2003 eHealth

THE CASE FOR
*e*Health

Denise Silber

Presented at the European Commission's
first high-level conference on *e*Health
May 22/23 2003

Information Society Technologies

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Foreword

It has been nearly 40 years since the term "computer" made its first appearance in a Medline abstract. Telemedicine was invented shortly thereafter by space and military researchers, as medical informaticists pursued their research separately in university departments.

The Internet seemed to invent patient empowerment and inspired media attention, but dot-com failures dashed our hopes, almost as quickly as they had encouraged them, before and after the turn of the 21st century.

Health systems capture our attention around the world, as they strain to maintain pace with growing demand and limited budget, while *e*Health develops quietly behind the scenes.

• What is *e*Health in Europe?
• What significant data has been published?
• What has been achieved?
• How many healthcare professionals and citizens are involved?
• Why should policy makers be impatient to move the *e*Health agenda forward?

Read *"The Case" for eHealth*

Acknowledgments

We wish to acknowledge the tireless efforts of the pioneers of cybermedicine, clinical computing, telemedicine, medical informatics, health telematics and all of their variants, without whom there would be no *e*Health. We recognized that kindred spirit amongst the many authors and experts we contacted in the course of our research.

The other indispensable component of the *e*Health equation in Europe has been the support of the *e*Health community by the European Commission, DG Information Society *e*Health unit, through the framework programs and accompanying measures for more than 15 years.

I have greatly appreciated the opportunity to participate in the process of "selling" Europe, and perhaps the world, on *e*Health and thank Jean-Claude Healy, Ilias Iakovidis, Petra Wilson for this mission.

I also thank Christine Leitner and Alexander Heichlinger of EIPA for their support.

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Note on author

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Executive Summary

WHY *the Case for eHealth?*

The Case for *e*Health is an independent report, researched and written for presentation at the European Commission's first *high level conference on eHealth*, May, 2003. Representatives of the Health and Telecommunications ministries of 25 European states attended this unique gathering, focusing on quality e-Health implementations in Europe.

The following reasons justify a dialogue with the ministers of Health and Telecommunications regarding *e*Health:
- e-Health is the single-most important revolution in healthcare since the advent of modern medicine or hygiene.
- There are numerous European e-Health achievements.
- European expertise can satisfy national and international needs for health services.

The Case for eHealth is intended to encourage dialogue regarding next steps for health systems; this dialogue will involve policymakers, healthcare professionals, and citizens, each at their own level of involvement.

WHAT *is the definition of eHealth?*

Often erroneously associated to the narrow dotcom perspective, *eHealth* is *the application of information and communications technologies (ICT) across the whole range of functions that affect healthcare, from diagnosis to follow-up*.

There can be no quality healthcare without the correct management of information and information flow.

A central component of *e*Health is the Electronic Health Record. The Electronic Health Record allows the sharing of medical records between care providers and patients, whichever the application.

These include: patient self-management, home care and sensor devices, telemedicine and telesurgery, electronic messaging, electronic registries and databases, regional and national networks.

HOW *were the illustrations of eHealth selected?*

- Research for *the Case for eHealth* was based on a sampling of the best available published data concerning *e*Health in Europe. The two main sources were review articles published in peer-review journals and data made available by the Directorate for Information Society and Technology *e*Health unit, for publication at the conference.
- No original scientific or cost-benefit research could be performed within the constraints of this mission.
- The selected implementations had to be real-life in scale and be used by Europeans. These implementations must have demonstrated improvement of access to care, cost of care, and or quality of care.
- We also sought to demonstrate the diversity of the sources of creativity; any healthcare actor may be at the origin of a useful program, and all actors must collaborate. Many, if not most, examples are under the management of health authorities.

WHICH *examples are presented?*

The Case for *e*Health focuses on three "drivers". They are consumers, professionals, and regional networks. More than 30 examples are presented.

Consumers:
- Rare disease (OrphaNet);
- Mental health forums and services (NetDoctor, APHA);
- Primary healthcare information offered online (Sundhed.DK);
- Primary healthcare via call centers and kiosks (NHS Direct).

Healthcare professionals:
- Online registers for cancer prognosis (Finprog) or poisons information (Toxbase);
- Hospital network (COHERENCE);
- Access to electronic evidence-based medicine libraries (NeLH);
- Distance learning applications (WebSurg);
- Electronically-assisted prescription reducing error and cost;
- Teleconsultation in neurology (Telif), dermatology, pathology, psychiatry.

Regional and national networks:
- Smart cards (Slovenia; Sesam-Vitale);
- A large geographic region (EVISAND; Hygeianet);
- A nation (Medcom).

HOW MANY? *data on eHealth usage*

*e*Health statistics are necessarily incomplete.

The one certainty is that consumption is rising, and that national policies facilitate use by professionals and consumers.

Our observations:
- Approximately 600 million people are online in the world; only 37% are native English speakers.
- Internet use in Europe is disparate.
- Healthcare professionals use the Internet more than do consumers.
- National computerization programs impact professionals favorably.
- Internet consumption is not determined by English language ability.
- Telecommunications policy facilitates the necessary high-bandwidth access.
- Almost half of connected physicians use some form of Electronic Health Record, with as many as 90-95% in Nordic countries and as few as 20-35% in Southern Europe.

KEY MESSAGES

eHealth's contribution to the quality of care is clear, but insufficiently known.
The following factors favor the adoption of *e*Health programs.
- Growing concern regarding medical error,
- Advance of patient-centric healthcare systems,
- Need to improve cost benefit ratios and to rationalize healthcare,
- Citizen mobility across Europe

*e*Health is a key factor in the improvement of the quality of care from:
- prevention to follow-up,
- student training to state-of-the art surgery,
- electronic prescription to poison control or tele-consultation
- patient self-management to national registries,

*e*Health enhances quality, accessibility and efficiency in all aspects of health delivery. Efficient national planning, evaluation of health policy, a cost effective delivery of health care all require the speedy, accurate and comprehensive exchange of data. But, knowledge of eHealth is fragmented and often circumscribed to experts

Progress amongst countries, regions, institutions and individuals is unequal.
Interoperability of national systems will be critical as citizens of Europe become more mobile in their healthcare management.

Growth in citizen use of the Internet may not be visible.
More patients research information on the Internet than tell their physicians, unless asked; yet better-informed patients obtain better treatment results.

Citizens are not sufficiently informed of the impact of *e*Health.

All aspects of healthcare can be favorably impacted by ICT.
The following (non-exhaustive list) items have demonstrated their *raison d'être* (alphabetical order)
- Computer-assisted diagnosis;
- Electronic health records;
- Electronically-assisted prescription;
- Digital libraries;
- Hospital information systems;
- Online registries;
- Online communities of professionals and citizens;
- Online training and distance education programs;
- Regional networks;
- Telemedicine (teledermatology, telepsychiatry, telecardiology, teleradiology, telesurgery);
- Telemonitoring;
- Videoconference.

Should not implementation of *e*Health be a priority in health policies?

We rest our case. ❑

1. Why make the case?

The Case for *e*Health is an independent report, researched and written for the European Commission's first *high level conference on eHealth*, May, 2003. Representatives of the Health and Telecommunications ministries of 25 European states attended this unique gathering, focusing on quality e-Health implementations in Europe.

The European ministers of health and telecommunications should engage in dialogue on the state of the art in *eHealth* or information and communications technologies for the following reasons.

- *eHealth* is the single-most important revolution in healthcare since the advent of modern medicines, vaccines, or even public health measures like sanitation and clean water.
- Numerous *e*Health implementations exist in Europe.
- As demand for more and better healthcare services increases worldwide, a significant part of that demand can be satisfied, using European expertise and products to access any point, at any time.
- The information presented in this report is little known beyond *e*Health circles. It is urgent to spread the word so that a more informed dialogue between policymakers, healthcare professionals, and citizens can begin.

Entire areas of "traditional" healthcare depend on informatics. Hospital laboratories are heavily computerized with many analyses, especially in biochemistry and hematology, being fully automated. The sample is placed in the analyzer and the result entered automatically into the Laboratory Information System. Similarly modern imaging techniques depend on informatics.

Prescription of medications without computer-assistance for customized dosage, preventing medical interactions, and other incompatibilities is source of significant error and excess cost that is beginning to become known to the public at large. Computer-aided diagnosis, which began more than 40 years ago, is now recognized as indispensable in rare disease and a source

of improvement of the quality of care in day-to-day practice

Advances in telecommunication, information processing, and miniaturization technologies support both professional-to-professional high-bandwidth telemedicine operations, and low bandwidth personal applications, enabling the individual to take greater responsibility in self health-management.

New markets have opened in areas such as personal sensor technology for integration into fixed and mobile consumer electronic products; communications infrastructure for disease prevention and health maintenance; centralized diagnostic services connecting patient and professional; evidence-based medicine and drug databases for professional and patient alike.

Unfortunately, a review of the medical literature reveals that no *e*Health assessment methodology is universally accepted. Experts criticize the scope of research, the choice of criteria, basic study methodology. We do not have authenticated, comparable data regarding purpose, scope, tools, costs, and results of eHealth implementations.

We know more about the barriers to adoption of *eHealth* than the keys to its widespread diffusion. The barriers are cultural, economic, political and informational, in a word human. Researchers repeat studies to determine whether conclusions apply to "their" location. We hear that consumers surf the net and find dangerous information, that time spent "behind a computer screen" is patient time lost for the professional, that no electronic system can protect the security of personal data, and that technology is expensive and ineffective.

Why do we insist on supporting *e*Health?

The quality management of information is indispensable to the quality of healthcare. No amount of compassion will save a patient whose prescription is wrong, whose condition is undiagnosed, who does not have regular

eHealth **is the single-most important revolution in healthcare**

Numerous *e*Health implementations exist in Europe

Demand can be satisfied, using European expertise and products

access to care. *eHealth* cannot cure healthcare of all of its current ills, but it can significantly contribute to improvement, if the introduction of eHealth accompanies an understanding of the underlying healthcare processes.

The article *"Health Informatics: Managing Information to Deliver Value"* (1) provides one of the most comprehensive reviews of the benefits of *e*Health. According to Marion Ball and colleagues, "we are beginning to gather proof that informatics can deliver value and improve health" in disease management, teleHealth, patient safety, and decision support. The authors cite:

- A diabetes program whose enrollees remained unhospitalized over a four year period and wherein net savings for one year were $510,133
- A congestive heart failure program involving telemonitoring and patient education which reduced the 30-day readmission rate to zero and cut the 90-day readmission rate by 83%
- A 4-month clinical trial of 200 patients in intensive care units, in which the addition of around-the-clock telemedicine coverage to normal staffing reduced patient mortality by 60%, complications by 40%, and costs by 30%.

Regarding patient safety, Ball and colleagues cite the groundbreaking Institute of Medicine's (IOM) publication *"To Err is Human: Building a Safer Health System"*. This report was the first to develop awareness of the "staggering statistics on medical error." 90,000 deaths, according to the IOM, are due each year to preventable medical errors in the US. The report indicates that decision support systems can cut adverse events by 55%, and that the prevention of adverse drug events saves over $4000 per event. *To err is human* concludes that "a computerized system costing $1 to 2 million could pay for itself in three to five years, while preventing injury to hundreds of patients."

How did we identify the state of the art of *e*Health in Europe? Our goal was to develop an overview of existing *e*Health results based on a sample of reliable data, rather than to undertake new, necessarily "narrow" scientific or cost-benefit research. Would we find a sufficient number of solid implementations, located in a diversity of settings to consider that *e*Health has reached a first stage of immaturity?

We used two kinds of sources to identify reliable data, selected publications available on the Medline database through the PUBMED website [1], and the records of the Directorate General Information Society *e*Health unit [2].

MEDLINE contains bibliographic citations and author abstracts from more than 4600 biomedical journals published in 71 countries, totaling over 11 million citations and dating back to the mid-1960's. More than 5000 publications with abstract contain the word "computer" and refer to a European country. More than 1000 publications with abstract contained the word "Internet" and involve a European country. Nearly 1000 refer to "telemedicine" and Europe...

We hope that your curiosity is aroused, and that you will follow on for the state-of-the art definition of *e*Health in Chapter 2. ❏

The information presented in this report is little known beyond *e*Health circles

More informed dialogue between policymakers, healthcare professionals, and citizens can begin

The quality management of information is indispensable to the quality of healthcare

2. Definition of *e*Health

The term "*eHealth*" is much broader than the Internet and dotcoms**.**

eHealth describes the application of information and communications technologies (ICT) across the whole range of functions that affect health. It is the means to deliver responsive healthcare tailored to the needs of the citizen. The Electronic Health Record (EHR) is a fundamental building block of all of these applications. The EHR allows the sharing of medical records between care providers across disciplines, institutions and geographic boundaries.

If we consider *eHealth* in reference to the settings in which healthcare services can be dispensed, we see the myriad of opportunities:

1. The **citizen/patient** uses *eHealth* when he seeks information online, uses self-management tools, participates in electronic communities, and requests a second opinion.
2. **Primary Care** includes the use of ICT by the Primary Health Care Team (PHCT) for patient management, medical records and electronic prescribing. Healthcare professionals can also call upon *eHealth* for their Continuing Medical Education.
3. **Home Care** includes care services which are delivered by home care professionals via telecommunications to a patient in the home
4. **Hospitals** may call upon ICT for scheduling logistics, patient administration, laboratory information, radiology, pharmacy, nursing, electronic messaging between the hospital and other healthcare actors for communication of clinical and administrative data, and telemedicine and second opinions, in any specialty.

How do we explain the difference between the narrow and the broader definition of *e*Health?

Although "Dotcom *eHealth*" erroneously seemed to herald the arrival of computers in healthcare in many European countries, the first computer applications for health and medicine were developed in the 1960s. The European Commission has been supporting health informatics and telematics for nearly 20 years. But, healthcare communication around the world continued to be largely paper-based, until access to the technology itself became quicker, easier, and cheaper, *thanks to the Internet.*

Health informatics research results are presented at informatics society gatherings, published in peer-reviewed medical informatics journals, and often too technical for mass media. While the pioneers of Health Informatics laid the groundwork, the dotcom *eHealth* companies stole the show and left behind a cultural mindset connoting unmet promise. Additionally, the dotcom period drove the computerization of the general practitioner's office and households in most countries, lending further fuel to the idea that *eHealth* meant the Internet.

Scope and Direction of Health Informatics (2), by Patrick McGinnis, stands out for its overview of health informatics, whose definition is quite similar to that of *eHealth*.

According to McGinnis, health informatics includes 11 categories:

1. Clinical data management,
2. Decision support systems,
3. Technical and hardware issues,
4. Network technical issues,
5. Database structures and constraints,
6. Autonomous smart devices,
7. Standards for the languages of communication between healthcare providers,
8. Data exchange standards language for communication between healthcare devices,
9. Legal and ethical considerations,
10. Telemedicine,
11. Patient-centered computing.

McGinnis further indicates that the most important avenue of Health Informatics is the transformation of the paper chart into an electronic medical record. He reminds us that the paper chart, invented in the 19th century, is nearly identical to the 1950's version, only thicker.

If we take into account the data provided by Reinhold Haux and colleagues' review article *Health care in the information society: what should be the role of medical informatics?* (3), we can understand the urgency of that transformation. At the Heidelberg University Medical Center, where 8000

> **While the pioneers of Health Informatics laid the groundwork, the dotcom *eHealth* companies stole the show and left behind a cultural mindset connoting unmet promise**

employees care for 50,000 inpatients and 250,000 outpatients per year, there are approximately 250,000 physician letters, 20,000 surgical reports, 30,000 pathology results, 100,000 microbiology results, 250,000 radiology results, and 1 million clinical chemistry results, for a total of 300,000 new medical files containing 6 million documents.

McGinnis concludes with a quote from *Beyond the Superhighway: exploiting the Internet with medical informatics* of JJ Cimino (4).

"The emergence of a true multimedia record seems likely. Perhaps clinicians will once again be able to look at all aspects of their patients, including blood smears and x-rays. Perhaps they will be able to see patients for the first time and know what they looked like a year ago, or what their hearts sounded like. In this way, perhaps the computer, which is blamed for taking us away from our patients, can bring us closer."

Let us explore the European illustrations of these points in chapter 3. ❑

3. Highlighting *e*Health initiatives in Europe

Given the diversity of European countries and contexts, what is a quality *e*Health implementation? Simply stated, a quality example must demonstrate improved quality of care, better access, and or cost benefit.

*e*Health is an end-to-end process, from birth registries to "cause-of-death" registries, from prevention and screening to follow-up, from emergency intervention to homecare, whatever the cultural or national context.

But, has quality been demonstrated? There is unfortunately an evaluation paradox. Evaluation tends to be done during a trial or pilot period. The more large-scale an implementation, the more costly it is, in absolute terms, for an organization to devote resources to measure results. The more difficult it is methodologically to include a control group. The system simply "is."

Given the relative youth of the field of *e*Health, we are fortunate to have found interesting papers. We note that cost-benefit data, which is difficult to collect, is rare but on the rise, and that the year 2000 represents a turning point in the depth and breadth of e-health publications.

The following examples have been "artificially" divided into categories based on the "driver" of the operation: consumer, individual professionals, a region or a nation. *e*Health components have no natural borders. Most programs are multi-actor: a government may well manage a program linking professionals and patients locally or nationally. Additional payors are often involved. Who is the driver? All of the above.

> **Rare diseases are very patient-centric diseases and highly compatible to the use of ICT or *e*Health**

This first set of examples, as shown in Table I, mirror the real world. The citizen, an individual, seeks health information and or a contact with peers and professionals via these *e*Health programs. Many are health authority initiatives, whether local, regional, or national.

a) Rare Diseases

Rare diseases are very patient-centric diseases and highly compatible to the use of ICT or *e*Health. While each disease may be sparsely populated, they collectively represent millions of Europeans.

OrphaNet

OrphaNet [3] is a European multi-lingual portal, devoted to orphan or rare disease, and supported by the French national health research institute, INSERM and funds from the European Commission.

OrphaNet's online encyclopedia offers information on over one thousand of the three thousand rare diseases. In France, there are 226 rare disease associations, 204 of which have a website. Orphanet has surveyed 2798 sites devoted to 1300 rare pathologies

According to Ségolène Aymé, French geneticist and founder of OrphaNet

"The most conscientious and expert clinician cannot keep up with this field which integrates new pathologies each week! Only 100 rare diseases are taught in medical schools. They are complex, often affecting multiple systems of the body. Rare disease patients have, for many years, worked directly with researchers, forming associations, and generally knowing more about their particular disease than the average health professional.

Any solution that can shorten the time necessary to diagnose a case, enter a patient in a trial, or identify treatment, significantly diminishes costs to the health system. ICT has the capacity to

1. CITIZEN-PATIENT DRIVEN *e*HEALTH

Table I. Examples of Citizen-Patient Driven eHealth Initiatives

Category	Examples	Origin
Rare Diseases	OrphaNet	Health authority
General portals	Sundhed NHS, NHS Direct Vardguiden	Pharmacy Assoc. Health authority Health authority
Mental health services	NetDoctor APHA	Private sector Patient associations
Patient information	CancerNet	University
Quality seals	HON	Foundation/canton

facilitate the matching of the right patient to the right professional, to extend health networks to a greater number of centers and to facilitate access to the results."

S. Aymé also remarks that information technology was first applied to rare diseases over 30 years ago, through diagnostic decision software. Two diagnostic decision systems are available today free of charge, OrphaNet and the London Dysmorphology Database [4].

OrphaNet has created an online resources data base, including data on biology laboratories, expert consultations, patient associations. 36 French health networks collaborate via OrphaNet's site. This database is being extended from France and Italy to Germany, Belgium, Switzerland, and Spain. OrphaNet also promotes the development of patient association websites by offering a free website creation tool and site hosting.

A user survey in September, 2002, showed that 50% of users are professionals and 50% are patients or caregivers, with 1/3 coming for the first time. 105 countries consulted the site at a rate of more than 3,000 visits daily, at that date.

b) General portals

Sundhed.DK
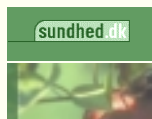
Sundhed.DK [5], meaning "health," is the name of a non-profit Danish health portal created by the Danish Pharmaceutical Association of 283 member pharmacies at a cost to them of € 27 million to the association. The member pharmacies are, of course, for-profit entities.

The Association's objective is to create an alternative to the purchase of prescription drugs online through e-pharmacies. The website allows patients to use the Internet to renew prescriptions at a physical pharmacy and to book doctors' appointments. These services are also available in Denmark through many physicians' practice homepages. 10% of Denmark's 3,000 physicians are currently registered in the program.

Sundhed.DK does not run ads or accept manufacturer sponsorships. According to industry estimates, Sundhed.DK captured 40% of Denmark's 125 million hits in healthcare use of the Internet in 2002. Its typical consumer user is a female with responsibility for healthcare decisions in her family. The portal contains more than 3,000 articles. 40 medical editors answer around 1,000 questions per month. This site will be part

of Denmark's national health portal, scheduled to be launched in 2003 (5).

NHS and NHS Direct

In the UK, the NHS is the abbreviation for the National Health Service as a whole. The NHS Information Authority led program, NHS Direct Online, and NHS Direct work as a triumvirate. The first two are websites, (NHS.UK and NHS Direct Online), and NHS Direct is a call center. These three resources work together to facilitate consumer access to proper information and care.

The NHS Direct Online website [6] provides health information online and access to a 24-hour nurse helpline. These services were initiated in 1999. Six million people have accessed NHS Direct website in approximately two years. There were 500,000 visitors in January 2003.

NHS UK established its data-driven website [7] in July, 2000. The site gives information on over 70,000 physical NHS sites, providing health services to the public. This information is used by NHS Direct call centers when dealing with consumer enquiries.

Public information kiosks were also introduced in the year 2000 by NHS Direct. 200 touch screen, printer-equipped, wheelchair-accessible kiosks were placed in high traffic locations. These included the NHS centers, pharmacies, libraries, supermarkets, leisure centers. At a rate of 300 people per kiosk per month, the NHS Direct kiosks serve 60,000 people. While the introduction dates of these various services are recent, they were based on prior work. The Center for Health Information Quality gave rise to the NHS Direct Online structure.

Vardguiden

Stockholm County, comprising 1.8 million inhabitants, deploys a health information portal, called Vardguiden [8], since February, 2002. This program offers information about healthcare services, a helpdesk, and secure communication of questions or messages to the patient's healthcare professional. There are now 55,000 users per month of the information site, and 12,000 who access the information by telephone. More than 800,000 answers are provided. The corresponding time saved is evaluated at € 1.25 million per year.

> **Six million people have accessed NHS Direct website in approximately two years**

c) Mental health services

NetDoctor (depression)

The for-profit consumer website NetDoctor operates, amongst others, online forums for depressed patients in several European countries. According to company data, 28,000 users were registered in these forums, across the UK, Sweden, Denmark, and Austria. A study by H. Agrell (6) and colleagues of the Karolinska Institute in Sweden examined NetDoktor Depression site [9]. The visitor access articles about the disease and treatments, take interactive tests, discuss with others, and submit questions to medical experts. The aim of Agrell's study was to examine how individuals are affected by the active use of an Internet community site dealing with depressive disorders.

The authors proceeded via an Internet-based survey, whose reliability was tested by sending out the questionnaire twice to the same people. 219 individuals responded to the first survey. 114 were active members of the community. Amongst the subgroup of 30% of participants who had not initially revealed their depression to anyone beyond the website, 80% of those did seek help, thanks to the advice of the group. The study conclusion is that "the Internet seems to have the potential to provide an important function for depressed people."

The Internet seems to have the potential to provide an important function for depressed people

APHA (crisis counseling)

The Finnish early-stage counseling and crisis portal was established in 2001. It is maintained by 15 organizations working in mental health, addiction, children's welfare, domestic violence, and other public health subjects. Consumers are directed to an appropriate service, based on the need they express. In January, 2003, there were 3022 unique users of this Finnish-language site.

d) Patient information

CancerNet

In their publication (7), G Quade and colleagues of the University of Bonn, examined the results of CancerNet online, which was established in 1994, as a website designed to enhance the patient-physician relationship. CancerNet [10], which provides access to the National Cancer Institute guidelines, is offered in English, Spanish, and German for patient information. Since

1994, nearly 2 million users, including more than 200,000 physicians, have consulted the site. 95% rated the service excellent or good.

e) Quality seals

The desire to evaluate the quality of health websites has generated nearly 200 papers by researchers in Austria, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Norway, Poland, Spain, Sweden, UK. These papers point to issues of quality in either a specialty such as cancer of gynecology or general health websites. Authors often seem to seek to demonstrate the dangers of health websites to the citizen.

Since no one has attempted to prove that healthcare professionals are more resistant to imperfect data than citizens, we noted with interest the research (8) of Howitt and colleagues, evaluating 90 general practice websites in the UK. These are websites provided by physicians for their patients. The median time elapsed since the last update was 249 days. The doctors' qualifications were absent in 26% of sites. The source of medical information was given in only 10% of the 109 topics treated.

The authors' conclusion is
"we wish to emphasize to practices setting up their own websites the concept of providing quality evidence-based information for patients and that their ethical duties with regard to disclosure of competing interests apply as much to new technologies as old."

Health on the Net (HON) [11]

The best known and oldest of the quality seals for health websites is proposed by Health on the Net since 1996. More than 3000 websites worldwide adhere to the HONCode. *The HONcode has been shown to be one of the major accuracy content indicators in a study conducted by Fallis* and colleagues. (9)

Adherence to the HONcode implies that the website includes the author's credentials, the date of the last modification with respect to clinical documents, ensures the confidentiality of data, indicates sources of funding, its advertising policy, and clearly identifies any advertising as such. Adherence to the HONcode, which is free of charge, would eliminate most defects observed in the various country studies.

We note that the *UK Consumers' Association 2003 Policy Report* (10) provides one of the most complete recommendations regarding the quality of consumer healthcare information. Its originality is the broad scope of the research, including the information that patients seek about medicines, therapies and illnesses, the deficiencies of the current UK situation, and recommendations for practical actions. This is the first policy paper in which Web-based quality criteria are recommended for application to all media.

2. PROFESSIONAL *e*HEALTH APPLICATIONS AND TOOLS

Table II. Professional and eHealth Applications and Tools

Category	Examples	Origin
Online databases and registries	FINPROG	Public teaching hospital
	Pediatric European Cardiothoracic Surgical Registry	European scientific society
	TOXBASE	Health authority
	Birth registries	Health authority
Electronic Health Record (EHR)	Framework programs	European Commission
	Management of dosage of medications	Public hospitals
EHR hospital system	COHERENCE	Public teaching hospital
Electronic libraries and information services	The Kostoris Medical Library	Research center/health authority
	Rouen University Hospital	Public teaching hospital/ Health authority
	National Library of Medicine	Health authority
	South Cheshire Local Multidisciplinary Evidence Center	Health authority
	(NeLH) National electronic Library for Health	Health authority
Distance education	Johns Hopkins online Gleason grading course Websurg	University
Telemedicine	Transcontinental Telehistopathology in prostate neoplasia	University
	Digital Image and cost-benefit	Radiology industry
	TELIF	Public hospital system
	Internet-facilitated home monitoring systems for disease management	Varied

Table II includes *e*Health applications and tools whose conception and implementation are under the direct control of professionals.

a) Online databases and registries

As more and more healthcare databases move online, they enable professionals and citizens to collaborate efficiently across boundaries, whether local, regional, national, or worldwide.

FINPROG

The Finprog Study

A Finnish web-based system for individualized survival estimation in breast cancer was developed by researchers at the Universities of Helsinki and Tampere. FinProg [12] generates survival curves dynamically, providing clinicians with tools that aid prognostic classification and give quantitative probabilities of survival. Researchers can obtain survival estimates based on actual and not inferred data. Users can enter any prognostic factor data. Researchers can explore the database and not just consult published results. The data base is intended for consultation by physicians, but access is not restricted. All personal identification information has been deleted.

Six institutions participate: Kuopio University Hospital, Oulu University Hospital, Tampere University Hospital, Turku University Hospital, Finnish Cancer Registry and the Finnish Breast Cancer Group.

"The source for the survival data is a Finnish nationwide series of women with breast cancer. There are 2842 total patients in the Finprog series. 91% of all breast cancer cases diagnosed within the selected regions and the chosen time interval could be included in the database, which would suggest that the series is relatively unbiased. The median follow-up time for the unrelapsed patients is 9.5 years." (11)

According to Lundin and Lundin, the researchers, "this web-based system could be applied to a variety of diseases."

Pediatric European Cardiothoracic Surgical Registry

EACTS Congenital Database

The European Congenital Heart Surgeons Foundation, established in 1992, created the European Congenital Heart Defects Database for the purpose of collecting outcomes data on congenital heart surgery procedures across Europe.

Since January 2000, the Pediatric European

Cardiothoracic Surgical Registry [13], as it is now known, has officially operated from the Department of Cardiothoracic Surgery at the Children's Memorial Health Institute in Warsaw, Poland, under the auspices of the European Association for Cardio-Thoracic Surgery. Participation in the database is free of charge through the Internet for all participants.

> *"In April 2000 the International Congenital Heart Surgery Nomenclature and Database Project published a minimum dataset of 21 items and lists of 150 diagnoses, 200 procedures, and 32 complications, as well as 28 extracardiac anomalies and 17 preoperative risk factors. As of March 2001, 84 cardiothoracic units from 33 countries had registered in the database and data on almost 4000 procedures have been collected."* (12)

TOXBASE

TOXBASE®

The National Poisons Information Service (NPIS) in the UK has six regional offices. In 1999, the NPIS's existing database TOXBASE was transferred to the Internet and made available to health professionals working throughout the NHS. TOXBASE [14] holds information on 14,000 agents including pharmaceuticals, chemicals, household products, plants, … Pharmaceuticals account for 73% of accesses to the database.

Results of the transfer were reported in *web-based information on clinical toxicology for the United Kingdom: uptake and utilization of Toxbase*. (13) Enquiries to TOXBASE were found to be more than 3,4 times more frequent on the Internet, than by telephone. Monthly use of the telephone service showed a gradual decrease as TOXBASE usage increased. The risk of telephone queuing was also reduced. Whereas most telephone inquiries came from primary care, the major TOXBASE users were accident and emergency departments. Referrals to senior clinical staff increased. A survey conducted across the UK confirmed that the system meets users perceived clinical needs.

DN Bateman and colleagues concluded that *computer information systems are alternative tools to the telephone for the provision of poisons information.*

Computer information systems are alternative tools to the telephone for the provision of poisons information

82 of 150 hospital doctors were unable to calculate how many milligrams of lignocaine were in a 10 ml ampoule of 1% solution

Birth and other registries

In *Medical birth registry—an essential resource in perinatal medical research* (14), LM Irgens reports on the Norwegian component of EUROCAT [15], the European network of population-based registries for the epidemiologic surveillance of congenital anomalies. More than 900,000 births per year in Europe are surveyed by 36 registries in 17 countries of Europe. The Nordic Association of Birth Registries is introducing non-paper notification in 2003.

Jaspers and colleagues of the Department of Medical Informatics, Netherlands Cancer Institute report on the benefits of a *national computerized pediatric cancer registry on late treatment sequelae in The Netherlands.* (15) Also in the Netherlands, DG Arts at the Amsterdam Academic Center, Department of Medical Informatics published in 2001 a review paper regarding registries, entitled *Defining and improving data quality in medical registries: a literature review, case study, and generic framework.* (16)

b) Electronic Health Record (EHR)

European Commission Framework programs

The electronic health record (EHR) is digitally stored clinical and administrative health care information about an individual's lifetime of health experiences, for the purpose of supporting continuity of care and education and research, while ensuring confidentiality. The EHR is a tool for supporting health care delivery, through all stages and at all points of care, linked via health telematic networks.

The European Commission has long supported a shared care setting for citizen/patients, professionals, health managers, public health authorities, researchers. Requirements of an EHR were formulated, as of 1991, in the European Union R&D Program.

An EHR System manages EHR information. The system can be a small group of PCs, a hospital information system, or a group of hospital and primary care systems in a regional network.

EHR systems for general practitioners have so far achieved the highest penetration. They are very popular in countries with a strong tradition of primary care such as United Kingdom, Ireland, Netherlands, Denmark and others.

Management of Medication and Dosage

An important feature of the EHR is its capability of supporting the determination of the drug dose. As Walton and colleagues confirm in *Computer support for determining drug dose: systematic review and meta-analysis,* (17) "many drugs have a narrow 'window' in which therapeutic benefits can be obtained at a low risk of unwanted effects." Yet, in one study cited by Walton, it is noted that "82 of 150 hospital doctors were unable to calculate how many milligrams of lignocaine were in a 10 ml ampoule of 1% solution."

The authors assessed the benefits of computer systems designed to help doctors determine the optimum dose of drugs. 17 controlled clinical trials were included, based on the criteria of the Cochrane Collaboration on Effective Professional Practice [16]. The original studies were performed in Australia, Israel, the Netherlands, Spain, and the US.

> *"Eleven studies examined change in the drug dose when computer support was used and seven found significant changes, involving both increases and decreases in initial and maintenance doses. Four of the six studies which measured unwanted drug effects found significant reductions in association with computer support."*

Two studies report economic data. In one, the mean direct cost of treatment with aminoglycoside was reduced from $13,758 to $7,102, with a benefit to cost ratio of 75. In the other study, *"there was a cost avoidance of $1,311 for each patient treated with a benefit to cost ratio of 4:1. These cost savings resulted from reduced hospital stays."* Another study showed that computer support lengthened the interval between outpatient visits.

A 2002 publication in *Quality and Safety in Health Care,* (18) found that more than 86% of mistakes in family-care offices are administrative or process errors: filing patient information in the wrong place, ordering the wrong tests, prescribing the wrong medication. However, 10 mistakes led to a hospital admission and one to a patient death. This study, performed by the observation of 42 physician volunteers over a 20-week period in the year 2000, is the first to focus on errors that occur outside the hospital setting.

Computer support lengthened the interval between outpatient visits

EHTEL

According to *Living at home-healthcare in the home*, published by EHTEL [17] and sponsored by Carelink and the Vardal Foundation, while the same technology is available in both countries, 75% of doctors' prescriptions are transmitted electronically in Denmark and only 10% in Sweden. The Swedish national figure ranges from Stockholm with only 2% to Norbotten with 95%. Further information on Denmark is available on, page 52.

c) EHR systems in hospitals

The hospitals with good examples of EHR systems have been running for many years and have begun to confirm cost savings through greater efficiency and improved care. As the technology evolves and some standards emerge, EHR installation in European hospitals is increasing.

Denmark, Finland, Norway, and Sweden support regional and national health telematics networks, These EHRS are shared within hospitals, between hospitals, between hospitals and primary care centers or individual physician's offices.

COHERENCE (European Hospital Georges Pompidou – HEGP, France [18])

COHERENCE stands for "Component-based HEalth REference architecture for Networked CarE". The opening of HEGP in July 2000, was the result of the biggest hospital consolidation in Europe. Three historic but technically obsolete hospitals were closed, and HEGP was allotted a budget lower than the sum of the 3 predecessors. 6% of this initial budget were attributed to IT for development and 1.8% of annual operating costs for maintenance.

The IT objectives for HEGP are: to control costs through organizational innovation, to improve the quality of the patient admission process, to decrease and redirect the number of beds. Over 140,000 patients have participated in the EHR system since opening day.

The Health Information System project started in 1996, with the publication of a European call for tenders. COHERENCE includes ERP (health Entreprise Resource Planing) from Medasys, a picture archiving system (PACS) from AGFA and an EAI (Entreprise

Application Integration platform) from THALES. Ubiquitous access to a lifelong multimedia EHR is achieved through the use of 1800 fixed and mobile computers with wireless transmission. Transmission of secured eMail to the patients is provided through "La Poste" Internet eMail secured transmission services.

Medical information is recorded at bedside and prescriptions distributed to technical platforms together with a minimum medical file. The appointment system, shared by 96% of the units, generates a personalized care plan, which can be followed by authorized professionals on any of 1800 computers. Waiting lists are reduced; conflicting appointments are highlighted; investigations are documented. Patients are re-assured by the quick entrance procedure at one of 22 decentralized access points and the physician's access to previous history.

> **When electronic versions are offered alongside a limited amount of interlibrary loans, a reduction in library costs was observed**

The HEGP brings all units of a same specialty together geographically, (for example, medicine and surgery) and merges traditional units into 7 major cooperative centers.

Compared to its predecessors:

> **The free-access US government health websites are visited by more non-Americans than Americans**

- Global operating costs at HEGP are 17 million euros lower, despite the 15 million euro increase in medical costs for diagnosis and treatment.
- HEGP offers a 0.9 increased nursing personnel bedside presence and a 1.0 day reduction of the mean length of stay.

d) Electronic libraries and evidenced-based medicine information services

The demand for greater access by professionals to evidence-based medicine (EBM) is growing, despite the controversy over the definition of good evidence. The trend for libraries to offer electronic access to their documents accelerates the access to EBM. However, the model for the distribution of EBM is a work in progress.

In *Information management and reading habits of German diabetologists: a questionnaire survey, (19)* Trelle notes that the need for evidence-based medicine has not reached German diabetologists. According to survey results of 461 professionals, 90% had convenient access to the Internet, MedLine or EMBASE [19], but only 45% searched databases regularly (three searches per month).

How can library and computer sciences best serve populations with varying needs: researchers, specialists, primary care professionals, and citizens?

The Kostoris Medical Library

KOSTORIS MEDICAL LIBRARY

The Paterson Institute for Cancer Research is one of the largest cancer research laboratories in the UK, with over 200 researchers, fellows, students, administrators. The Institute is connected to the Internet via Manchester Computing Center and is part of the Joint Academic Network, benefiting from a super-fast connection and large bandwidth. Electronic mail is the primary form of communication.

In "*Biomedical information @ the speed of light: implementing desktop access to publishers' resources at the Paterson Institute for Cancer Research in Manchester*," (20) Steve Glover, the systems librarian explains how every Thursday at midnight, a list server in Massachusetts delivers an electronic table of contents messages containing the details of the latest edition of the *New England Journal of Medicine,* complete with hyperlinks to the full text of the content online.

The Kostoris Medical library [20] initiated an e-toc (or table of contents alert) service in 1998. They began with the *Proceedings of the National Academy of Sciences,* one of the most cited science journals and published twice monthly. This was followed by *eBMJ, NEJM, the Lancet Interactive, Nature,* and the *Journal of the National Cancer Institute.* The institute saves up to 21 days per publication, compared to the arrival of the paper journal.

Rouen University Hospital

CISMeF

Rouen University Hospital is known in Francophone Internet circles for CISMeF [21]. CISMeF is the French acronym for Catalog and Index of French-language health resources. This 60,000+ page Web site, which receives 15,000 queries daily, was created by the Rouen University Hospital in 1995, and regularly scores as the best known Web site among French physicians.

CISMeF describes and indexes quality French-language health resources available on the Internet and evaluated by NetScoring criteria. CISMeF uses the Medline bibliographic database, MeSH thesaurus, and several metadata element sets, including the Dublin Core. CISMeF offers a thematic index, including indexation by medical specialties and an alphabetic index.

In *Cost effectiveness of a medical digital library*, (21) Roussel and colleagues at Rouen University Hospital in France assessed the cost impact of modifications to the digital library and found that:

"The digital OVID library at Rouen University Hospital continues to be cost-effective in comparison with the interlibrary loan costs. Moreover, when electronic versions are offered alongside a limited amount of interlibrary loans, a reduction in library costs was observed."

National Library of Medicine

The National Library of Medicine produces Medline [1], which is available online since 1997. Elliot R. Siegel, the Associate Director for Health Information Programs Development, presented *Strategic Approaches to Web Evaluation* at the ICSTI Conference on Scientific Information in Stockholm, June, 2002.

This paper confirmed that the free-access US government health websites are visited by more non-Americans than Americans. With 6 million global unique visitors per month and 3.2 million Americans, the NIH websites are far and away the most visited health sites in the world.

Table III. International Statistics of NIH Websites

Figures (2002) represent one month of data	US unique visitors	Global unique visitors	US pages viewed	Global pages viewed
NIH (including NLM)	3.2M	5.9M	42.7M	84.5M
CDC	1.8M	2.7M	9.0M	13.6M
FDA	0.76M	1.2M	7.5M	10.1M
HHS	0.97M	1.1M	8.5M	8.9M
VA	0.78M	0.85M	9.2M	10.2M
HCFA	0.24M	0.26M	1.5M	1.6M

South Cheshire Local Multidisciplinary Evidence Center (LMEC)

In a 1998 report which confirmed that primary and community care staff in the UK had limited access to library and information services, the recommendation was made that Local Multidisciplinary Evidence Centers (LMEC) be created to improve the situation. JC Howard and colleagues, present the results obtained in South Cheshire between 1998 and 2000 (22) [22].

The library catalogue was automated and included on the website as were local directories, clinical guidelines, and training opportunities. Throughout the two year period, staff monitored use of the website, library membership, and book or article requests by LMEC users. Evaluation was carried out by a survey of 760 staff in February 2000.

Uptake of the training to support use of the LMEC was disappointing as was overall activity, but the authors note that *the 120 staff who use the LMEC were enthusiastic about the service.*

115 practice staff joined the library as new members. Overall usage of the library increased significantly. Requests for books increased from 5 to 25 per month. Article requests increased to 35 per month. Website hits increased from an initial 150 to 300 per month. The bibliographic databases and clinical guidelines were found to be the most useful resources on the website.

They conclude that the study *"demonstrates the importance of the availability of training and the need for a greater investment in communicating to a staff about the service."*

NeLH National electronic Library for Health (UK)

Alison Turner, Veronica Fraser and colleagues describe the NeLH [23], whose purpose is *"to provide health professionals with a core knowledge base of accredited and evaluated information"*, in *A First Class Knowledge Service.* (23)

The NeLH is based around a central website including 70 information resources, obtained through partnership with the NHS Libraries, NHS Direct Online, and the electronic Library for Social Care. The purpose of the NeLH, which was launched in November, 2000,

Provide health professionals with a core knowledge base of accredited and evaluated information

is to provide a user-friendly environment and guidance to health professionals in accessing and using evidence, avoiding unnecessary visits to the library or office "to look things up."

One of the quantifiable benefits is the ability to purchase resources centrally.
The NeLH licensed access to the Cochrane Library of Clinical Evidence on behalf of the NHS. According to the NeLH, there are no other free, single-source, evidence-based knowledge resources available to and focused on clinical staff.

Its professional portals also include, midwifery, nursing, radiography, podiatry, dietetics, physiotherapy, occupational therapy, speech and language therapy, and library science.

A cost-benefit analysis concluded that the investment in evidence-based content offer cost savings in terms of staff time at between £3 million and £12 million per year

In February 2002, the first online continuing professional development modules were launched on the NeLH website, as well as a breast cancer Web resource in collaboration with NHS Direct online, and a diabetes knowledge base for NHS professionals. Anatomy, schizophrenia, telemedicine, child health are all present. The "Hitting the headlines" service provides evidence-based analysis of the news reports regarding new cures and techniques, within 48 hours of publication.

The website achieved 2.7 million hits in April, 2002.

A cost-benefit analysis concluded that the investment in evidence-based content offer cost savings in terms of staff time at between £3 million and £12 million per year.

e) Distance education for professionals

According to Grimson and colleagues in Dublin,

> "the need to participate in continuing professional development or continuing medical education, is considered to be at the very least highly desirable and more likely mandatory. The use of ICT is one means by which this can be facilitated in a timely and cost-effective manner." (24)

Their comment is supported by Kronz and colleagues's paper whose title provides the conclusion: *A Web-based tutorial improves practicing pathologists' Gleason grading of images of prostate carcinoma specimens obtained by needle biopsy: validation of a new medical education paradigm.* [24] (25)

Johns Hopkins

In this first large-scale international study evaluating the use of a Web-based program to educate widely-dispersed physicians, the Johns Hopkins Hospital team [25] tested Web-recruited international pathologists' ability to evaluate 20 images of prostate carcinoma specimens, before and after exposure to 24 tutorial images. 643 practicing pathologists participated in this free Web-based program. Pre-tutorial score correlated <0.0001 to the pathologist's location; higher scores were achieved by US than non-US based pathologists.

What was the effect of the tutorial?

> "the Web-based tutorial significantly improved grading in 15 of 20 images. Of these, on average, there was an 11.9% increase in assigning the correct Gleason score..."

Yet, we know from the work of Dr Bernard Sklar, that continuing medical education credits are obtained online by only 5% of physicians. Surveys regularly confirm that physicians prefer to meet with their colleagues at live conferences, even though this is not the most pedagogically effective means to deliver CME.

We were thus interested in the positive results of a 5 year experience in Canada, 1995 to 2000, described in *Videoconferencing for continuing medical education: from pilot project to sustained program* (26), by M Allen and colleagues.

> "In the year 1999-2000, a total of 64 video-conferences were provided for 1059 learners in 37 sites. Videoconferencing has been well accepted by faculty staff and by learners, as it enables them to provide and receive CME without travelling long distances. The key components of the development of the videoconferencing program include planning, scheduling, faculty support, technical support and evaluation. Evaluation enables the effect of video-conferencing on other CME activities, and costs, to be measured."

WebSurg [26] is a distance education program with an international conception and scope. This virtual surgical university, launched by Professor J Marescaux at the European Institute of Tele-surgery (EITS) in Stras-bourg, France, provides online video training in English, French, and Japanese, and access to world experts. A first for a European estab-lishment, the courses are also accredited by the Uni-versity of Virginia.

WebSurg's distance education ability is an outgrowth of the on-site surgical insti-tute. Between 1999 and 2002, the EITS trained over 7000 international surgeons on site in the latest robotic and telesurgery techniques, including simulation of the operation prior to surgery, via 3D modeling. 83% of the trainees were from Europe. The Institute has a video hook-up enabling both telesurgery and broadcast of local surgery to conference sites around the world.

Virtual Medical University

The French online medical university is the French Virtual Medical University or *Université virtuelle médicale francophone* [27]. The UVMF includes the medical schools of Grenoble, Lille, Marseille, Nancy, Paris V, Paris VI, Rennes and Rouen who together place their elearning materials online through multiple, integrated virtual campuses. Preparation for full-scale use is expected by 2004.

f) Telemedicine

The first two publications on Medline regarding tele-medicine date back to 1975 and concern space flight. There are now several thousand publications containing the keyword telemedicine. Twenty percent refer to Eur-ope.

The Telemedicine Research Center website [28] has a database of more than 12,000 articles. According to the TRC, telemedicine has been defined as the *use of telecommunications to provide medical information and services.* (Perednia and Allen, 1995).

There are five telemedicine applications: tele-education, telesurgery, and health networks, tele-expertise, and tele-monitoring. Tele-expertise is defin-ed as prevention, diagnosis and collaborative practice. Tele-monitoring invol-ves prevention and fol-low-up of the patient.

Two-way interactive television (IATV), used for "face-to-face" con-sultation is an important technology, as is image archiving. Peripheral devices can also be attached to computers. The word "tele" or far is a relative concept. In telesurgery, the surgeon may be in the operation room and simply calling upon robotic assistance for greater precision and to eliminate tremor.

Home monitoring is a form of telemedicine.

Almost all specialties of medicine have been found to be conducive to teleconsultation: psy-chiatry, internal medi-Scine, rehabilitation, cardiology, pediatrics, obstetrics and gynecology and neurology.

Telepathology enables electronic diagnosis on images downloaded from a remote place

The filmless radiology department can save approximately € 250,000 in a large hospital

Transcontinental Telehistopathology in prostate neoplasia

According to the publication (27) by Montironi and colleagues (Ancona), 1167 prostate neoplasia biopsy slides were transmitted and downloaded via the Internet among investigators collaborating in Europe and North and South America. The study measured inter and intra-observer reproducibility and found that there was 98% concordance amongst the results. Montoroni and colleagues conclude that *"telepathology enables electronic diagnosis on images downloaded from a remote place."*

Digital Image and cost-benefit

Siemens AG MHS consulting practice published cost-benefit data regarding a PACS or picture archiving and communication system. The filmless radiology department can save approximately € 250,000 in a large hospital through the savings on film, personnel archiving facilities, developers, printers, and light boxes. PACS also reduces length of stay from 0.1 to 0.3 days. Since savings cannot be guaranteed, SIEMENS proposes to share the risk, through a variable payment based on savings.

The telemedicine mission of the Paris Hospital System (AP-HP) [29] provided data on TELIF, a telemedicine program for the management of neurosurgical and neuro-medical emergencies in the Paris area.

An initial study showed that 65% of patients transferred to neurosurgery emergency centers were not admitted and that 57% of the transfers would not have been recommended by the neurosurgeon on duty if the CT scans of the patients had been transmitted. TELIF increased the access of patients to appropriate care and reduced the risk of transport of an unstable patient.

The TELIF network, operational since 1994, supports transfer of CT scans between 34 peripheral hospitals and specialized centers, in order to avoid inappropriate transfers. Decisions are taken by a multi-disciplinary group: radiologist, neurosurgeon, emergency physician, methodologist, ...

Thanks to the TELIF image transmission:

- Transport budgets are reduced.
- 90% of patients transferred are admitted.
- Hospital stays are diminished.
- Emergency staff expertise is improved via receipt of second opinion.

According to the European evaluation, TASTE, 1380 transfers were avoided in two years, with a net gain of € 1600 per transfer.

Systematic reviews

The Journal of Medicine and Telecare devoted its eighth issue 2002 to review studies of telemedicine. The authors' judgments regarding previous telemedicine studies are mixed.

Hersh and colleagues (Oregon) noted in, a *Systematic Review of the efficacy of telemedicine for making diagnostic and management decisions*, (28) the existence of over 450 telemedicine programs world-wide. The authors reviewed 58 studies and noted that few were high-quality. Their findings are:

"1. Strongest evidence for the efficacy of telemedicine for diagnostic and management decisions were in psychiatry and dermatology.
2. General medical history and "physical" examination performed by telemedicine had relatively good sensitivity.
3. Cardiology and ophthalmology provide evidence for efficacy.
4. Only a few specialties can obtain comparable results to face-to-face care by telemedicine."

Halley and colleagues from Canada and Finland reviewed 66 comparative telemedicine studies (29). They found that 56% were positive, 36% were inclusive and 8% weighed in favor of "face-to-face." The appendix provides a classification of the comparative telemedicine studies by specialty.

Loane and colleagues (Queensland Australia) conducted a review (30) of telemedicine guidelines and standards and concluded that:

- the guidelines are insufficient
- there is no consensus as to who should take the responsibility for developing them
- telemedicine guidelines should be developed internationally, by telemedicine specialists under the direction of telemedicine-versed clinicians from each subspecialty

Whitten and colleagues wrote a *Systematic review of cost effectiveness studies of telemedicine interventions.* (31) They included 24 of 612 identified articles presenting cost benefit data.

"Only 7/24 (29%) studies attempted to explore the level of utilization that would be needed for telemedicine services to compare favorably with traditionally organized health care. None answered the question... Conclusion: There is no good evidence that telemedicine is a cost effective means of delivering health care."

Rashid Bashshur and colleagues from WHO wrote a remarkable Executive Summary (32). Their key observation is the discrepancy between the potential

> **The highest priority should be given to funding appropriate, long-term, large-scale telemedicine projects by national and international agencies**

> **Home monitoring systems "transport" the patient's vital signs and statistics, virtually to the healthcare professional**

> **Patient education and self-management are key to the success of these programs**

and the reality of use: in a sample of 132 programs, only 15 reported more than 1000 teleconsultations per year.

Their conclusion: *"the highest priority should be given to funding appropriate, long-term, large-scale telemedicine projects by national and international agencies. Positive results will expedite the rate of diffusion."*

Internet-facilitated home monitoring systems for disease management

Since the late 1990s, a form of "telemedicine" has been applied to disease management, thanks to Internet-facilitated home monitoring systems. Home monitoring systems "transport" the patient's vital signs and statistics, virtually to the healthcare professional.

Chronic diseases including asthma, congestive heart failure and diabetes have begun to demonstrate the value of home monitoring. More frequent monitoring of selected patient data (heart rate, blood pressure, glycemia, peakflow) improves compliance and the quality of care itself. The patient has a more frequent dialogue with a health professional. The professional is alerted when necessary, making dosage and other adjustments possible. Face-to-face encounters can be scheduled more appropriately than in the absence of continuous data from the patient. Emergency room visits diminish. Overall health is improved.

Patient education and self-management are key to the success of these programs and the Internet makes it possible to communicate with the patient, whether by computer, cellphone, PDA, or specific devices.

In an editorial on the JMIR [30] website entitled *Internet use in disease management for home care patients: a call for papers,* Demeris and Eysenbach highlight some of the key disease management and new technologies papers published to date.

One such program, cited by Demeris and Eysenbach, is The Telematic Management of Insulin-Dependent Diabetes Mellitus (T-IDDM) project, funded by the European Commission

"T-IDDM implemented and evaluated a computer-based system for the management of insulin-dependent diabetes mellitus... The system includes a module allowing patients to automatically download their monitoring data from the blood glucose monitoring device, and to send them to the hospital database. The system provides physicians with a set of tools for data visualization, data analysis and decision support, and allows them to send messages, including therapeutic advice, to the patient."

3. REGIONAL AND NATIONAL NETWORKS

Regional and national networks link the healthcare actors in a region or a country, electronically, for clinical and administrative healthcare purposes. Prior to the emergence of these systems, the citizen-patient was the "network" doing the footwork of carrying or mailing clinical documents and information, reimbursement papers to the different points of care. Since the paper file remained in one place, the physician's archives, no one had access to the full data. Now, networking technology improves the efficiency of both clinical care and the administration of care.

Tens of millions of Europeans are already included in these networks.

Table IV. National and Regional Health Networks

Category	Examples	Location
National smart cards	Health Insurance Card System	Slovenia
	Sesame-Vitale	France
Regional	EVISAND	Andalusia
	Northern Norwegian Health Network	Northern Norway
	HygeiaNet	Crete
National	NHSNet	Scotland
	Medcom	Denmark

a) Smart cards

Smart cards have been applied to healthcare applications in Europe in France, Germany, and Slovenia. Rumania, Finland, and the UK have pilot projects.

Health Insurance Card System (Slovenia)
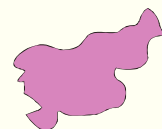
The Health Insurance Card System of Slovenia was introduced in the year 2000, to the two million person population of Slovenia. The system establishes data interconnections between all health insurance and health service providers. These include 1081 physicians, 77 institutions, 92 pharmacies, 64 healthcare centers, 26 hospitals, and 15 health resorts.

Sesame-Vitale (France)

The most recent statistics of the French program, "Sesame-Vitale" are found on the government website [31]

French National Social Security (CNAM) had been planning to modernize its reimbursement system for over 20 years. In 1978, the CNAM adopted a secure electronic data capture system using electronic or smart cards, program which would later be named SESAM-Vitale. The paper reimbursement form would become an "electronic care sheet" *(feuille de soins électronique)*, produced by the interaction of the health professional's computer, the citizen's Vitale Card, and a central network. The data from the electronic care sheet transits via the Social Health Network or Réseau Santé Social (RSS) and is treated automatically by the CNAM's IT system.

More than 10,000 km of optical fiber installed under the railways, accessible by 155 points of presence in France, Monaco, and French Guinea ensure the backbone of the telecommunication system. The backbone is managed by a shared subsidiary of the French National Railways Company and a private telecom group.

Cegetel RSS authenticates the identity of health professionals and ensures interconnection amongst healthcare actors, secure mail; and access to drug and medical information, alerts.

This system was rolled out between 1998 and 2001, through France. Private practice health professionals were requested to introduce a computer and teletransmission device to their offices and were equipped with the "Health Professional's card". Over 50,000 MDs and 300 hospitals are connected. One million forms were transmitted in 2002. A total of 450,000 professionals have received cards.

b) Regional health information networks

Health information networks typically involve the linking of healthcare institutions, via telemedicine and Web-based services, to professionals and patients disseminated over a broader geographic area, than could be serviced by the institution without the technology.

There is no standard "regional" health information network. One regional hospital may deliver health services to a population equivalent to that of a small country

EVISAND (Spain)

EVISAND is operational since the year 2000, in three provinces of Andalusia, Spain, representing a total of 2.5 million inhabitants. The program includes:

Telemedicine video-assisted specialist consultations in cardiology, dermatology, pediatrics, psychiatry, ophthalmology, radiology, ambulatory surgery, and neurosurgery;

Multipurpose training for health professionals;

Virtual support to health emergency situations.

- Online consultations represent 80% of the medical activity and emergency assistance 20%.
- Online consultations average 17 minutes with a span of from 4 to 35 minutes. 76% of patients did not need to be transported to reference hospitals.
- Of the 24% remaining who are transported, 82% of those needed further diagnostic procedures that could not be provided at the consultation site.
- In 2002, programmed health transport increased 18% over 2001, whereas emergency transport increased by only 7%.
- Transmitting and receiving physicians as well as patients indicate a very high satisfaction rate with the service.

Northern Norwegian Health Network (Norway)

The NH is the Northern Norwegian Health Network, a closed network for healthcare institutions. The University Hospital of Northern Norway, which includes the Norwegian Center for Telemedicine, provides health services in the network. The region includes 464,159 inhabitants, many living in remote areas. One million messages went through the health net in January 2003.

These messages include transmission of dermatology images, of ear-nose-throat stills, of pediatric cardiology recordings, discharge letters, laboratory and radiology analyses, telemedical referrals. The University

> **In more than 95% of cases, the dermatologist could conclude on the basis of the information forwarded in the still images**

> **Telemedicine services have replaced phone calls from general practitioners to specialists for advice, and travel for many patients**

Hospital receives 6500 teleradiology consultations a year. The Troms Military Hospital sends an additional 8400 teleradiology consultations, because it does not have its own radiologist.

Patients can request appointments and access results via the Web. Ultrasound and stethoscopes are connected to video equipment. The hemodialysis machine is monitored by software.

In more than 95% of cases, the dermatologist could conclude on the basis of the information forwarded in the still images, although many patients prefer videoconferencing; the prerecorded heart sound study demonstrated economy of time for specialists. Telemedicine services have replaced phone calls from general practitioners to specialists for advice, and travel for many patients.

HYGEIAnet (Greece)

HYGEIAnet [32] is the regional health information network of the island of Crete, Greece. This network provides homecare, an integrated health record, teleconsultation services, clinical information systems for hospitals; and emergency care. HYGEIAnet allows patients to provide access to information in their health records 24 hours a day with greater security than can be provided with a paper-based system and facilitates access to remote cases by professionals

The first phase of HYGEIAnet's implementation ran from 1995 to 2001. 2000 staff members have been trained regarding the use of the system.

Results have been evaluated regarding pre-hospital health emergency services, remote management of chronic disease, and for cardiology. Further studies are ongoing.

82% of dispatching decisions regarding emergency situations have been judged correct, a significant improvement over the previous situation. Clinical trials on telemanagement

82% of dispatching decisions regarding emergency situations have been judged correct, a significant improvement over the previous situation

An evaluation (36) of a pilot project in Viborg County shows that it was possible in 95% of selected diagnoses to examine and treat patients by means of teledermatology

of pediatric asthma have been successful. And in cardiology, whereas previously all patients were transferred to the hospital, in only 9 of the 21 evaluated cases, was this necessary.

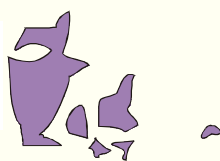### c) National Networks

NHSNet (Scotland)

Willmot and colleague describe the positive, but imperfect results of NHSnet in linking primary care practices in Scotland, in *NHSnet in Scottish primary care: lessons for the future (33)*. NHSnet [33] is the name of the electronic network for primary care professionals in the United Kingdom. NHSnet will provide access to up to date information through NHSnet Webpages and the Internet, as well as to laboratory results, referral and discharge letters, hospital appointments, electronic prescription transfer.

Scotland, a separate jurisdiction, had moved forward before England and Wales, launching its GP initiative in April, 1997. All Scottish general practices received "a free computer, installation of an ISDN line, registration to NHSnet, and one day's training."

Results of the program were evaluated through questionnaires at end 1998. 99% of the 1065 general practices agreed to participate!

In 56% of practices, someone accessed NHSnet at least once a week. However, the authors observed great local variation in results due to a "lack of coherent infrastructure across Scotland" and consider that "implementation has been less than satisfactory", because local decision making within a national initiative had led to a "highly variable system" in terms of basic technical service rendered to the physicians. This implementation demonstrated that professionals are willing to evolve, and that a homogeneous offering is preferable.

Medcom (Denmark)

MedCom
- det danske sundhedsdatanet

From Theory to practice: electronic communication and Internet opportunities in the Danish health service (34) by Claus Pedersen and colleague describe 12 years of work in developing an electronic national health network. In 1990, the system was launched with EDIFACT technology and a closed network. Pilot projects were developed by each county until 1994, when one county took the initiative to establish a national project to avoid redundancies, and to compile national EDIFACT standards for the most frequent messages. This project was called Medcom [34]. All major public health organizations participated, as well as some private companies.

MedCom II was established to ensure the diffusion of the standards that had been developed.

Today 80,000 messages are communicated daily. 100% of hospitals, pharmacies, emergency doctors, 90% of GPs, 98% of laboratories, 55% of specialists, 20% of municipalities are connected to the healthdata. MedCom enables hospitals to use electronic referrals, avoiding data re-entry. The professional quality of referrals has risen. Discharge letters are stored directly in general practitioner ("GPs") journal systems and monitoring of time elapsed before receipt of the discharge letter is facilitated.

Several different studies of specific aspects of the program have concluded that MedCom has led to significant financial and quality gains for the Danish health service.

One study demonstrates the problems generated by a paper-based system:

"A study at the University Hospital in Odense, Denmark, shows that more than 50% of all paper referrals from GPs were so inadequate that it was impossible to implement patient referrals without first contacting their GP.

In 21% of these cases, the errors involved missing data, so that it was not possible to search for previous admissions. In 20% of cases, missing information was necessary for summoning patients (name, address, etc.). In 8% of cases it was not possible to read one or more pieces of decisive information on referrals due to the handwriting."

A 1995 study by the Danish Institute for Health Services Research, focused on the introduction of electronic communication between GPs, pharmacies and hospitals in Funen County, (35) GPs and hospitals saved time per message regarding referrals, prescriptions, laboratory reports, and discharge letters.

An evaluation (36) of a pilot project in Viborg County shows that it was possible in 95% of selected diagnoses to examine and treat patients by means of teledermatology. Another study concluded that pharmacies have reduced their staffs by 6.3%, largely due to electronic communication.

The following data was provided to the European Commission by the Medcom team.

Potential annual savings in Denmark

Pharmacies have reduced their staffs by 6.3%, largely due to electronic communication

Table V. Potential Annual Savings by Medcom Network in Denmark

Time saved per message in minutes	Hospital	GP clinic	Pharmacy	Total time saved per message in minutes	Total messages per year (approx.)	Working hours saved in man-months per year in Denmark
Discharge letters	3.1	5.1		8.2	360,0000	2,982
Referrals	18.5			18.5	180,000	336
Laboratory reports		3.7		3.7	4,800,000	1,794
Prescriptions		1.2	0.3	1.5	10,696,488	1,621
Total savings in man-months	6,733					25,360
Potential savings[1]						22,554,884

[1] Based on average monthly salary per employee of € 3350.

GPs in Denmark are self-employed and yet spend between € 14 K and € 40 K in Medcom set up costs. More than 90% have done so. Approximately 50% of GPs believe that electronic communication is significant in this respect (37)

MedCom IV represents the transition to Internet technology, including: secure email; appointment making; Web access to laboratory results, xrays, patient information; home monitoring; telemedicine and health information.

The Danish health Internet began officially on June 18 2002, with a large-scale pilot project. By 2004, the project will include a national telemedicine dermatology network, interorganizational posting of xrays, lab results, and ECGs, and a link between GPs, hospitals and carers. ❑

4. *e*Health statistics and behavior

eHealth Statistics

Data on both the distribution of *e*Health software applications in Europe and the use of the Internet are incomplete, except for those countries benefiting from large regional or national networks. Some of the gaps on relevant data are being filled through the research work of HINE, Health Information Network Europe, a program initiated through EU support. Our sources are publicly available information, from both the European Commission and market research sources.

There are approximately 600 million people online

EHRs
According to European Commission data, almost half of the connected GPs (48%) in the EU use an EHR. 90% and 95% respectively of connected GPs in Sweden and Denmark use EHR's. The use is more limited in Spain (35%), Greece (27%) and France (17%).

Estonia and Slovenia stand out as leaders in the region, as both countries have Internet penetration levels on par with Western Europe

In most of the European countries, the equipment is bought by the practice; for 10%, the equipment was provided by national or regional health care services. The figure rises to 72% of Swedish GPs and 38% of Dutch GPs. In Germany, 17% of GPs are equipped through GP or health care associations.

Non-English native speakers now represent 63.5% of Internet users

Internet

We consulted CyberAtlas and Global Access for global Internet data, and Eurobarometer for both consumer and healthcare professional data, specific to the EU.

a) CyberAtlas
According to both CyberAtlas [35], and Global Access [36], there are approximately 600 million people online.

In an article posted February 21, 2003, *"More than half-billion online globally,"* CyberAtlas presents the figures of Nielsen-NetRatings, IDC, UCLA 2002 (http://cyberatlas.Internet.com/big_picture/geographics/article/0,,5911_1593591,00.html)

- The global Internet population grew by 4% in 11 major Internet markets during 2002.
  - Spain registered a 22% increase to 17 million users. Spain also had the biggest percentage increase in most of the Internet activities undertaken among surfers in the past six months.
- Germany (35.6 million), the United Kingdom (29 million) and Italy (22.7 million) have the largest number of people outside the U.S. with Internet access via a home PC, accounting for 54% of the total for all 10 countries (160.6 million) outside the U.S.
- Sweden, Hong Kong, the Netherlands and Australia have the highest Internet connection rates (81+%) for those who have a PC in their home.
- IDC confirmed increases in Internet usage in Central and Eastern Europe (CEE), driven by workplace and school users. IDC forecasts usage to reach 17% in 2003 and 27% in 2006.
- Estonia and Slovenia stand out as leaders in the region, as both countries have Internet penetration levels on par with Western Europe. This can be attributed to government efforts to promote Internet usage in schools and public access points, as well as to private initiatives among businesses to promote the Internet.

b) Global Reach
Global Reach [37] estimates the number of people online in each language zone (native speakers). Non-English native speakers now represent 63.5% of Internet users. This is further broken down into 35.5% for European languages and 25.8% for Asian languages. The Chinese and Japanese languages represent the second and third languages after English with 9.3 and 10.8% of users respectively.

- English 231 M (36.5% of total world online population)
- Non-English 403.5 M (63.5%)
- European Languages 224.1 M (35.5%)
  - Spanish 40.8 M (7.2%)
  - German 42.0 M (6.6%)
  - French 22.0 M (3.5%)
  - Italian 24.0 M (3.8%)
  - Portuguese 19.0 M (3.0%)
- Asian Languages 146.2 M (25.8%)
  - Japanese 61.4 M (9.3%)
  - Chinese 68.4 M (10.8%)
  - Korean 28.3 M (4.5%)

(See Fig. 1.)

c) Eurobarometer 2002

EUROBAROMETER

The DG Information Society and Technology *e*Health Unit sponsored Eurobarometer [38], a study providing data regarding Internet penetration in 15 member states, for both households and general practitioners.

The sizes of the two total samples are high, relative to other surveys. Telephone surveys were conducted separately for households (30,336 individuals) and general practitioners (3512). The increase in Internet penetration is apparent during this period. (See Fig. 2)

The comparison of physician and household penetration of the Internet demonstrates the absence of correlation between the two factors. (See Fig. 3.)

Physician attitude to the Internet is not a function of the percent penetration of the Internet in the consumer population. We note the difference in physician behavior in three countries, wherein the populations have very similar behavior (NL, DK, S). This is again the case in the group composed of Lux, Fin, A, Irl, UK, and all the way through the chart.

Comparison of general population and healthcare professional use of the Net.
The next chart compares the general population to the professionals, presented by decreasing order. Countries with similar physician rates have dissimilar household

rates of Internet penetration. The highest rates for professionals are in countries where government impetus has been the strongest: the Nordic countries, UK, and France, thus dispelling the contentions that language, culture, or physician inability to work with computers are definitive obstacles. (See Fig. 4.)

The third chart presents the household and physician data as grid coordinates. The highest dual coordinates (physician and household) are achieved by Denmark and Sweden, followed by Finland. These are countries where national policies have strongly promoted health informatics and *e*Health. (See Fig. 5.)

eHealth behavior as reported in the literature

Consumer and professional behavior with respect to the Internet have been the object of numerous medical publications around the world.

Healthcare Professionals
More than 60 publications with abstracts present surveys concerning the use of the Internet by healthcare professionals in Europe: dietitians in the UK, gynecologists in Switzerland, GPs in Poland, dental schools across the continent... The data confirms the trends presented in the Eurobarometer surveys.

Vorbeck and colleagues present early data on Austrian radiologists in *Internet use in radiology: results of a nationwide survey. (37)* In 1999, 26% of 854 radiologists returned the questionnaire that was mailed to them on the subject of their Internet use. Of those 210 radiologists, 73% had Internet access.

According to Nylenna and colleagues in *The use of Internet among Norwegian physicians, (38)* a postal survey of GPs in Norway revealed that 72% of the 78% of respondents had Internet access in December, 1998. The conclusion:

"Doctors using the Internet professionally had longer working hours, read more medical literature and participated more often in CME activities than did non-users. With its universal accessibility, the Internet has been seen as a major force in making medical knowledge available to all doctors. This is not yet the case; for the time being, it appears that the net widens the gap between doctors who actively seek new professional knowledge and those who do not."

Feschieva and colleagues underscore the wish of Bulgarian physicians to improve their knowledge in the

Health service workers are looking for leadership

An appropriate vehicle is the specialist postgraduate program in health informatics, which emphasizes the interdisciplinary nature of the field

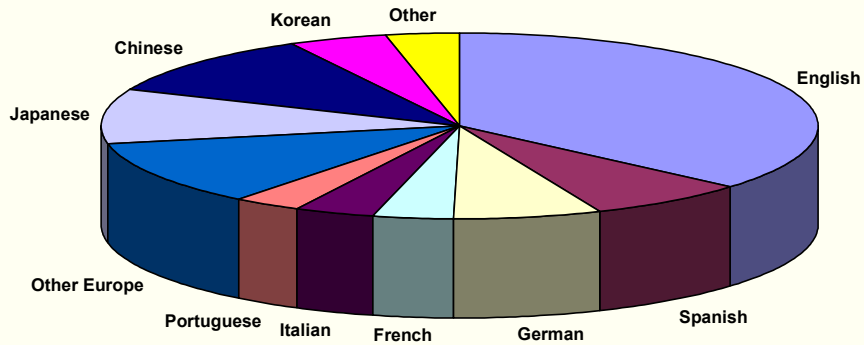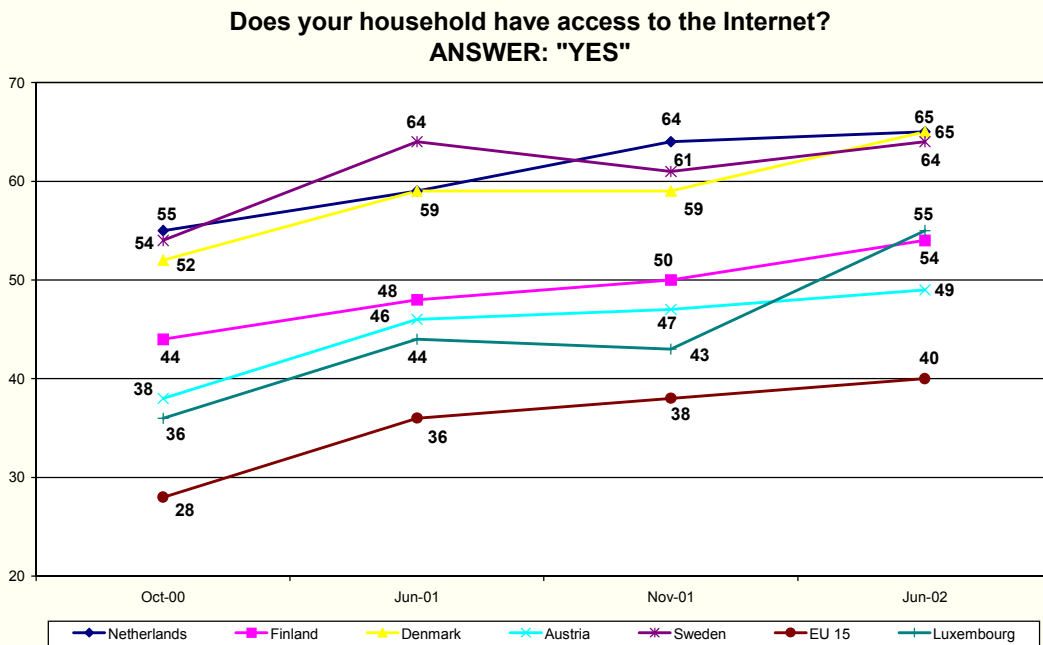## Fig. 1. Language Distribution Among Internet Users

Fig. 2. Increase of Internet Use During the Period 2000-2002 in EU

Does your household have access to the Internet?
ANSWER: "YES"

Netherlands — Finland — Denmark — Austria — Sweden — EU 15 — Luxembourg

Note: Values represent % of respondents

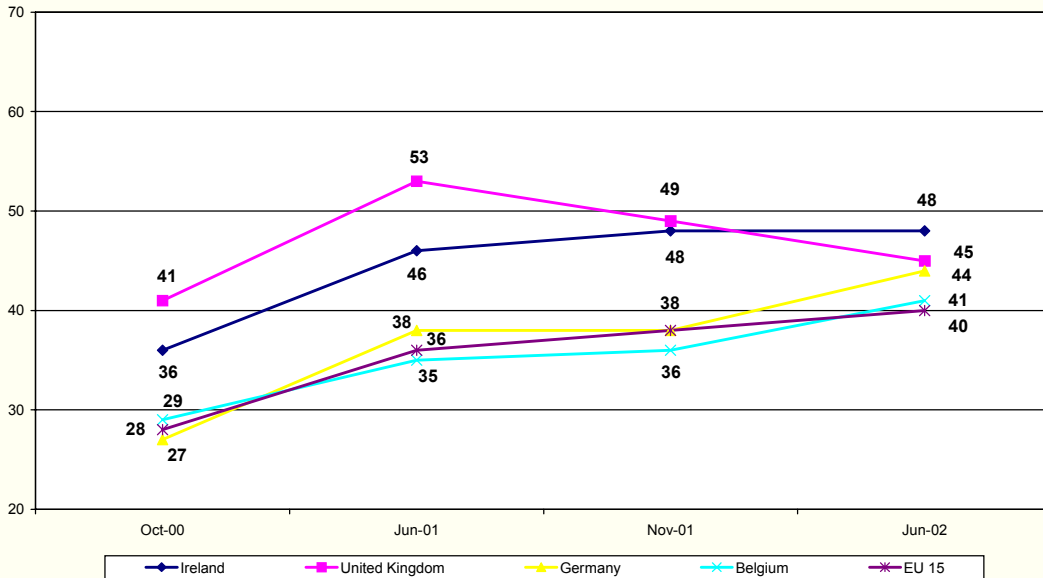Ireland — United Kingdom — Germany — Belgium — EU 15

Fig. 3. Comparison of General Population and Healthcare Professional Use of the Internet per European Country, June 2002
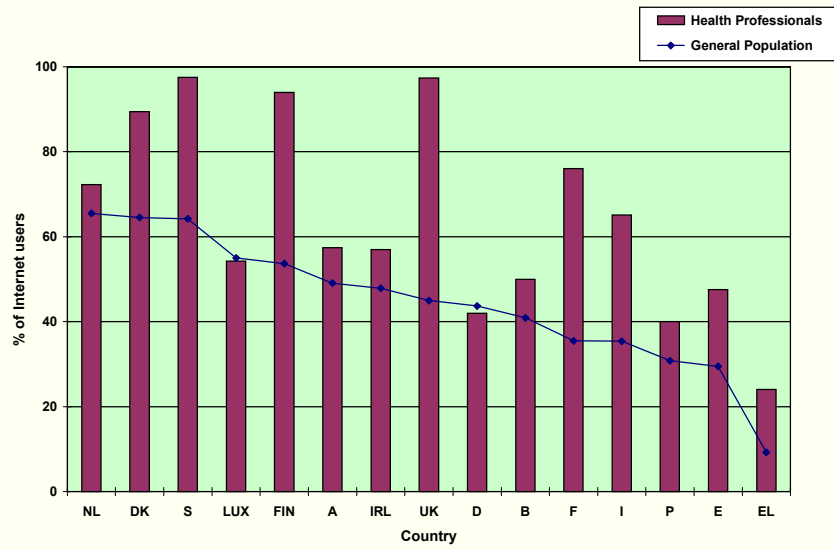

Fig. 4. Comparison of General Population and Healthcare Professional Use of the Internet per European Country, June 2002
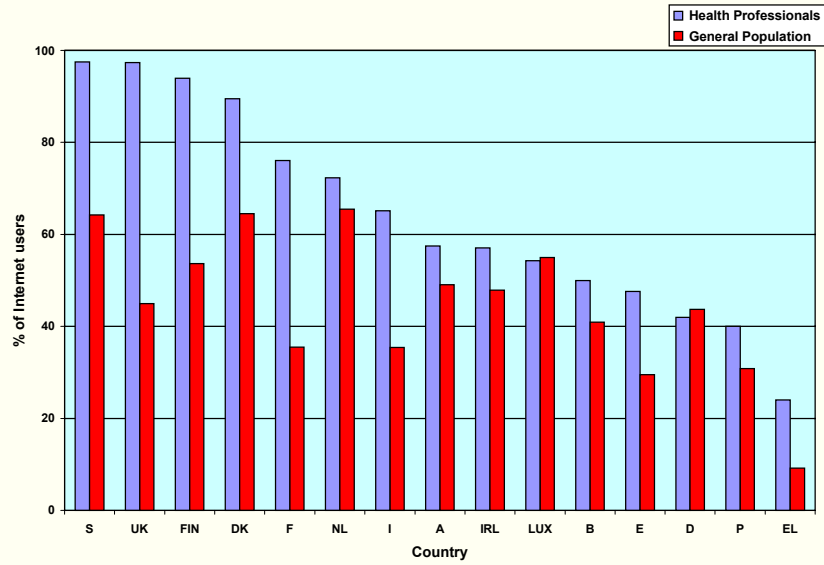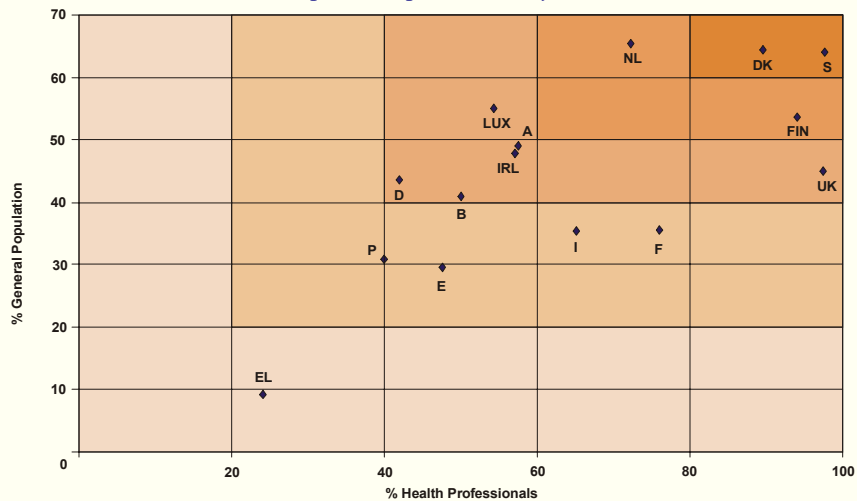

Fig. 5. Comparison of General Population and Healthcare Professional Use of the Internet per European Country, June 2002

article *Proofs of the necessity of medical informatics for the physicians in Bulgaria.* (39)

"97.5% of the Bulgarian physicians have a positive attitude to information technologies ... 84.1% of them do not have the necessary skills and knowledge to use computers in their daily medical practice... The first step of the implementation of this strategy is to include medical informatics in the regular curriculum of students of medicine."

Grimson and colleagues (Dublin) propose solutions in *A multimedia approach to raising awareness of information and communications technology amongst healthcare professionals.* (40)

The authors report on a training program that was successfully delivered to over 2300 health professionals across Ireland. The program was supported by a CDROM and a website and delivered to health professionals at their place of work at convenient times with repeat sessions at high-density locations. According to the authors, the 45 symposia met with an overwhelmingly positive reaction. They also note that:

"... health service workers are looking for leadership. These leaders need to be drawn from within the health sector itself and go forward in a unifying manner, learning from each other, and adopting international best practice...An appropriate vehicle is the specialist postgraduate program in health informatics, which emphasizes the interdisciplinary nature of the field."

Consumers/citizens

Publications in medical literature confirm consumer use of information technologies in regards to healthcare information access. The key findings are:

- Consumer use of the Internet for health purposes is on the rise in Europe,
- Consumers would like guidance from their physician regarding quality websites
- Neither party initiates the discussion, patients

out of fear of physician reaction and physicians because they don't consider the patients' information and communication needs, as part of the treatment.

Stroetmann and colleagues in Bonn, Germany, carried out a survey (41) of 9661 elderly people in 15 European countries. The percentage of computerized individuals is low, but higher than many imagine:

"13% had access to digital television. Almost half (48%) had access to mobile phones (with 42% actually using them), 36% had access to PCs (with 27% being active users) and 22% had access to the Internet (with 17% being active users)."

In *Consulting the Internet before visit to general practice. Patients' use of the Internet and other sources of health information,* (42) Budtz and colleague in the Department of General Practice, University of Copenhagen, Denmark, concur with the two UK references. In a survey of 93 consecutive patients after visiting their GP, they found that:

"Only two patients never looked for health information. Of all patients, 20% had used the Internet to get health information, 8% because of the current visit, i.e. a third of all with Internet access had used it because of the current visit. Women used the sources of information more than men.

In *Use of the Internet and of the NHS Direct telephone helpline for medical information by a cognitive function clinic populatio*n (43), AJ Larner of Liverpool (UK) examined behavior of patients seen consecutively over 6 months by one GP at a cognitive function clinic. He found that more than 50% of patients and families/carers had Internet access and over half of those had accessed relevant information, but did not speak of it, unless asked. 82% confirmed that they were interested in accessing websites with relevant medical information, if these were suggested by the clinic doctor.

Parents who knew their child's diagnosis were more likely to have used the Internet than those who named their child's symptoms only

Eighty nine (84%) parents who had used the Internet prior to this clinic appointment found it useful

Eighty-four percent expressed interest in having a Web site on IBD supported by the physicians of their referral center and *65% were prepared to pay a subscription for this service*

Tuffrey and colleagues of Bath (UK), confirm consumer interest for the Internet in *Use of the Internet by parents of paediatric outpatients*. (44) 485 families responded to a survey regarding the Internet as pertains to a pediatric problem.

"A total of 332 (69%) families owned a computer and 248 (51%) had Internet access; 107 (22%) had looked on the Internet for information about the problem for which their child was being seen in clinic that day. Parents who knew their child's diagnosis were more likely to have used the Internet than those who named their child's symptoms only. A health professional had suggested that parents seek information on the Internet in 6% of cases. These parents were more likely to use the Internet than parents to whom this had not been suggested (67% v 20%, p < 0.001). Eighty nine (84%) parents who had used the Internet prior to this clinic appointment found it useful."

Panes and colleagues researched the extent to which patients with inflammatory bowel disease (IBD) in Barcelona (Spain) make use of the Internet and the relationship between Internet use and demographic characteristics in *Frequent Internet use among Catalan patients with inflammatory bowel disease. (45).*

*"Replies were received from 86%. Sixty-eight percent had home computers and 49% had an Internet connection. Forty-four percent sporadically or regularly obtained information on IBD from the Web. Eighty-four percent expressed interest in having a Web site on IBD supported by the physicians of their referral center and **65% were prepared to pay a subscription for this service.**"*

***

An important question is: which data do we need, before moving forward in *e*Health?

The Internet was not built to survey the number of its users, quite the contrary. So, statistics are based on samples, as they are for all media. The number of accounts or computers is not an accurate description of the population. No one knows exactly how many electronic patient records are in use in Europe, the US, or Asia.

An important question is: which data do we need, before moving forward in *e*Health?

There are e-supporters and e-detractors. The initial generation gap has been largely eliminated, as Internet penetration passes the 50% rate of a population. Those opposed to the computerization impute previously existing issues to "e". They say that people will spend their time surfing rather than working, that privacy and confidentiality will be infringed, and that "e" has not demonstrated its return on investment. We ask whether poor work habits were born with computerization, whether paper-based records are secure, and whether you need to make a business case for essentials such as phone and fax.

Those who noted that the Internet would modify the current situation, whether the market share of a traditional business, the organization of a health system, the relationships within a professional hierarchy are right. This is good or bad, depending on each person's situation and motives.

The *New York Times* February 23rd, 2003, in *"Critical Mass: how the protesters mobilized"*, noted that

"the Internet has become more than a mere organizing tool; it has changed protests in a more fundamental way, by allowing mobilization to emerge from free-wheeling amorphous groups, rather than top-down hierarchical ones... In contrast to hierarchies, with top-down structures, heterarchies are made up of previously isolated groups that can connect to one another and coordinate."

Does the Internet-enhanced ability to mobilize and modify relationships not apply equally to healthcare? ❏

5. Key messages

The Case for *e*Health is replete with lessons learned from the *e*Health experience. Stepping back from the specifics, what are the key messages?

The proof of eHealth's contribution is clear, clear, but the fragmentation of that knowledge is slowing implementation.

- *e*Health is older and broader than you think. It is the application of informatics to healthcare, and this began nearly 40 years ago.
- *e*Health has demonstrated its contribution to the improvement of the quality of care in every aspect of the chain of care.
- The medical literature is an excellent resource for identifying the state of advancement of *e*Health around the world, although the timelag from study to publication in print and on Medline is problematic.
- There is no lack of interesting examples of *e*Health in EU countries.
- But there are few examples of country-to-country knowledge transfer. The Nordic countries are the exception which confirms the rule.
- Specific examples have generally not been communicated beyond academic circles. The technical nature of the subject matter must be simplified for mass media.
- The importance of *e*Health needs to be explained to citizens through the concrete benefits. They will then become part of the process to move *e*Health forward.

Progress amongst institutions, countries, individuals is unequal.

- Many healthcare institutions are far ahead on the ICT experience curve.
- By allowing the gap to increase between institutions, it becomes all the more expensive and challenging to enter the race.
- Interinstitutional research and cooperation should be encouraged.
- Use of the Internet (and of a computer) is generally linked to a higher socio-professional category; so in almost all cases, healthcare professionals are more

frequent users of the Internet than consumers. Computerization is also favorably correlated to GDP per inhabitant.

- The countries that have imposed some form of computer-related obligation on professionals have a much higher rate of participation than those who have not.
- An obligation must be accompanied by quality training and education programs and financial incentives.
- Telecommunications infrastructure and cost-effective access to broadband connections are key, related success factors to professional, institutional, and consumer use of *e*Health.

Growth in citizen use of the Internet may not be visible.

- The number of patients using the Internet to seek healthcare information is important and growing.
- However, they tend not to inform their physicians of their use of the Internet, unless asked to do so.

All aspects of healthcare can be favorably impacted by ICT.

- The growing concern regarding medical error in Europe and the U.S. favors the massive recourse to *e*Health tools.
- While continuing professional education could be facilitated by *e*Health tools, professionals do not generally seek today's online course offering. Courses are mostly text based and insufficiently interactive.
- Existing telemedicine resources are under-utilized, in terms of the number of consultations; yet waiting lines for face-to-face consultations with healthcare professionals lengthen and costs rise in most of Europe.
- A myriad of registries and health-related databases have migrated online in recent years, opening greater opportunity for access to the information, but they are not well known. Some, but not all, are coordinated at a European level.
- National networks seem to provide an appropriate level of coordination of information and service

No study sample is as large, no observation period as long, as you would wish

Do policy makers need more data before they decide that *e*Health must be a major component of their health organizations, if it is not already the case?

today. However, the interoperability of these systems must be ensured as citizens of Europe become more mobile in their healthcare management.

- The adoption of worldwide common standards for *e*Health tools and programs would significantly accelerate the implementation of eHealth.

Delay in the implantation of eHealth bears a high cost.
- We must be wary of the negative impact of the search for definitive *e*Health data. No research is as complete, thorough, evaluative as the study you and your team could have imagined. No study sample is as large, no observation period as long, as you would wish. No one publcation will satisfactorily answer a specific objection. No "foreign" example is as relevant as one done in your country, region, town, institution. The risk of this criticism is both the generation of redundant pilot studies and delay in implementation.

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What is the Case for *e*Health?

There is no one right answer.

No worldwide database lists and structures *e*Health data and achievements.

There are very few common criteria and standards of assessment. As the pharmaceutical industry developed and continues to refine specific methodologies for drug assessment, *e*Health applications need a common methodology of evaluation, so that decision makers, health professionals and citizens can dialogue objectively with *e*Health producers.

Should we not devote further time and energy to moving forward with implementation?

The immediate question is: do policy makers need more data before they decide that *e*Health must be a major component of their health organizations, if it is not already the case?

The US Surgeon General presented data against smoking in the 1960s. Are we satisfied by the progress in eradicating this killer? Should we have continued to collect data demonstrating the cause and effect or devote more funds to a better understanding of the prevention and eradication of smoking itself?

Have the following not already demonstrated their *raison d'être*?

- Computer-aided diagnosis;
- Electronic prescription;
- Electronic records;
- Digital libraries;
- Online registries;
- Online communities of professionals and citizens;
- Online training and educational programs;
- Hospital information systems;
- Regional networks;
- Robotic surgery;
- Telemedicine (teledermatology, telepsychiatry, telecardiology, teleradiology, robotic and tele-surgery);
- Telemonitoring;
- Videoconference.

Should we not devote further time and energy to moving forward with implementation?

We rest our case. ❏

Moving the Case for *e*Health Forward

Where do I go from here? What is the road forward? These are the right questions, but they are prickly. How can one road map be right for such a diversity of contexts and actors? We have identified the following steps, common denominators for the promotion of eHealth.

1) Communicate to and educate healthcare stakeholders, regarding the benefits of eHealth in improving quality of care. Explain that eHealth is a means and not a finality.
2) Provide incentives for increased use of quality eHealth tools.
3) Review eHealth programs presented here and in other relevant sources. Make contact with program coordinators. Involve healthcare stakeholders in this review, nonetheless keeping study groups lean!
4) Determine which one, two, or three programs, would meet with the best support by the greatest number of

healthcare partners around you.
5) Engage in informal networking and exchange on these choices with European colleagues in other countries.
6) Appoint a leader and a representative of stakeholders to participate in the implementation of each program. Request an action plan with a firm deadline.
7) Ensure that evaluation methodology is an integral part of the program.
8) Introduce healthy competition into the implementation process.
9) Reward use of existing tools and programs wherever possible.
10) Maintain regular dialogue with healthcare stakeholders on these issues.

…And let us know how you progress! ❏

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