmatic, step-by-step nature. Future investors should not expect miracles and big-bang-type faultless and complete applications, especially in more complex cases where large amounts of data and organisational effort are required. At the ten eHI sites, there is a clear vision of long-term goals, but usually not a fixed long-term strategy towards those goals.

To have concrete short-term assignments, in combination with flexible long-term strategies is an important practical lesson to be learnt.

5.4 Meeting concrete needs

At each site, the eHealth investment focuses on addressing well-defined needs, either of citizens, or related to the process of health and healthcare provision. This can be in the form of solutions to problems, as well as process optimisation addressing the need for more timely, more accurate, or easily available healthcare, information about health and lifestyle, or any other health related service.

It is not always the citizen that the eHealth application is aiming to benefit directly. Often, eHealth improves specific elements of the healthcare process, which in turn benefit citizens indirectly. The type of eHealth investment that focuses on changing processes that benefit citizens is as appropriate as aiming at a direct impact on patients. The important point is that the use of ICT is not technology driven and imposed on processes not requiring significant changes, but addresses a concrete optimisation, or other, need or problem.

FIGURE 4: EACH OF THE TEN EHEALTH FOCUSES ON SATISFYING NEEDS AT DIFFERENT PARTS OF HEALTH AND HEALTHCARE PROVISION

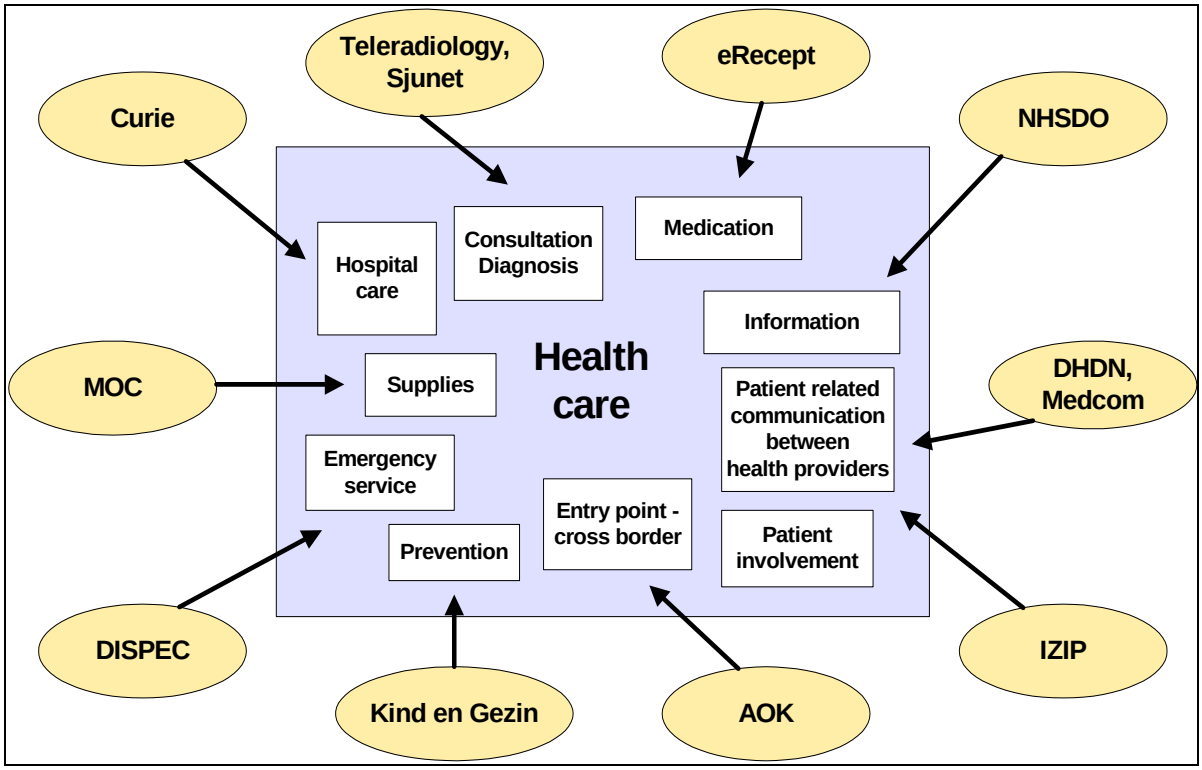


Figure 4, without claiming to present a comprehensive depiction of the health and healthcare chain, illustrates the areas in this chain that the ten eHI sites focus on. At NHSDO, and to a certain extent the AOK application, eHealth focuses directly on the citizen. The Medical Order Centre solution is a clear example of the patient not being directly addressed; here, the eHealth application provides a direct benefit to the hospital by optimising the supply chain. This in turn, benefits citizens by improving the efficiency of the healthcare provided. Curie's Elios and Prométhée tools, MedCom's national network, and the IZIP national health record system support the work of health-care professionals and HPOs, and so facilitate better healthcare for citizens.

5.5 Project and change management

There are some important differences in the eHealth investments across the ten sites. Some have a rapid impact on users, others take several years of development time before utilisation and benefits can be realised. For each type of site, the nature of the eHealth application, and the healthcare setting, determine the change management goals.

Correlations between rates of change in utilisation, benefits and costs are different across the sites. Correlations of changes in utilisation and benefits range from 1 to -0.83. A high, positive correlation indicates that utilisation itself can drive the benefits. Where it is low, or negative, then change management processes are a driver of benefits realisation. For some

sites, especially HPOs with complex service and in-formation structures, and with long development periods, benefits realisation includes complex changes to switch from clinical and working processes without eHealth, to new ones that use eHealth. In these settings, effective change management resources are critical to benefits realisation.

Benefits form eHealth applications that are utilised directly by citizens tend to show a higher correlation. This reflects the greater role of the citizen as the direct beneficiary from the effective use of eHealth, and so a momentum, underpinning the benefits.

Similar complex relationships can be found in managing eHealth costs. Resources are often deployed over long time periods, and not always with a firm relationship with eHealth utilisation. In these settings, strict project management is essential to control spending so that it does not erode, or defer, the onset of net benefits from the eHealth investment.

These factors emphasise the need for effective project and change management. Leaders in the core eHealth teams must have these skills at well-developed levels to achieve the net benefits from eHealth.

5.6 Transferability of applications

Most of the ten sites can be regarded as pioneers when they started planning their eHealth investment. Then, they had few concrete reference points and comparators to draw from, especially in the 1990s. They had to rely on their own grasp of ICT's potential to change healthcare, and to learn on the job during their period of innovation. In this setting, learning curves have relatively flat slopes. If these pioneers were starting now, but with the knowledge that they have gained, it is feasible that the time needed to reach a positive net benefit would be shorter.

For the people who follow, and draw from the pioneers' experience, the learning curves may extend across a shorter time period till peak performance is reached, and so will be steeper. In all ten cases, the ICT component of eHealth can be transferred and adapted to other settings, albeit with some technical effort and modifications. However, the organisational component of eHealth, such as changing work processes and creating and sustaining multidisciplinary team working, cannot be transferred so easily.

The implications are that subsequent eHealth investment has the potential to shorten the time needed to achieving a net benefit, but this will depend on the pace at which the organisation can learn and adapt. Replicating the ICT alone will not be enough

6. Policy recommendations

The eHI findings point to a few important recommendations to policy makers at all levels: local, national, and EU. In strategic terms, the overarching conclusion from the ten detailed site analyses is that effective eHealth in support to meeting citizens' healthcare demands can have substantial economic impacts and benefits, and is therefore worth encouraging. Key success factors to achieve such outcomes where identified above.

However, to pursue and accelerate the realisation of these benefits, health system policies as well as healthcare providers and third party payers must implement polices which foster such results.

Policy makers, healthcare providers and other actors must ensure the right mix of eHealth applications in order to achieve the goal of increasing benefits at stable costs. The following specific recommendations towards this goal are made:

- Support investment in eHealth because of the significant and sustained positive economic impact possible:

  Provide incentives, such as tax breaks, regulatory and other advantages

Invest directly, with co-funding, or even full funding, by governments or third party payers for national and other eHealth applications benefiting society, but not sufficiently benefiting an individual private investor

Integrate eHealth strategies into overall healthcare strategies

Promote proven eHealth applications and effectively disseminate lessons learnt.

- Ensure the investment is appropriate:

  Monitor the mix of existing applications and adjust efforts in order to achieve the virtual eHealth economy result. Otherwise, there is a risk of overall costs rising at a rate similar to the rate of increase of benefits, which might not be affordable or desirable in the medium to long term

  Analyse and treat eHealth alongside other investments in healthcare systems and provision, both as complementary and substitutive

  Base eHealth investment decisions on clear business cases that focus on the benefits to be gained and the needs that will be addressed

  Reflect eHI findings in eHealth strategies and investment decisions, especially realism in time periods allocated for achieving net benefits, setting realistic goals to be realised in progressive stages, and committing the resources needed for essential enablers

  Invest in training and education to create stable multi-disciplinary teams with several multi-disciplinary individuals, and extend this to structured training to expand the personnel available.

- Ensure meaningful investment is allowed to work by providing the appropriate framework and environment:

  Invest in relevant RTD and innovation research, education and curriculum development, Continuing Professional Development, and a better understanding of the organisational change processes

  Support the professional development and retention of eHealth ICT expertise in health systems and provider organisations

  Disseminate case studies and develop application models of successful eHealth dynamics for healthcare providers and cooperative health systems at the local and regional level

  Ensure solutions are thought through, yet pragmatic, so implementation can start within a reasonable time period of no longer than 5 years, depending on the application

  Encourage, and actively organise working partnerships between suppliers of the ICT component, HPO and third party payers' managers, and most importantly users: healthcare professionals and non-professionals, citizens and administrative staff.

  Use the eHealth Impact methodology to monitor performance of investments and identify corrective actions

  Continue to analyse more applications and services in diverse settings to validate and improve the method developed, and to compile more evidence about economic performance from other healthcare settings across the Union, and include financing implications, possibly with users and suppliers working in partnership.

The next most important step towards guidance, encouragement, and support toward investment in effective eHealth is to adapt and use the methodology developed in the eHealth Impact study for ex-ante appraisal of investment opportunities. Further, an in parallel to that, a methodology for investigating affordability and financing options, complementing the eHI analysis should be developed. There are already some noteworthy discussions on the topic in the literature, and the eHI findings contribute to the debate.

G. F. Anderson et. al. in "Healthcare Spending and the use of Information Technology in OECD countries" claim that it is "recognised that benefits and cost savings accrue primarily to patients and insurers, not to providers"[6]. This is not supported by the eHealth Impact study. In some cases this possibly prohibitive allocations of costs and benefits can be observed. However, across all ten eHI sites, providers gained about 52% of the benefits, with an estimated monetary value that exceeds their eHealth investment costs materially. Healthcare providers seem not to be adequately aware of the benefits they can gain from eHealth, partly because benefits are far too often associated with cash, not cost, savings, which are indeed much lower and often even negative.

The challenge is for providers to use the eHI cost benefit approach to identify, realise and secure the benefits from eHealth, and finance the required investment. Traditional models for return on investment are not appropriate for this creative role.

This is supported by a presentation to the Southern California Chapters of Healthcare Financial Management Association, Health Information Management Systems Society, and Healthcare Executives on the return on investment (ROI) of electronic medical and health record systems. The keynote speaker was Nir Menachemi, a researcher at the Florida State University College of Medicine who recently published an article titled "Hospital Information Technology and Positive Financial Performance: A different approach to ROI"[7].

In his research, Menachemi's message was that "We are running out of time to figure out the return on investment." He believes that in five years EMRs and EHRs will be a cost of doing business for hospitals wanting to survive in the healthcare marketplace. Instead of looking at ROI, hospital leaders will be focused on the cost and benefits. The eHealth Impact assessment methodology is an excellent basis for research, but also more importantly for investment decision support methodology embracing this approach not only for hospitals, but eHealth applications affecting any part of the health and healthcare chain.

7. Disclaimer

This paper is part of a Study on the Economic Impact of eHealth (www.ehealth-impact.org) commissioned by the European Commission, Directorate General Information Society and Media, Brussels. This paper reflects solely the views of its authors. The European Community is not liable for any use that may be made of the information contained therein. We thank our colleagues at the European Commission, in our institutes and our partners in this study for their critical input and review.

[6] G. F. Anderson et. al., "Healthcare Spending and the use of Information Technology in OECD countries" in Health Affairs, Volume 25, Number 3, May/June 2006

[7] Nir Menachemi et. al., "Hospital Information Technology and Positive Financial Performance: A different approach to ROI", Journal of Healthcare Management, 51:1, January/February 2006

8. Annex 1: The ten eHealth Impact evaluation sites

8.1 AOK Rheinland, Germany – GesundheitsCard Europa (GCE), cross border access to healthcare D/NL/B

GCE is the German health insurance card issued by AOK Rheinland, the sixth largest health insurance in Germany. The card allows direct access to Healthcare in 14 hospitals on the Dutch and Belgian coast. Insurance validation and reimbursement takes place via a web application and without delay. An information package for insured at the point of care is part of the service.

Annually, between 150 000 and 200 000 travellers to the North Sea beaches benefit form the comfort of avoiding extra effort for, and higher acceptance rates of insurance validation abroad. Citizen acquire over 90% of the approximately € 450 000 net economic benefit on an annual basis. The productivity gain for AOK Rheinland, measured in unit costs of providing an insured with a valid and accepted insurance validation certificate for travel abroad, is estimated at about 70%.

8.2 Apoteket and Stockholm County Council, Sweden – eRecept, an ePrescribing application

The delivery of ePrescriptions is a joint effort between each county council in Sweden and Apoteket, Sweden's national pharmacy. Currently 42% of all prescriptions in Sweden are transferred from the doctor to the pharmacy electronically via Sjunet, the Swedish ICT network for healthcare, or by using web based prescribing. ePrescriptions can either be sent to a specific pharmacy or to the national mailbox. From this mailbox, all 900 pharmacies in Sweden are able to pick up the ePrescription. The prescription form is available only to registered clinicians and, when complete, is again dispatched through Sjunet.

The concrete service evaluated, ePrescribing in the Stockholm County, generates an expected annual net economic benefit of over €95m in 2008. In 2005, five years after the beginning of planning and development, there was already a net benefit of approximately €27m. This is impressive performance, given the relatively low investment costs of less than €4m for the whole period 2001-2008. Healthcare provider organisations obtain 80% of the benefits, mainly from time savings and avoided costs of providing the same timeliness, convenience and reduction in errors without eHealth. The safety aspect of correctly issued and read prescriptions is the main item in the 20% of total benefits reaped by the citizens.

8.3 City of Bucharest Ambulance Service, Romania – DISPEC tele triage and dispatch system

DISPEC concerns a sophisticated, complex emergency ambulance service dispatch system. With support from the system, operators can, in communication with the person reporting the incidence, identify the nature and severity of the emergency, give first advice, and dispatch an ambulance equipped with the appropriate facilities and staff. Time savings occur from a location reporting system based on GPS, allowing operators to identify free ambulances nearest to the location of the emergency.

The system is designed mainly for support in process optimisation, the main beneficiaries of which are the citizens in need. They gain over 80% of the benefits. Despite decreasing resource availability during the 1990s, the ambulance service was able to cope with demand due to the implementation of the DIOSPEC system. This is reflected in a peak in benefits in the late 1990. After 2003, estimated annual net economic benefits stabilise at a sustainable level of just over €1.4m.

8.4 Institut Curie, Paris, France – Elios and Promethee

Institut Curie, a combined research and treatment hospital in Paris, France, specialises in oncology. Elios is their comprehensive Electronic Patient Record (EPR) system, allowing for access to patient data by all members of the healthcare team involved in the treatment, including external partners such as other hospitals or GPs. Related to this is Prométhée, a sophisticated, yet very user-friendly search meta-engine tool that enables healthcare professionals not only easy access to Elios but also to ask, at the same time, medical questions across a large number of Curie's other hospital (patient and administrative) and clinical research databases. This enables fast data compilation and analysis, particularly for research and quality assurance, as well as statistical and administrative evaluation purposes.

Elios and Prométhée together fundamentally transformed healthcare processes, improved the quality of care, supported the change towards a paperless hospital, and led to considerable economic gains. The tools were designed to improve Institut Curie's medical as well as research and administrative performance. This explains why Curie reaps about 92%, and citizens 8% of the annual benefits, estimated at between € 4 and 5 million. Elios is a large-scale, ongoing project, conducted with external support by 4 IT companies, and includes a fully integrated EPR, which allowed the transition from a paper records system to a paperless hospital. In comparison, Prométhée is a small-scale project, funded by resources internal to Curie, and which has still to reach its full potential. This is reflected in the shares of costs and benefits allocated to the two ICT tools. Most of the estimated overall benefits, 91%, come from Elios, with Prométhée contributing 9%. For a large institution the investment sum of around € 3m over 7 years was relatively modest, especially in comparison with the annual net benefits, estimated at a sizeable € 3 to 4m since 2002. The whole eHealth application took 7 years to achieve an annual net benefit and 8 years for a net benefit on a cumulative basis. The estimated productivity gain, measured in eHealth cost per patient, was found to be 17%.

8.5 IZIP, Czech Republic – web based electronic health record

The IZIP web-based citizen health record system, active across the whole of the Czech Republic, is one an electronic health record (EHR) that includes relevant information about contacts of the citizen with healthcare services, from regular GP visits to complicated surgery. The principal objective of IZIP is to provide comprehensive access to medical data for insured citizens, individual healthcare professionals and healthcare provider organisations (HPOs). Only the citizens themselves can authorise healthcare professionals to view their data, converting citizens to an active actor of the healthcare system.

This eHealth application took 7 years to achieve an annual net benefit and 8 years for a net benefit on a cumulative basis. The estimated net benefit in 2008 exceeds € 60 million. The estimated productivity gain, measured as the decrease in the cost of using a record, was found to be 74%. Citizens, having control over the information on their health history and access to it, as well as avoiding unnecessary interventions, are estimated to receive about 10% of total gains. Doctors and other healthcare providers have access to the full medical account of the patient at the point and time of care. This leads to better care and time savings, amounting to 37% of the direct benefits. The biggest partner of IZIP, the General Health Insurance Company of the Czech Republic benefits from avoided duplicative tests and treatment, estimated at 53% of the economic benefits.

8.6 Kind en Gezin, Flanders, Belgium – Flemish vaccination database (FVD) and Vaccinet

The application provides an electronic vaccination record for each child, an effective means of vaccination stock control and supply, a rapid, reliable channel of communication to doctors and nurses about changes to vaccination policies and practices and a source of data for performance monitoring, and policy and strategy development.

Over the period 1996 to 2008, the application generates a net economic benefit of over €17.5m. The lower risk of infectious diseases, transparency of vaccination cover and healthier children amount to over 95% of the benefits reaped by the citizens.

8.7 MedCom, Denmark – Danish Health Data Network

This national network allows fast information flow in form of consistent data exchange based on EDIFACT or XML messages amongst the respective software systems of the participating healthcare providers. Agreements on interface specifications and certification allow for optimal interoperability. The network connects healthcare providers (GPs, hospitals, pharmacies…) as well as relevant stakeholders of the community-based social care system.

The system generates considerable net economic benefits estimated to exceed €75m on an annual basis by 2008. About 80% of the total annual costs, estimated to be in the order of € 50m, are investment in ICT and organisational change. The main impact of the application is effective and efficient communication between health- and social care professionals. This translates to over 95% of the direct gains going to care providers.

8.8 MedicalORDER®center Ahlen (MOC) and St. Franziskus Hospial Münster – supply chain optimisation, Germany

MOC offers a standardised, ICT-supported storage and supply system. About 90% of articles used at a hospital ward, including most drugs, can be barcoded and stored according to a standardised system. This standardisation of supplies for a large number of hospitals leads to more easily manageable and cheaper logistics, as well as lower product prices as a result of the possibility of bulk purchasing. At the wards and hospitals, the system leads to demand based ordering. Demand is analysed continuously by MOC and stock levels are adjusted accordingly. This results in a smaller stock of supplies, compared to the without eHealth situation, less waste of materials (especially medications) not being used by their expiration date, and up to 4 times fewer incidents of medication and other supply shortages.

The system was implemented in the intensive care unit of the St. Franziskus Hospital Münster in 2005. The initial investment was just over €100 000. Including the annual running costs of the MOC service, the economic benefits from the application are expected to exceed total costs in 2006. The annual net benefit from the application at the intensive care unit in the years to 2008 is expected to surpass €40 000 every year. The impact on the whole hospital is a multiple this. Even though the system is designed for supply chain optimisation, patients receive a benefit as well. The time saved by nurses is spent with the patients in need, which gives citizens a 3% share of total direct gains. The rest goes to the hospital unit.

8.9 NHS Direct, UK – NHS Direct Online (NHSDO) information service

NHS Direct, the call centre service of the UK National Health Services (NHS), has developed and used NHS Direct Online (NHSDO) to provide citizens with access to information about health and healthcare via the Internet. The NHSDO web portal enables them to improve their knowledge and choices about life styles, nutrition, health, healthcare, self-treatment, healthcare services in their region etc. Information is provided by access to a range of facilities, including a health information enquiry service; a health encyclopaedia; a best treatments website, self-help guide; details of local NHS services, common health questions, interactive tools and a health space. The number of visitors to NHSDO has risen dramatically from about 1.5 million in 2000 to the forecast of some 24 million for 2008. The number of repeat visitors has risen too, from about one third of visits to about half.

The continuous investment total approximately €22m in the period 2000-2008. Annual running costs increase over the period to some €12m in 2008. Yet these are exceeded by the benefits in the third year of operation. Net economic benefits rise to approximately €112m in

2008. Although the obvious tangible impact is the service to the citizens, the main benefit is the avoided costs of providing the same level of access to the same quality and quality of information. This explains why over 85% of the benefits are observed to be for NHS Direct, leaving about 13% of direct gain for the citizens.

8.10 Sollefteå and Borås hospitals; Sjunet, Sweden – radiology consultations between Sweden and Spain

Reacting to a shortage of radiologists in Sweden, the application allows regular teleconsultations for Swedish patients given by specialists in Spain. Radiology nurses at Sollefteå and Borås hospitals conduct the MRI examinations and the images are sent to the Telemedicine Clinic in Barcelona for analysis via the Swedish ICT network for healthcare, Sjunet. Borås also sends a number of CT images. This lowers the pressure on the radiologists in Sollefteå and Borås, and shortens the patient waiting lists. Since the beginning of the service in 2003, the waiting time for MRI scans has been reduced to half, by between 6 and 30 weeks. The hospitals not only can better cope with the shortage of specialists in Sweden, but also are more flexible in coping with potential short term peaks in demand.

With over 85% of the total economic benefits, estimated at over € 800 000 per year from 2006 onwards, citizens gain significantly from the reduced waiting times. The cost per scan analysis for the two hospitals has already decreased by about 35%. Net economic benefits were achieved in the second year of operation and are sustainable at over € 700 000 per year beyond 2007.

9. Annex 2: Terms of reference of the study

As detailed in the call for tender, the study had the following objectives:

1. To contribute to the actions of the eHealth Communication action plan that deal with collection and dissemination of best practices. The specific objectives are:
   - to identify best practices in eHealth area in the Member states, in particular those that contribute to improved efficiency and cost benefits;
   - to identify best practices related to conformance testing and accreditation or certification of eHealth products and services.
2. To describe the state of the art in assessment of eHealth systems and services by examining existing methodologies and approaches;
3. To propose a common approach assessment and evaluation, including specific quantitative indicators, for categories of eHealth products and services, focusing on efficiency and economic benefits;
4. Apply the chosen methods to a limited number of sites – hospitals or regional networks - (approximately 10 sites) and present the findings.

The activities covered by the study Economic and productivity impact of eHealth will be based on a common methodological approach, which takes into account the specificities of each region but allows the aggregation of results and a global analysis.

The study will start from the analysis of the state-of-the-art in assessment methodology of eHealth applications.

The study will gather all available information about the impacts on productivity and economics in healthcare. The choice of a method to measure the economic impact of the eHealth applications must be motivated in the adequate context:

The study will use participant questionnaire surveys to complement available information and to collect information from the selected sites. Also, the analysis may be complemented with stakeholders' interviews, case studies on specific projects or clusters of projects/participants, as well as other data gathering and analysis methods, subject to approval by the Commission services.