

Electronic Health Record Systems
Present situation, lesson learned and future challenges



Ilias Iakovidis, PhD
European Commission
Applications relating to
Health

CONTACT ADDRESS: European Commission, Information Society Technologies Programme
Systems and Services for the Citizen: Applications relating to health
Tel: +32.2.296.35.06/66949, Fax: +32.2.296.01.81, E-mail: ilias.iakovidis@cec.eu.int

Very happy to be here again - thanks to the organizers

What to talk about in the country I refer to as “Example to Follow” ?

I personally owe to this country and its people many lessons I have learned

E.g. what means long term planning, “Forum” of all interested players

After all, ... it was a Dane that opened the door for me to explore this world!

But there must be some topics you do not know,

(or do not want to hear?)

So let us take the little journey and identify them together..

Topics considered in the presentation

- 1. Present situation in EU**
- 2. Major obstacles in wider implementation**
- 3. Latest technologies pertaining to user friendliness**
- 4. Lessons learned from EHCR implementation around EU**

EUROPEAN COMMISSION

Research and Development (R&D) Programs

88-90: AIM I- Advanced Informatics in Medicine - (20 Mil. EURO)

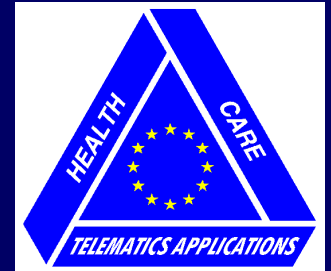
91-94: AIM II 50 R&D projects (108 Mil. EUR)

94-98: Telematics Applications for Health (135 Mil. EUR)

130 R&D PROJECTS

1300 Research Inst., Industries, User Associations, Public Authorities

7000 EU Citizens involved



99-02 Information Society Technologies relating to Health

75 new projects

(200 Mil. EURO)



www.cordis.lu/ist/ka1/health/home.html

The Electronic Health Record - EHR

Digitally stored (subset of the) healthcare record about individual's lifetime with a purpose to support the continuity of care (quality, access, efficiency), education, and research.

The Electronic Health Record System -

information systems that manages and operates on the EHR. Helps to access and share information to qualified persons in user-friendly manner. Meets the security requirements to ensure confidentiality of data.

A record is not a message

RECORD

generic purpose

specific author

self-addressed

permanent

within HCR systems

MESSAGE

specific purpose

specific author

specific recipient

transient

between HI systems

**Electronic
Computer-based**

Medical

Record

**Electronic
Computer-based**

**Health
Patient**

Record

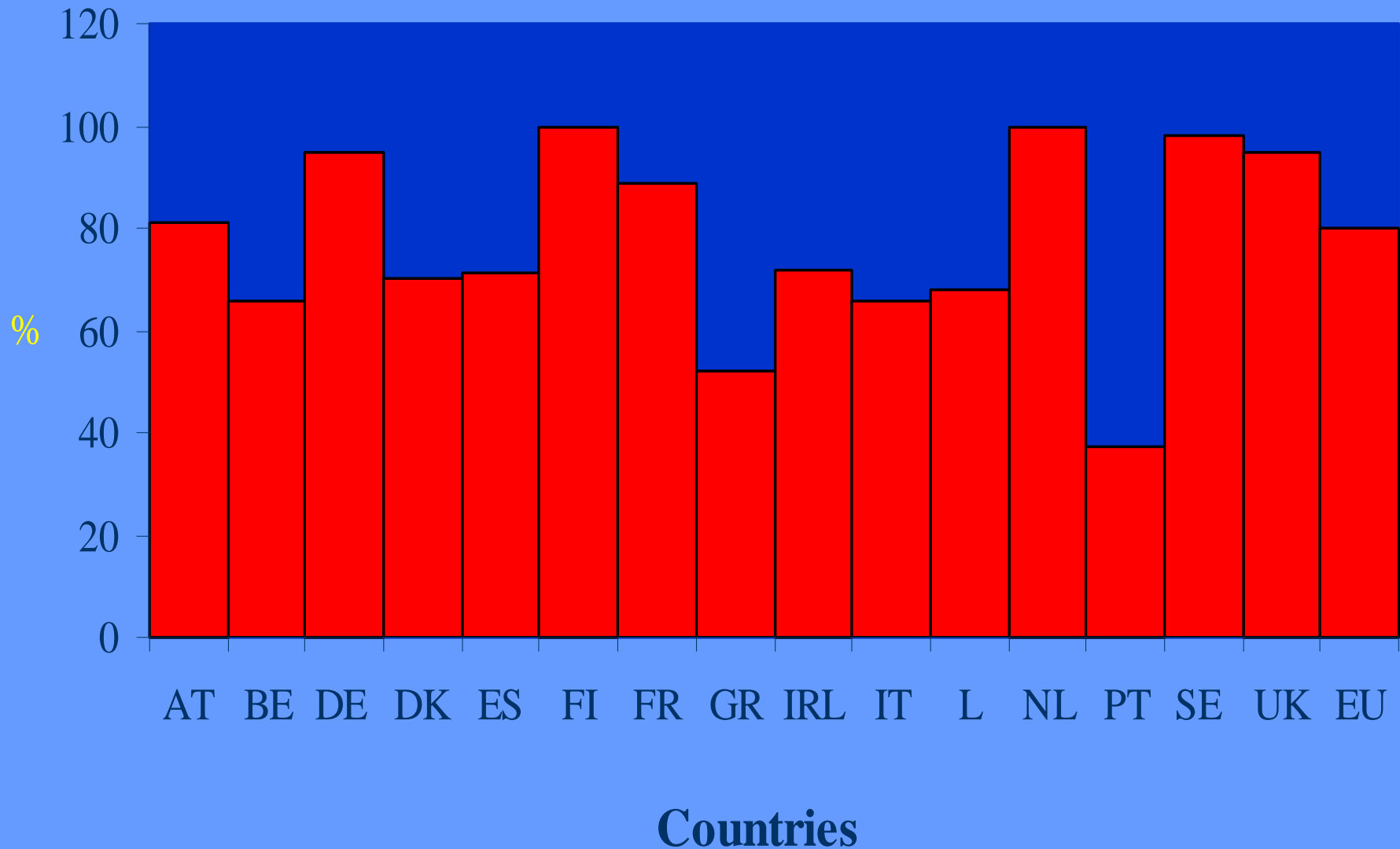
Personal

Health

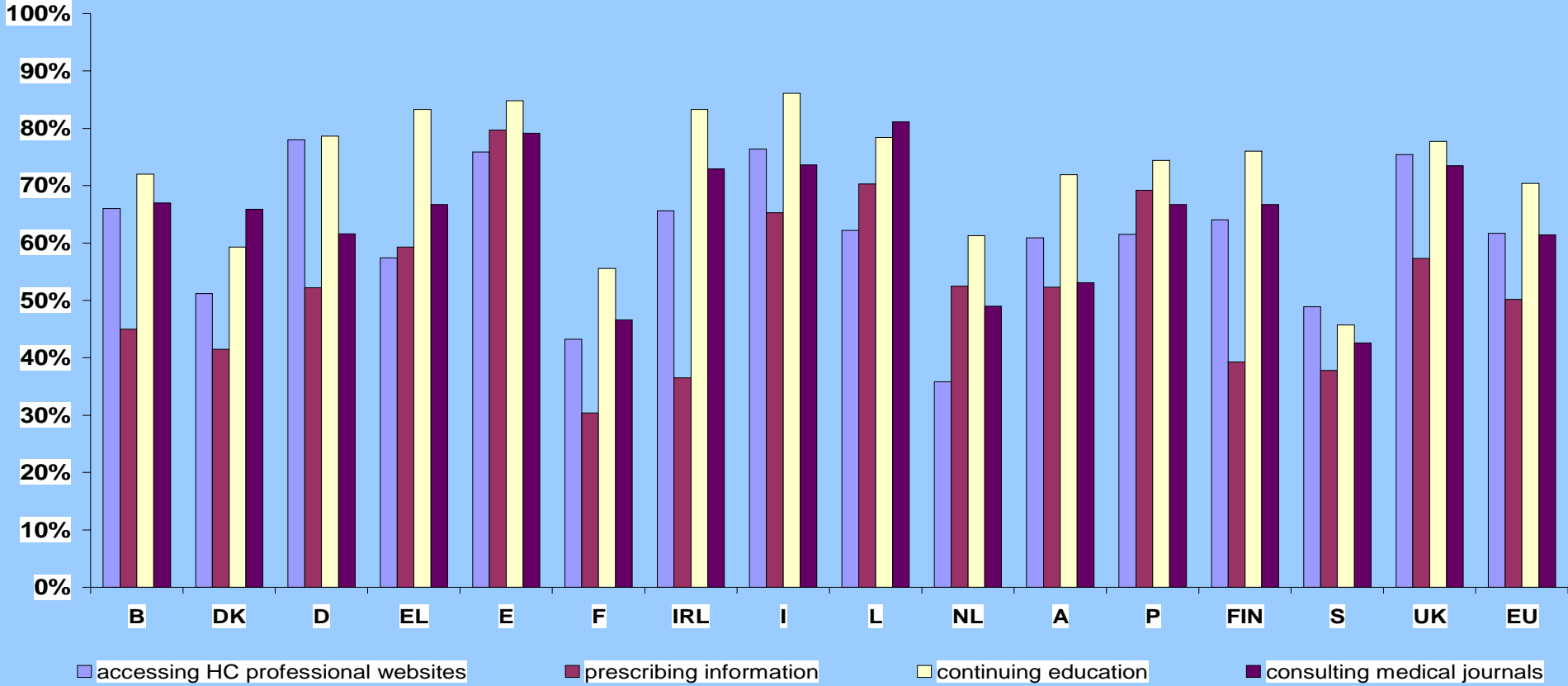
Record

Percentage of Physicians having Computer in their practice

Eurobarometer (June 2001)



Online medical practices using different categories of web content



Source: Eurobarometer June 2001

Usage of Internet EU Averages

Consult professional databases	73%	
Consult doctor-to-doctor information	70%	
Search clinical cases	57%	
Consult (official) guidelines	50%	
Searching for new drugs	29%	
Receiving analyses results	27%	
Consult alternative treatment sites	23%	
Transfer administrative data	15%	
Transfer patient data	19%	
Interacting with patients	12%	30+%
	Eurobarometer 2000	2001

Current situation in EU hospitals

= 100%

***Patient Administration Systems
Hospital administration
Pharmacy***

50 - 80%

***Laboratory Information System
Radiology Information System
Different medical applications
(operation theater, nursing systems, ...)***

< 50%

***Clinical Patient Record
Management Information Systems***

**** IT investments by European hospitals =1,2% of budget (2,5% in the USA)***

Deloitte&Touche study: www.cordis.lu/ist/ka1/health/home.html

Towards wider implementation of EHCR systems

1. Organizational, cultural

2. National/regional strategies

Some examples of national/regional strategies

Electronic Reimbursement / Billing

(DK, FR, NL, SE, UK, SLO)

Patient and professional cards

(ES, FR, IT, DE, IRL)

EC Projects: CARDLINK, DIABCARD

National / Regional healthcare networks

(DK, FI, ISL, UK, SLO)

Home care and telemedicine services

(FI, GR, NO)

Towards wider implementation of EHCR systems

1. Organizational, cultural issue
2. National/regional strategies s
3. **Industrial issues**

Health telematics industry

- **Unclear economic model - HC is not a 'free market'**
(heavily regulated (public) market, large size-low profit sector)
- **Fragmented "local" market - mobility (export) restrictions**
language, legal, cultural factors
- **Lack of industry lead standardization**
CEN standards not necessarily adopted
- **Providers not willing to collaborate - no "Shopping guide"**

Towards wider implementation of EHCR systems

1. Organizational, cultural
2. National/regional strategies
3. Industrial issues
4. **Legal, ethical**

European Council and Parliament directives

- **95/46/EC on the processing of personal data and free movement of such data to be implemented 24/10/98**
- **96/9/EC on the Legal Protection of Databases**
- **97/66/EC - concerning the Processing of personal Data and the protection of Privacy in the Telecommunication Sector**
- **Council of Europe recommendation on the protection of medical data (NoR.(97)5) Adopted 13/2/97**
- **New EC Committee on ethical issues - info-ethics**

Contact Person: Petra Wilson, Petra.Wilson@cec.eu.int

Towards wider implementation of EHCR systems

1. Organisational, cultural
2. National/regional strategies
3. Industrial issues
4. Legal - confidentiality and security of data
5. **Technological, Standardisation**

Interoperability, Security, Terminology, Architecture, ...

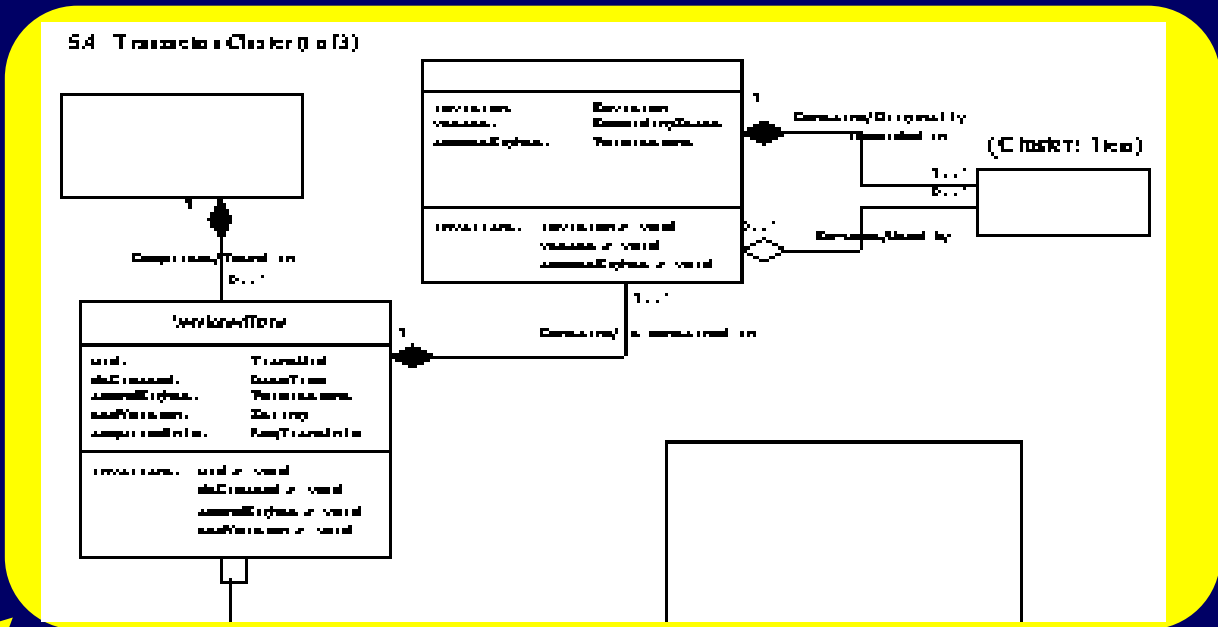
www.cordis.lu/ist/ka1/health/home.html)

application

engine

format

architecture



GEHR
CEN
KONA

...

application

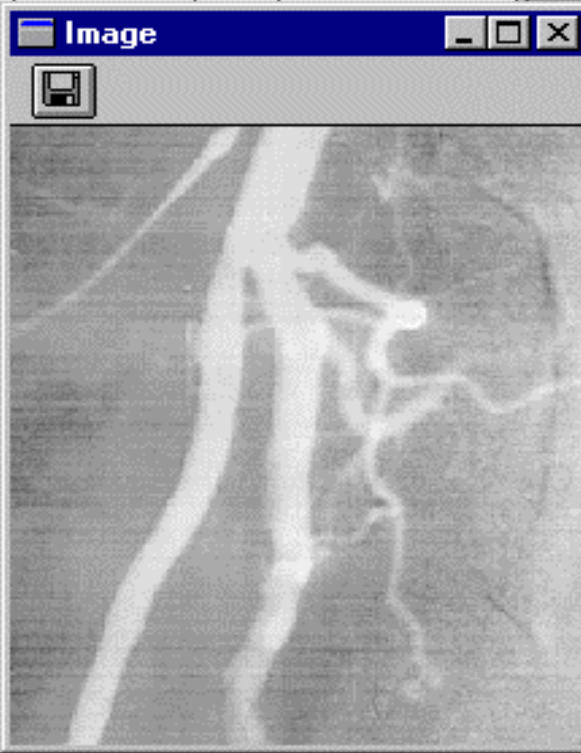
engine

format

architecture

M 15-09-1990, 00:00:00 consultation general practice Dr A. MASKENS

reason of encounter:	diffuse abdominal pain
general physical examination	
general state of health:	mild jaun
abdomen:	soUPLE
liver:	tenderne
blood	
cholesterol (total):	270
ESR 1 h:	30
gamma-GT:	40
AST (GOT):	120
ALT (GPT):	110
bilirubin (total):	1.2
alkaline phosphatase:	600
haemoglobin:	11
angiography:	stenosis



The image shows a medical application window with a patient record and a separate image viewer. The patient record lists various clinical findings and lab results. The 'angiography' entry is highlighted in blue and shows 'stenosis'. The 'Image' window displays a grayscale angiogram of a blood vessel, showing a narrowing (stenosis) in the lower portion of the vessel.

EHR Projects of the European Commission

Electronic Health Records Projects: >50 Mil. EURO EC contribution

**GALEN, SYNAPSES, SYNEX, I4C, HANSA,
GEHR, PROREC, EHCR-SUPA, TOMELO
TELENURSE**

www.ehto.org, www.cordis.lu



European Standardization Organization

CEN TC251 <http://www.centc251.org/>

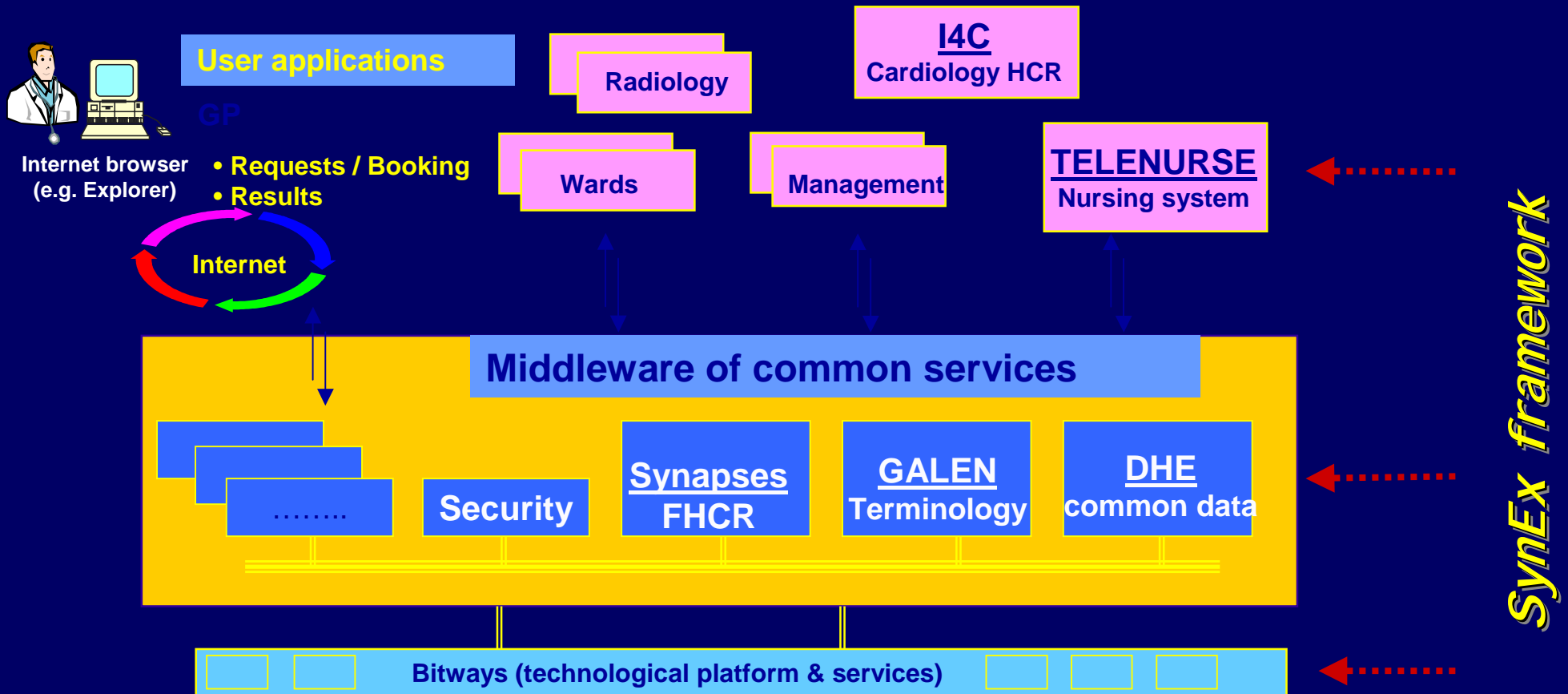
Working Group I: Information Models (prENV 13606-1)

Working Group II: Terminology and Knowledge Bases

Working Group III: Security, Safety and Quality



The Synex Project Framework



Towards wider implementation of EHCR systems

1. Organizational, cultural
2. National / regional strategies
3. Industrial issues
4. Legal - confidentiality and security of data
5. Technology and standards
6. **User acceptance**

Example : Health Professionals Acceptance Challenges

- **Difficult to use at the point of need**
 - need to go to “computer” room
 - portable devices either very limited (small) or very heavy non-practical
- **Non- friendly Human-Computer Interaction**
 - more natural access procedures (speech, mobile access)
 - presentation of recorded data, input output devices
 - top 3 priorities in interaction: **speed speed speed**

Data entry/output “The Bottleneck”

- **First there was a free text**

Do physicians read many pages of accumulated free text?

- **Then there was computer driven menu**

difficulties of expressing the reality

- **Now is the time for Intuitive, fast, and reliable ways of interacting**

- **new interfaces and input devices**

- **more reliable speech recognition**

(95% accuracy is not sufficient!)

- **natural language processing & understanding**

Input Devices for Intraoperative Planning

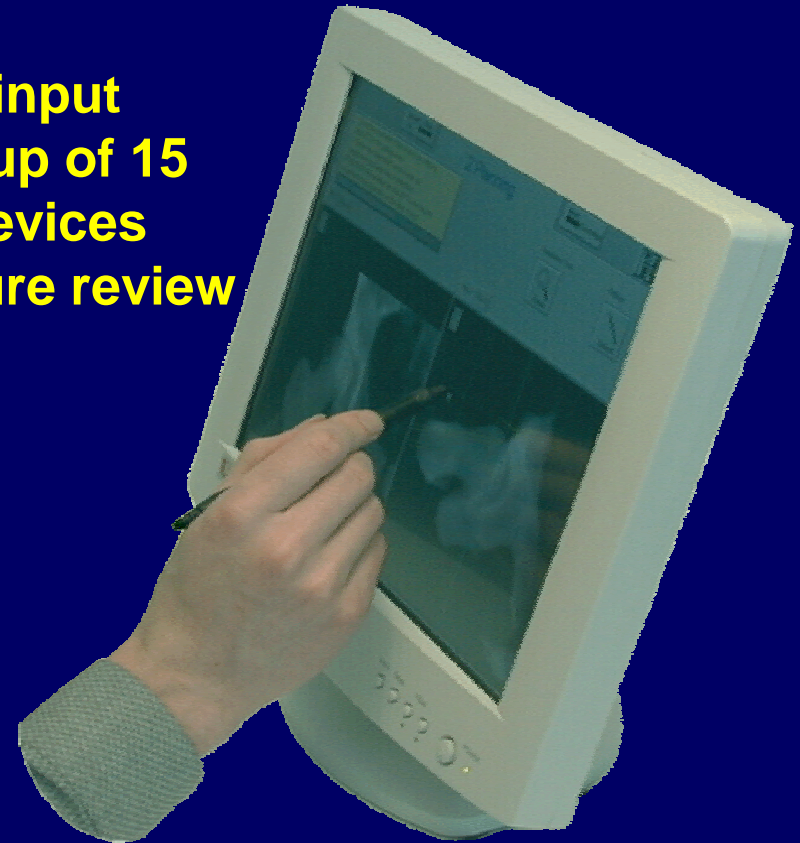
Touchpad



Most promising input devices of a group of 15 different input devices based on literature review



Mouse



Touchscreen with pen

Andreas Zimolong, Helmholtz-Institut für Biomedizinische Technik an der RWTH-Aachen

zimolong@hia.rwth-aachen.de, www.hia.rwth-aachen.de

Evaluation Criteria and Measurements

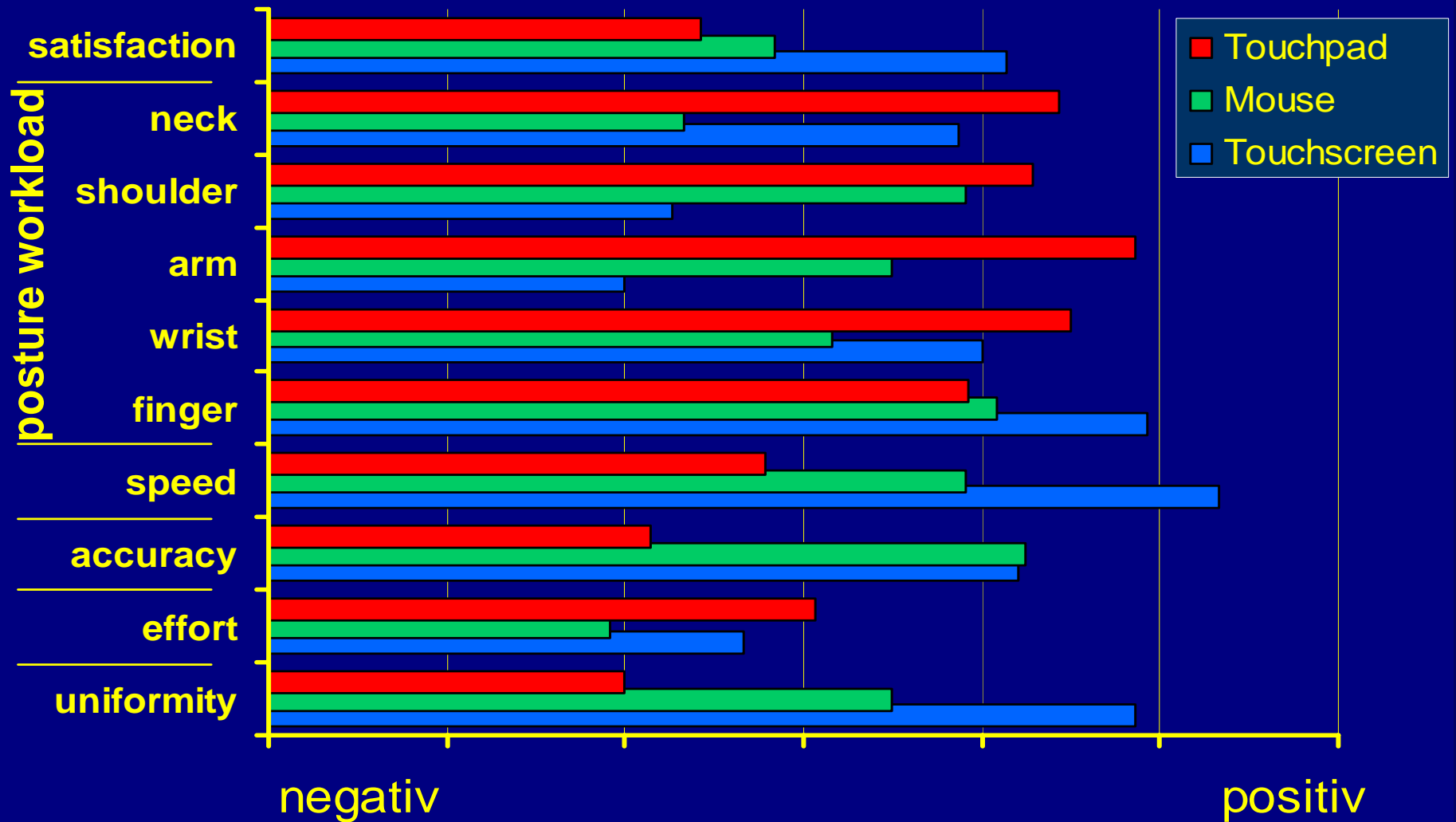
Criterion

- Learnability:
- Efficiency:
- User-satisfaction:
- Workload:

Measures

- Time needed for the task vs. number of steps needed for improvement
- Index of difficulty (according to Fitts Law) vs. time needed
- subjective comparison of input devices, ISO 9241 questionnaire
- comparison of devices by ZEISS scale, ISO 9241 questionnaire

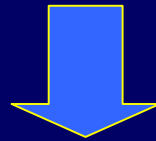
Results: Subjective Rating by ISO 9241 Questionnaire



Conclusions

Using a touchscreen allows for highest efficiency and requires the less learning efforts

Touchscreens are mostly preferred over other input devices and induce the smallest overall workload



The use of a touchscreen for intraoperative interaction tasks involving manipulation of geometries in 2D is most recommendable.

Language Engineering



Structured representations of the text

information ↓ processing

coding, translation, check for completeness, terminology update

DRIVING THE COMPUTER

Example of Medical prescription

*“ 3 * 2 co Lasix 20 on Monday, Wednesday and Saturday one hour before the meal “*

Part 1 : adm-dose

{f-a-unit} 3 {adm-num} 2 {adm-unit} co

Part 2 : pn-spec

{med-pn} lasix {med-ppd} 20

Part 3 : t-spec-pat

{day-sp-prep} on
{dayname} Monday Wednesday Saturday
{and} and

Part 4 : med-meals

{rm-prep-spec} 1 {rm-prep-unit} hour
{rm-prep-pre} before {rm-pre-meal} the meal

Wish list

- Improving efficiency of search engine
- Building query engine (based on concepts) for end-users, physicians and internal use
- Automating index mechanism and topic assignment
- Making a consistent index and topic list
- Building a formal terminology system
- Opening towards other languages

Success criteria: scalability, performance and time.

Benefits medical language understanding

- **Clinical coding as a (semi-)automatic by-product of clinical registration**
- **Compatibility of current interface with voice input**
- **Consistent terminology management over users in a center, and even amongst centers**
- **contextual spell checking content analysis**
 - **patient selection in clinical trials**
 - **generation of alerts**
 - **summary of large documents**

6. User acceptance

International Workshops (IWP)

- **Convince me!** 1st IWP Thessaloniki '97
 - **Train me, but I have only 2 minutes!** 2nd IWP Thessaloniki '98
 - **Don't change my way of working!** 3rd IWP Thessaloniki '99
- Give me more user-friendly technology!!**

Results: Books (1997, 1998), Journal Special Issue

International Scientific Forum "Information Society for All"

- **1st ISF Workshop San Francisco, USA, 1997 (Sponsored by IBM)**
- **2nd ISF Workshop, Crete, Greece, 1998 (Supported by EC)**
- **3rd ISF Workshop, Munich, Germany, 1999 (Supported by EC)**

Results: 2 white papers and working group (IS4ALL)

Example : Health Professionals

Are Health Telematics systems accepted and beneficial?

BMJ vol. 22, Feb. 3rd 2001: 5475 articles searched from 1980 -1997 on computer use in primary care setting ..

only 67 scientific “clinical trial” studies!

Which of the below processes have been found acceptable

Consultation process	No
Performance of preventive tasks	Yes
Disease management	Yes
Prescribing	Yes

Towards wider implementation of HT systems & services

SOME LESSONS LEARNED

Lesson 1. Ensure well thought-out strategy

- It is more about information management than IT
- **Get external experienced help!**
- **Need to understand the issues related to**
 - terminology, architecture, patient index
 - integration, security, performance
 - organizational issues, cultural issues
 - legal issues, human issues, ...
- **Many experts in Europe**

Lesson 2: Break the pattern of large scale all at once implementations

- **Stepwise approach more effective**

- I. overcome the fear of users

- II. Systems that improve the existing work processes

- III. Systems that require re-engineering of processes

Follow closely the work of CEN, HL7/XML, CORBA MED

Lesson 3: Keep it up... do not just set it up

- **Product vs service**

It is more about service of what information you need where and how fast instead of which computer to buy

- **The time window of available budgets are too short. Long term commitment needed for installation phase and running of the system**

Open source

Open Source is an Intellectual Property Right model for both the developer and the user & software development model

Open Source = Free Software = Libre Software

Open Source is **not** freeware, shareware

- SPIRIT - <http://www.euspirit.org> (Inventory and dissemination)

The point of view of a MD:

D. Carnall, Medical software's free future, BMJ, Oct 2000

<http://www.bmj.com/cgi/content/full/321/7267/976>

Contact point: Yves.paindaveine@c3ec.eu.int

Lesson 4: Ensure commitment of the “leaders”

- There is a vulnerable moment in all implementations shortly after installation (phase of disillusionment) where the success depends on “opinion leaders”
- Involve the leaders, keep the management and the authorities committed

COMMITMENT = INVOLVEMENT = COMMITMENT

Lesson 5: Ensure (legal and ethical) compliance

- **There is a lot of legal “grey area” around “paperless environments”**
- **Legal points relating to confidentiality and security are the best excuse to boycott the system**
- **Seek some accreditation scheme**

Lesson 6: None of the parties can do it alone!

- **There is still lots of mistrusts and misunderstanding between industry, users and decision makers**
- **Necessary condition: Joint “venture” of authorities, users. industry**
- **Examples: MEDCOM, Greek Health Telematics Forum, ...**
- **EHTEL** www.ehtel.org
- **PROREC - Electronic Healthcare Record Centers**
www.sadiel.es/europa/prorec, www.prorec-france.fr

Topics considered in the presentation

- 1. Present situation in EU**
- 2. Major obstacles in wider implementation**
- 3. Latest technologies pertaining to user friendliness**
- 4. Lessons learned from EHCR implementation around EU**
- 5. NEXT Call for proposals & Future challenges for EC?**

Research Challenges

Strengthen the collaboration with the fields of

Biomedical engineering - noninvasive sensors

Human Computer interaction

Language engineering

Bioinformatics

Need for evidence in the form of ‘clinical trial’

Example: Clinical trials of Distance Monitoring & Support technologies

- Distance monitoring has been shown to improve the clinical outcome of diabetes care
- Nocturnal haemodialysis, home sleep analysis, and measurement of self care behaviours are among the innovative applications of electronic monitoring
- Further randomized clinical trials of distance technologies could produce the scientific evidence regarding safety and efficacy in various areas of care

E Andrew Balas, Iakovidis I., Distance technologies for patient monitoring, *British Medical Journal*, BMJ 1999; 319:1309, www.bmj.com/cgi/content/full/319/7220/1309

Summary

- ❑ EHCR Situation - very good in EU (especially north)
- ❑ Many Lessons learned - but can we learn from others mistakes?
- ❑ Next challenge- make the systems **USER FRIENDLY**
- ❑ many experts in EU - take advantage !
- ❑ Are you proving benefits?
- ❑ Ultimate goal - personal health records..

Are we really ready for such a major restructuring?

References

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