



Health/Medical Informatics in Canada: 50+ years of history

~1964 – 2014

My personal journey

- **1965 – 1967**
 - Shell Oil, Calgary Alberta
- **1967 - 1972**
 - Computer Department for Health Sciences, University of Manitoba Medical School
- **1972 - 1979**
 - St. Boniface General Hospital, Winnipeg
- **1979 - 1981**
 - Royal Jubilee Hospital, Victoria
- **1981 - 2010**
 - School of Health Information Science, University of Victoria

1967 was a long time ago

- Canada begins a year-long celebration of the 100th anniversary of the BNA Act of 1867
- 1st Boeing 737 rolls out
- "O Canada" becomes our national anthem
- Toronto Maple Leafs win the Stanley Cup!!

I remember when....

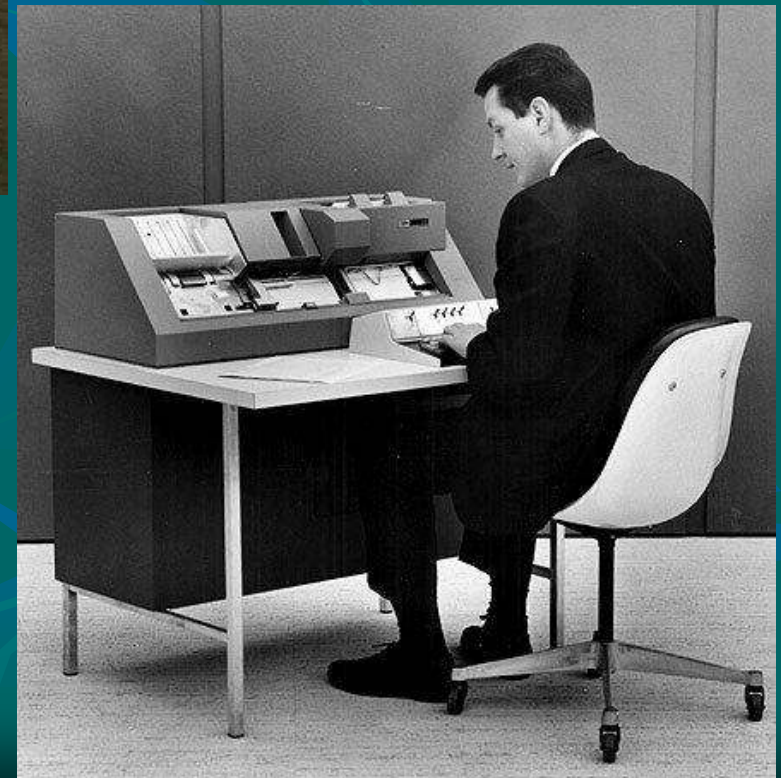
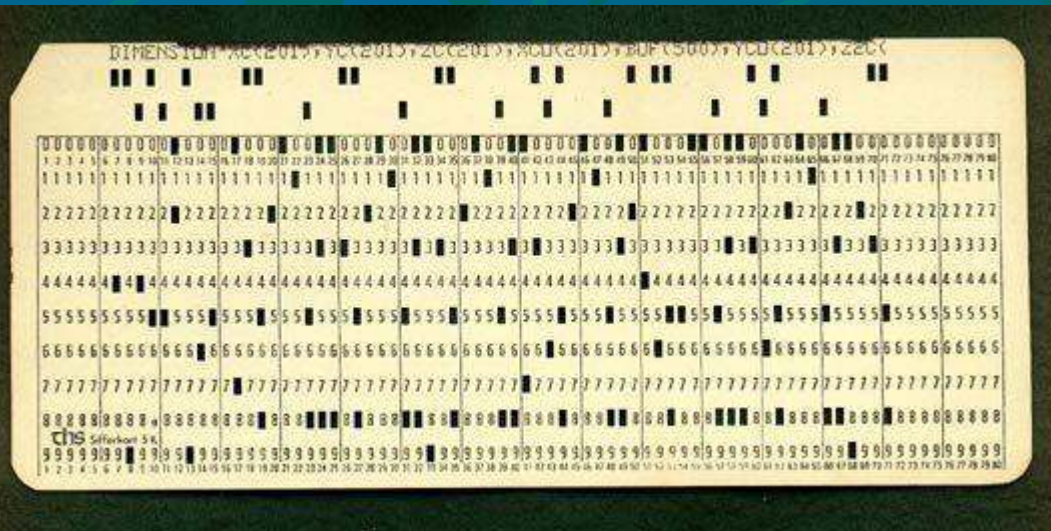
- a **window** was something you hated to clean....
- and **RAM** was the cousin of a goat....
- **MEG** was the name of a girl
 - and **GIG** was something you did on stage for money
- an **application** was for employment
- a **program** was a TV show

I remember when....

- **memory** was something that you lost with age
- if a man **unzipped** anything in public, he'd be in jail for a while
- if a man had a 3 1/2" **floppy**, he hoped nobody found out



When I started, computers heated entire rooms with their large vacuum tubes, and we key punched FORTRAN or COBOL programs onto Hollerith cards...



When I started in April 1967

- The Medical School was in the centre of Winnipeg, 6 miles away from the main frame computer on the U of M campus.
- Remote Job Entry (RJE) was a system, widely used in the mid-late 1960s, for submitting computer programs (on punched cards) to mainframes like the IBM 360.
 - *One of the 1st non-military sites in North America to transmit digital data over analog telephone lines!*
- In 1968, the Medical School upgraded to a CDC 1700, 16 bit mini computer.
 - The total amount of memory?

8K!



The History of Health/Medical Informatics

- 1949: Dr. Gustav Wagner founds the German Society for Medical Documentation, Computer Science and Statistics - the world's very first professional organization for informatics.
- <http://healthworkscollective.com/frankie-xavier/162251/long-road-digitization-history-healthcare-informatics>

The very early years of our field

'Brain' to Store Medical Data

New York Times (1923-Current file); Oct 24, 1956;

ProQuest Historical Newspapers The New York Times (1851 - 2007)

pg. 41

'Brain' to Store Medical Data

CHICAGO, Oct. 23 (UP)—A new "electronic brain" that will keep track of hospital and medical records of more than 3,500,000 Michigan residents has been ordered by the Michigan Hospital Service. Scheduled for delivery next July, the computer will be used by both the Michigan Hospital Service and the Michigan Medical Service to replace punched, and file index cards.

Journal of The Franklin Institute

Devoted to Science and the Mechanic Arts

Vol. 263

JANUARY, 1957

No. 1

Developed by Datamatic Corporation, the new "brain" is a large-scale general-purpose electronic data-processing system known as Datamatic 1000. It will occupy 5000 sq. ft. of air conditioned, humidity-controlled space and will consist of 12 sections. These include a central "brain" which can "read" and "write" at the rate of 60,000 digits per second, simultaneously handling 1000 multiplications, or 4000 additions or 5000 comparisons. The "brain" is scheduled for delivery next July.

Historical Origins

- *1959 – “Punched cards” added to National Library of Medicine’s Cumulated Index Medicus*
- 1959 – ‘Computers in Medicine and Biology’ by Weinrauch and Hetherington
- 1959 – Digital Electronic Computers in Biomedical Science by Robert Ledley
- 1960 – NIH creates ‘Advisory Committee on Computers in Research’ in the USA
- *1960 – 15 citations under ‘automated data processing’ in the National Library of Medicine’s Cumulated Index Medicus*
- *1962 – Methods of Information in Medicine launched*
- *1962 – Origins of Kaiser Permanente’s clinical information system under Dr. Morris Collen*
- 1963 – 7% of American hospitals using ‘automated data processing’ equipment

The early '60's

- Some Canadian hospitals would voluntarily send their discharge abstract data to the Commission on Professional and Hospital Activities (CPHA) in Ann Arbor, Michigan where they were processed in the Professional Activity Study (PAS) system.
- In the '70's Canadian hospitals began to send their data to the Hospital Medical Records Institute in Toronto (forerunner to CIHI) which started as an Ontario organization in the mid 60's and became a national one in 1977. Quebec had their own discharge abstracts data base.



Dr. Collen, with open binder, explains potential uses of the computer in medical care to a visiting delegation from Washington, D.C. in 1966 [2].

Medical Informatics

“The science of analysis, documentation, steering, control and synthesis of information processes within the health care delivery system, especially in the classical environment and medical practice.”

Reichertz P

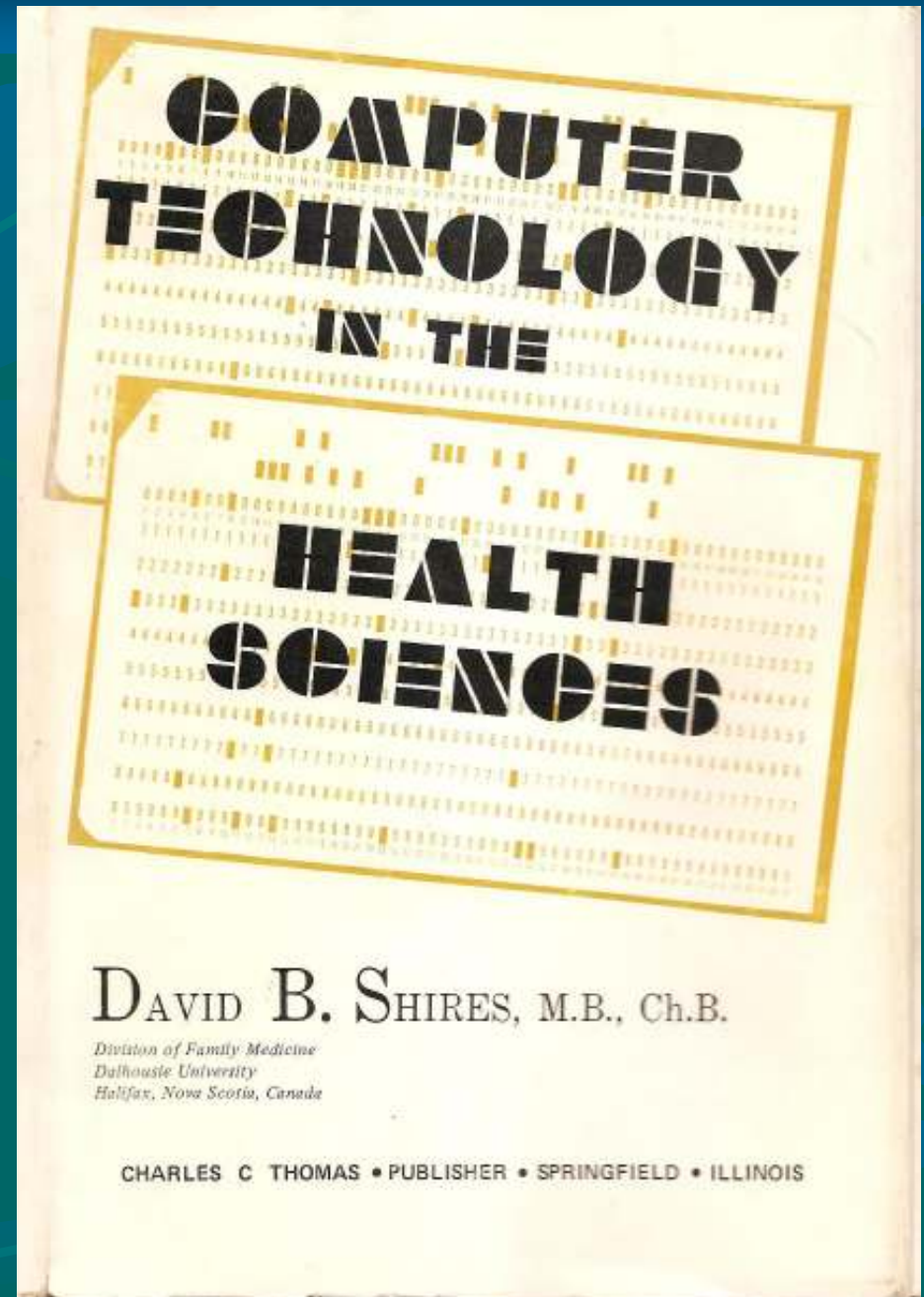
Protokoll der Klausurtagung Ausbildungsziele, Inhalte und Methoden in der
Medizinischen Informatik
Ulm: Reisenberg/b. 1973

Medical Information Science

"the study of the nature and principles of information and its application to the science and art of diagnosing, treating, curing and prevention of disease."

Shires D
1974

8-Dec-14



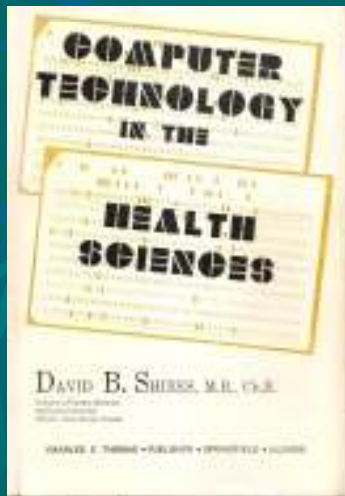
Medical Informatics

- “The application of computers, communications and information technology and systems to all fields of medicine - medical care, medical education and medical research.”

MF Collen
MEDINFO '80
Tokyo

Health Information Science

"the study of the nature and principles of information and its application within all aspects of health care delivery."



Shires D
Computer Technology in Health Sciences
Charles C Thomas, Springfield Ill, 1974

Health Informatics

"The study of nature and principles of information and its application and impact within a health care delivery system."

Protti DJ

A New Undergraduate Program in Health/Medical Informatics

AMIA Proceedings

Masson Publishing, 1982

Outline

- The Infant Years: '60 – '70's
- The Childhood Years: '70's – '80's
- The Teenage Years: '80's – '90's
- The Young Adult Years: '90s – 00's
- The Maturing Years: 21st Century
- Closing Thoughts

Outline

- *The Infant Years: '60 – '70's*
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Systems history '60's – '70's

- *From 'Manual' to 'Data Processing'*
- Financial focus
 - Outsourced payroll and general ledger systems
- Shared systems (associations)
 - *Use of computers generally "discouraged" in individual facilities*
 - Statistical abstracting data comparison reporting (PAS, HMRI)
 - *Canadian data sent to Ann Arbor Michigan for processing*
- In-house developments
 - Data processing systems
 - Early mainframes
- *Few clinical systems*
 - *Start of laboratory (pathology) systems*

Organizational history '60's – '70's

- 1964 – Symposium on Applications of Digital Computers to Research at the Mayo Clinic
- *1964 – 1st electronic laboratory reporting system at the University of Missouri – Dr. Don Lindberg*
- 1964 – Lockheed Information Systems Division formed – forerunner to Technicon and the current Allscripts Sunrise system – Mel Hodge
- *1965 - 40 citations under 'automated data processing' in the National Library of Medicine's Cumulated Index Medicus*
- 1967 – Laboratory of Computer Science at the Mass General Hospital – *Dr. Octo Barnett*
- 1967 - Health Evaluation through Logical Processing (HELP) at the LDS Hospital in Salt Lake City - *Dr. Homer Warner*
- 1968 – The Computer and Medical Care by Dr. Donald Lindberg
- 1969 – Medizinische Informatik at Hannover – Dr. Peter Reichertz
- *1969 – ARPANET - the forerunner to the Internet*
- 1971 – Technicon system implemented at El Camino Hospital
- *1972 – Medical Informatics at Heidelberg/Heilbronn – Jochen Moehr*

Canadian Pioneers

1964 – (Ontario) Hospital Medical Records Institute -
forerunner to CIHI

1965 – SNOP created – the forerunner to SNOMED - *Dr.
Roger Cote*

1966 – Saskatoon Hospital System Study Group

1967 – *Computer Department for Health Sciences, University
of Manitoba, Winnipeg – Denis Protti*

1969 – University of Alberta Hospital, Edmonton – *Al Haskell*

1970 – Manitoba Hospital Association Data Centre, Winnipeg
- *Roger Girard*

1971 – Misericordia Hospital, Edmonton – *Steve Huesing*

1972 – York Central Hospital, Toronto – *John Flint*

In the early 1970's

- Scarcity of industry-specific software
- Few experienced health IT staff
- Scarce investment dollars
- High IT failure rate
- Limited executive understanding
- IT seen as a “high-risk” issue
- Only early adopters in the game

Outline

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Systems history '70s – '80s

- *From 'Data Processing' to 'Computing Systems'*
- Focus continues to be primarily financial systems
- Lab systems became more common
- *Major hospitals move to “on-line” technology supported by mainframe computers*
- US-based suppliers start to acknowledge the marketplace
- Provincial governments recognize that IT is here to stay and reorganize to develop expertise and control mechanisms

Organizational history '70s – '80s

- 1974 – 1st World Congress of Medical Informatics in Amsterdam – John Anderson
- *1975 – COACH formed*



Organizational history '70s – '80s

- 1974 – 1st World Congress of Medical Informatics in Amsterdam
- 1975 - COACH is formed
- *1976 - First Canadian National Conference in Ottawa - 120 participants, no exhibitors*
- *1977 - 2nd World Congress on Medical Informatics in Toronto*
- 1979 - International Medical Informatics Association (IMIA) established as an independent organization
 - Separating from the International Federation of Information Processing Societies (IFIPS)

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Systems history '80's – '90s

- *From Computing Systems to Management Information Systems (MIS)*
- Micro computers
- Continuing financial focus as a priority
- More clinical systems (Pharmacy, Radiology)
 - stand alone systems (best of breed)
- *Turnkey/integrated systems (e.g., Meditech)*

Semantic Challenges

- **Hospital Information System**
- **Clinical Information System**
- **Integrated Health Information System**
- **Medical Information System**
- **Patient Management System**
- **Patient Care System**
- **OSCAR, Help, Ulticare, Vista**
- **etc...**

Organizational history '80's – '90's

- 1981 - School of Health Information Science at the University of Victoria is founded



Organizational history '80's – '90's

- 1986 - HIMSS (Healthcare Information & Management Systems Society) founded
- *1987 - First Canadian Industry magazine, "Healthcare Computing & Communications Canada"*



Organizational history '80's – '90's

- 1986 - HIMSS (Healthcare Information & Management Systems Society) founded
- 1987 - First Canadian Industry magazine, “Healthcare Computing & Communications Canada”
- *1991 - Federal Task Force Report leading to the creation of CIHI*
- 1997 - The Office of the Health Information Highway in Health Canada

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Systems history '90's – '00's

- *From 'Hospital Information Systems' to 'Electronic Health Records' (HIS to HERS)*
- Personal computers
- Networks
- *Enterprise-wide – 'integrated' - systems*
- Office automation
- *Shift to clinical focus from financial focus*
- Clinical data repositories
- Order entry/results reporting systems
 - Early decision support systems

The Formal Start to the EHR Journey

- A Computer-based Patient Record (CPR) is an electronic patient record that resides in a system specifically designed to support users through availability of complete and accurate data, *practitioner reminders and alerts, clinical decision support systems, links to bodies of medical knowledge and other aids.*

Institute of Medicine (IOM), 1991

More semantic challenges (the ExR phenomenon)

- **Computer-based Patient Record System (CPR)**
- **Electronic Medical Record (EMR)**

- **Electronic Patient Record (EPR)**
- **Electronic Health Record (EHR)**

- **Consumer Health Record (CHR)**
- **Integrated Health Record**
- **Patient Medical Record (PMR)**
- **Personal Health Record (PHR)**
- **Etc..**

We continue to be semantically challenged (i.e. the “xxR” phenomena)

- Caregiver Electronic Record (CER)
- Computer-based Patient Record (CPR)
- Consumer Health Record (CHR)
- Continuity of Care Record (CCR)
- Detailed Care Record (DCR)
- Electronic Care Record (ECR)
- Electronic Case Record (ECR)
- *Electronic Medical Record (EMR)*
- *Electronic Health Record (EHR)*
- Electronic Health Record Solution/System (EHRS)
- *Electronic Patient Record (EPR)*
- Emergency Health Record (EHR)
- Integrated Care Record (ECR)
- Integrated Electronic Health Record (iEHR)
- Integrated/Individual Health Record (IHR)
- National Care Record (NCR)
- Patient Medical Record (PMR)
- *Personal Health Record (PHR)*
- Single Shared Electronic Patient Record (SSEPR)
- Summary Care Record (SCR)
- Etc.

Organizational history '90's – '00's

- 1990 – American Medical Informatics Association (AMIA) is formed
 - merger of three organizations:
 - American Association for Medical Systems and Informatics (AAMSI)
 - American College of Medical Informatics (ACMI)
 - Symposium on Computer Applications in Medical Care (SCAMC)
- 1991 – Institute of Medicine (IOM) introduce the concept of the Computer-based Patient Record
- 1994 – Journal of American Medical Informatics
- *1994 – Canadian Institute for Health Information (CIHI)*
- *2001 – Canada Health Infoway*

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Systems history

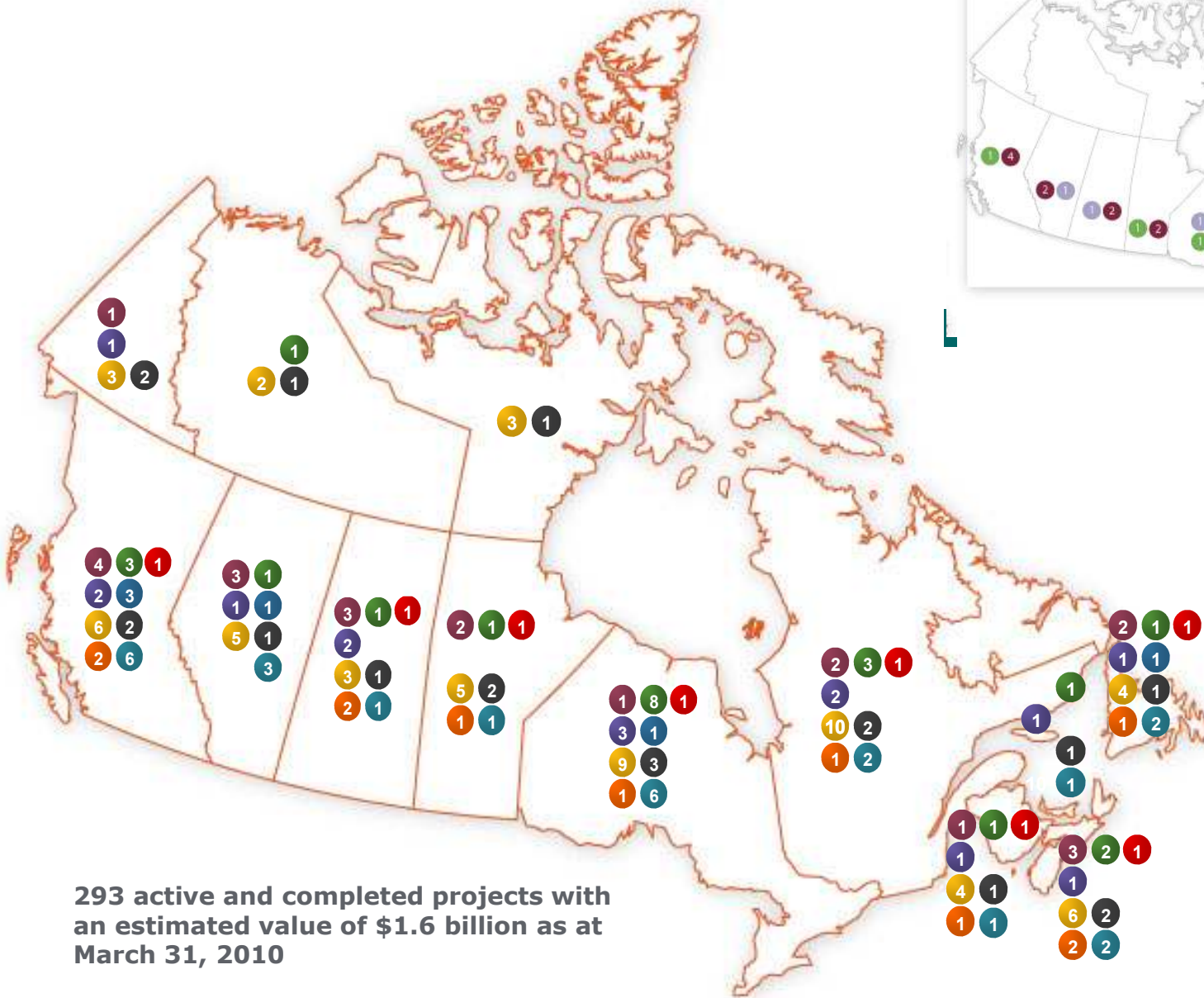
- *From 'Electronic Health Records' to 'e-Health'*
- Health 2.0; Client/Patient and Clinician Portals
- Telematics - Telehealth/ telemedicine
- mHealth - wireless and remote monitoring technologies
- *Regional and national EHRs*
- PHRs
- Secondary Uses (*Data Warehouses and Analytics*)
- Genomics and Proteomics



Have we made progress in 50+
years?

Absolutely

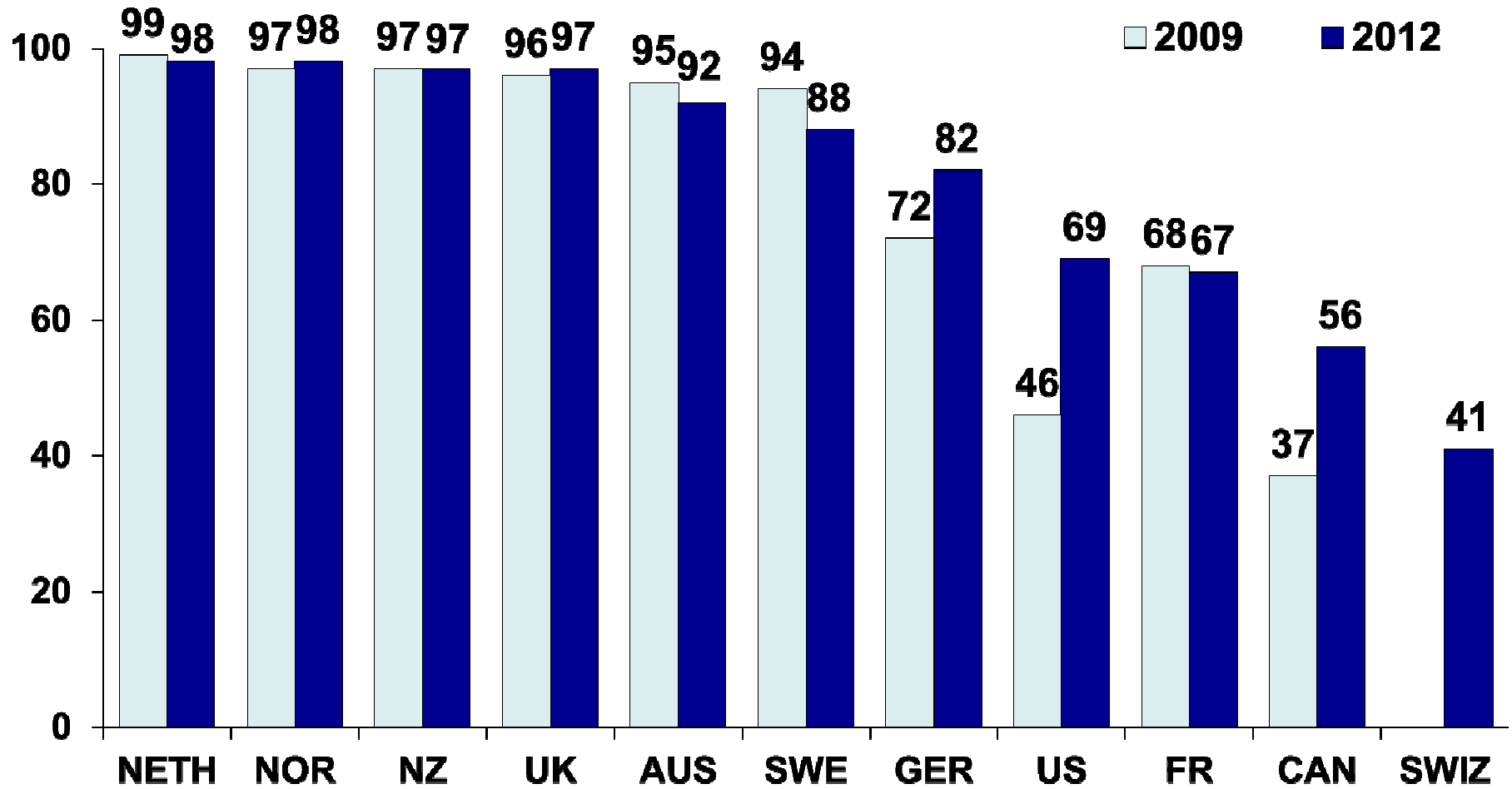
Program activity summary



293 active and completed projects with an estimated value of \$1.6 billion as at March 31, 2010

Primary Care Physician Use of Electronic Medical Records in Their Practice, 2009 and 2012

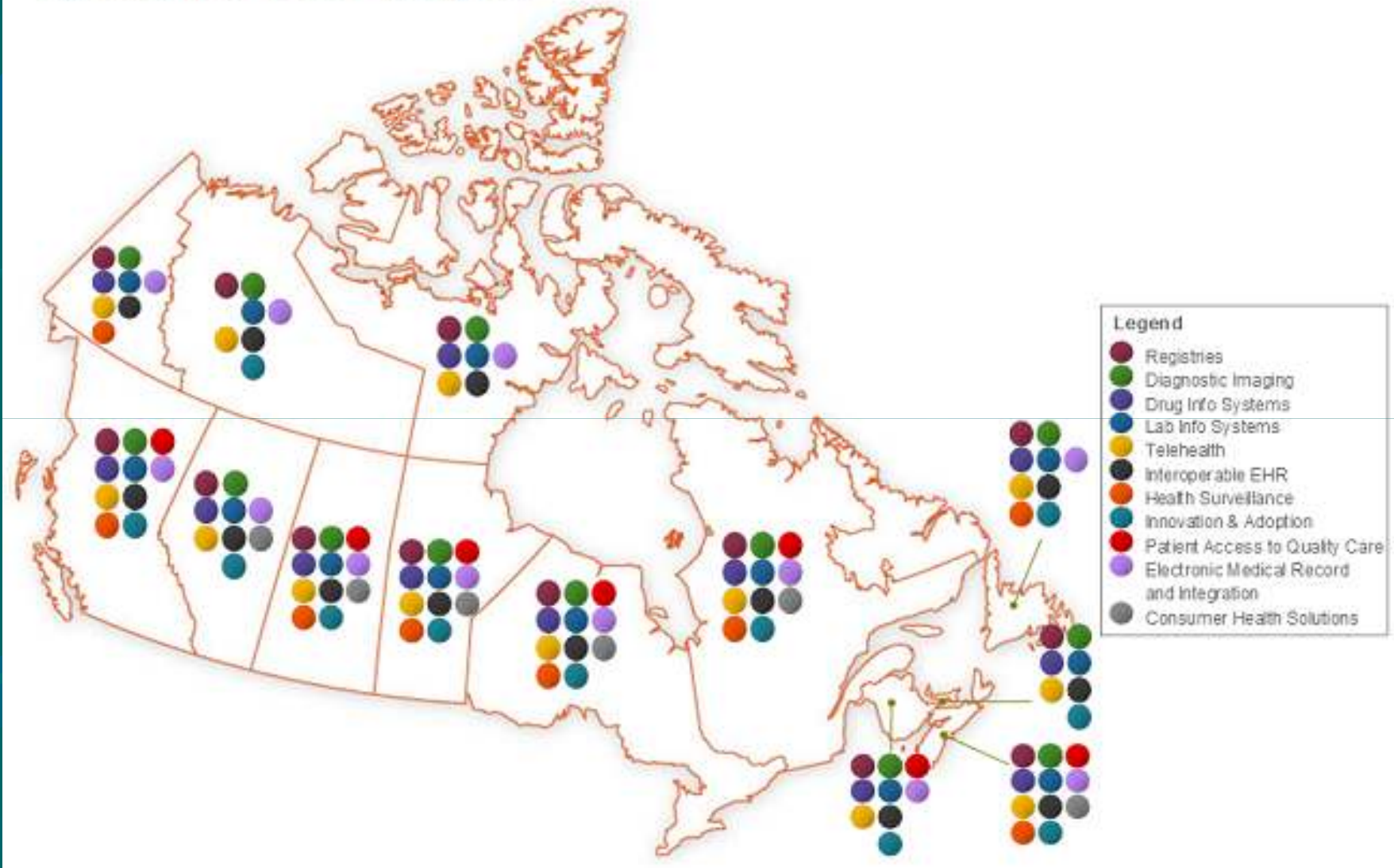
Percent



Source: 2009 and 2012 Commonwealth Fund International Health Policy Survey of Primary Care Physicians.

Program activity summary

(Active/complete projects ~ March 2014)



Canada EMR Adoption Model SM

Stage	Cumulative Capabilities	2013 Q3	2013 Q4
Stage 7	Complete EMR; CCD transactions to share data; Data warehousing; Data continuity with ED, ambulatory, OP	0.0%	0.0%
Stage 6	Physician documentation (structured templates), full CDSS (variance & compliance), full R-PACS	0.5%	0.6%
Stage 5	Closed loop medication administration	0.2%	0.0%
Stage 4	CPOE, Clinical Decision Support (clinical protocols)	3.8%	3.8%
Stage 3	Nursing/clinical documentation (flow sheets), CDSS (error checking), PACS available outside Radiology	32.0%	32.2%
Stage 2	CDR, Controlled Medical Vocabulary, CDS, may have Document Imaging; HIE capable	29.1%	29.1%
Stage 1	Ancillaries - Lab, Rad, Pharmacy - All Installed	14.5%	14.5%
Stage 0	All Three Ancillaries Not Installed	20.0%	19.8%

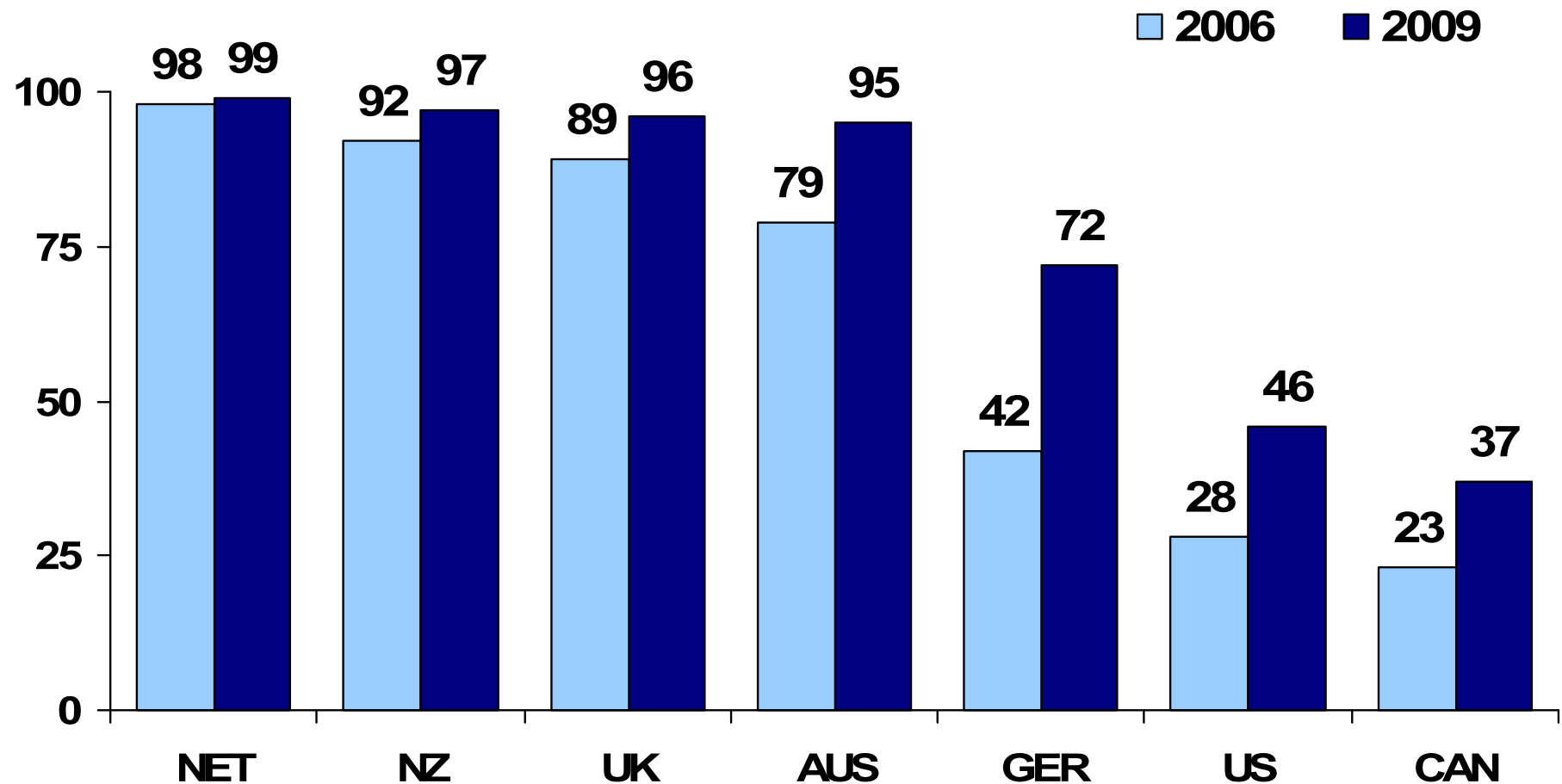
Data from HIMSS Analytics® Database ©2012

N = 640

N = 640

Doctors Use Electronic Patient Medical Records in Their Practice, 2006 and 2009*

Percent

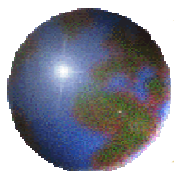


* 2006: "Do you currently use electronic patient medical records in your practice?"

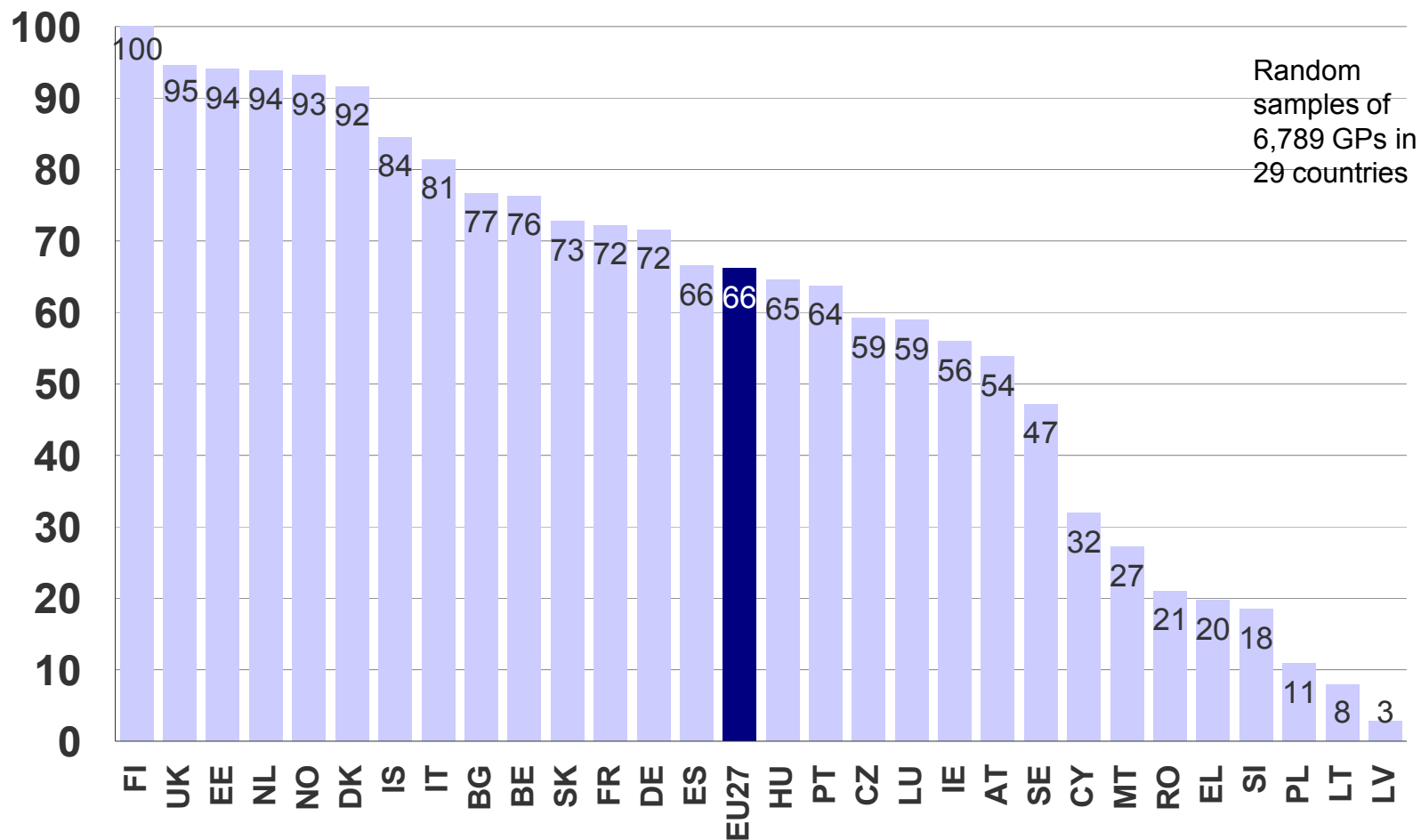
* 2009: "Do you use electronic patient medical records in your practice (not including billing systems)?"

Source: 2006 and 2009 Commonwealth Fund International Health Policy Survey of Primary Care Physicians.





European GPs using a computer during consultation (EC Study 2007)



Source: empirica: eHealth use among GPs in Europe 2007, Bonn, April 2008

From handwritten prescriptions to..

Patient		Patient	
[Redacted]		[Redacted]	
[Redacted]		[Redacted]	
[Redacted]		[Redacted]	
Særlige tilskud		Særlige tilskud	
MK DK		MK DK	
Andele	Ordination	Andele	Ordination
Sygesikring	Lægemiddelform, præparatnavn, styrke og mængde samt brugsanvisning og udlevering	Sygesikring	Lægemiddelform, præparatnavn, styrke og mængde samt brugsanvisning og udlevering
Kommune	1 Amoxicillin 1000 mg / 1000 mg	Kommune	1 Amoxicillin 1000 mg / 1000 mg
Patient	60 d x 3	Patient	60 d x 3
Sygesikring	1 kg sup og efter for	Sygesikring	1 kg sup og efter for
Kommune	antler	Kommune	antler
Patient	1 Paracetamol 1000 mg	Patient	1 Paracetamol 1000 mg
Sygesikring	400 mg d	Sygesikring	400 mg d
Kommune	200 d x 2	Kommune	200 d x 2
Patient	1 kg sup og efter	Patient	1 kg sup og efter
Sygesikring	fombiggede med antler	Sygesikring	fombiggede med antler
Kommune		Kommune	
Patient		Patient	
Forbeholdt apoteket	Læge / Tandlæge: Dato og underskrift	Forbeholdt apoteket	Læge / Tandlæge: Dato og underskrift
	12/4 99 [Signature]		12-04-99 08:10 [Signature]

Printed/legible prescriptions

UNA:+.? '
UNB+UNOC:3+5790000120314:14+5790000172825:14+010430:1
456+26+++++1'
UNH+15+MEDPRE:0:962:RT:SST012+Æskulap'
BGM+PRS:SKL:SST++9'
DTM+137:20010430145604:204'
PNA+PO++291714:YNR:SFU+++US:Max Berggren+US:MedCom'
ADR++1:Rugårdsvej 15++5000'
COM+66133066:TE'
EMP+4+PHY:SKL:SST'
PNA+SE++5790000172825:9'
DTM+97:20010430:102'
RFF+CH:200118'
ICD+DK:SKL:SST+NA:SKL:SST'
GIS+ZZZ:SKL:SST'
PNA+PAT+2512484916:CPR++++SCC:BERGGREN, NANCY
ANN'
ADR+1+1:PARK ALLE 48+Hillerød+3400++020:SKL:SST'
LIN+1++385229:AK:NVN:LMS'
IMD+A+DDP+:::creme'
IMD+A+DNM+:::Diproderm'
MEA+AAU+CT:::Tube a 60 g'
MEA+DEN+S:::0,05%'
PGI+10+NS:SKL:SST'
QTY+189:1:NMB'
PNA+GZ+++++AB:OR'
CIN+9+222:LDD:LMS:mod eksem'
EQN+2:ITE'
DTM+264:30:804'
DSG+5+104:LDD:LMS:udvortes 2 gange daglig'
TOD+2++OAD:SKL:SST'ADR+5+US:Vestergade 17++3400'
PNA+AB+++++US:Knud Mosebryggelsen'
UNT+30+15'
UNZ+1+26'

FYNS AMT
Udsteder
291714 Æskulap
MedCom
Rugårdsvej 15
5000 ODENSE C. Tlf. 66133066

EDIFACT- Receipt

Tårnsvej 251248-4916 (Personnr., navn og adresse) Agoset 282
BERGGREN, NANCY ANN
PARK ALLE 48
3400 Hillerød Side 1
Ben Amt 020

Fornævnelse og andre bemærkninger
sendes pr. bud til Knud Mosebryggelsen
Vestergade 17 3400 DK

Ordination (Gyldig indtil 2 år fra udstedelsesdatoen)
Rp
Diproderm creme OR
0,05%, Tube a 60 g x 1
Ikke substitution
d.s. udvortes 2 gange daglig
mod eksem
Udleveres 3 gange med 30 dages mellemrum

Dato og underskrift
30.04.01 15:04 Max Berggren

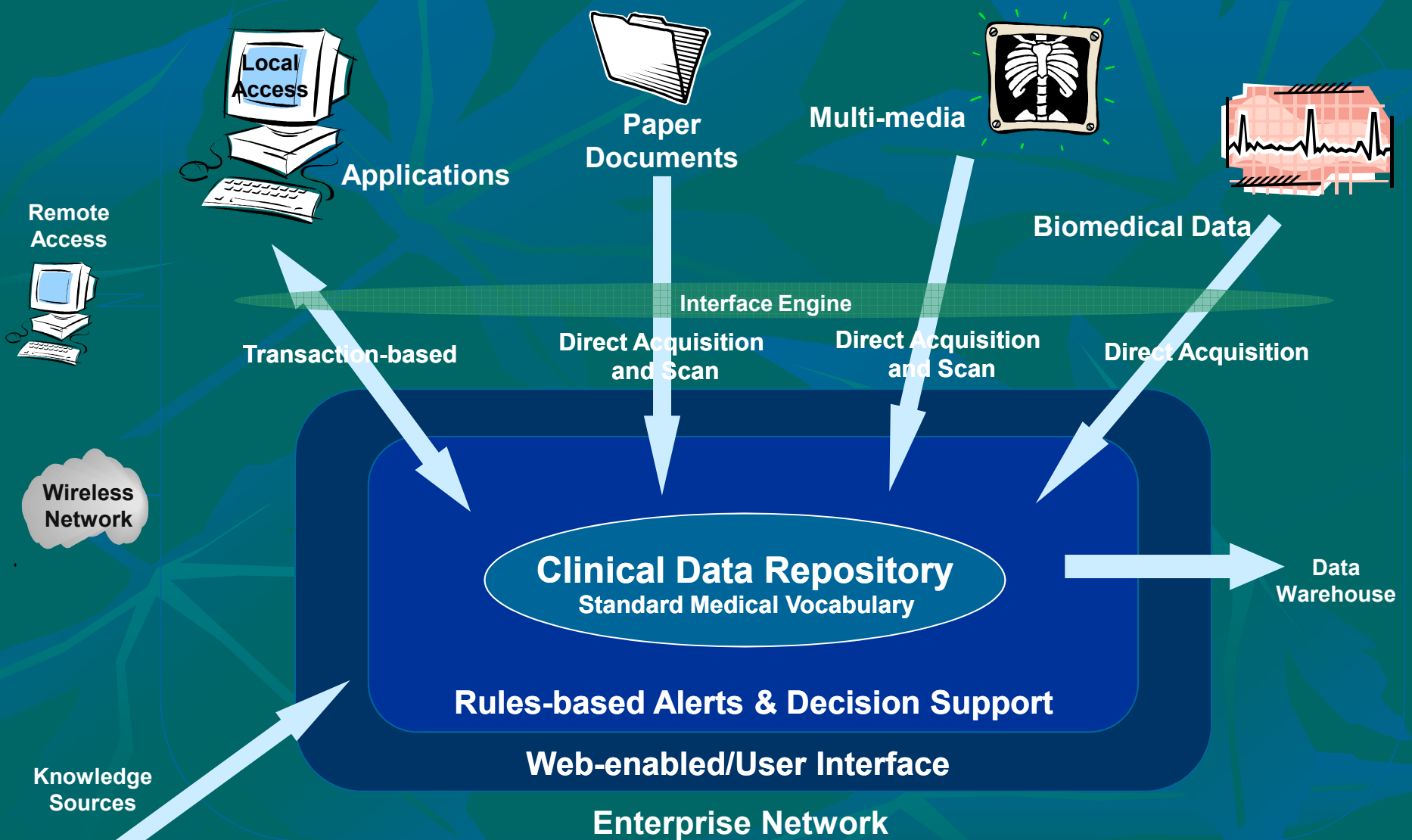
Fortegnelse over lægemidler

Udstedelse af typenøglen fortællingsprogram
Kommerciel information
05 11 542 02/00 SMA

8-Dec-14

Denis Protti - University

From islands of data to the EHR



Canada has definitely progressed

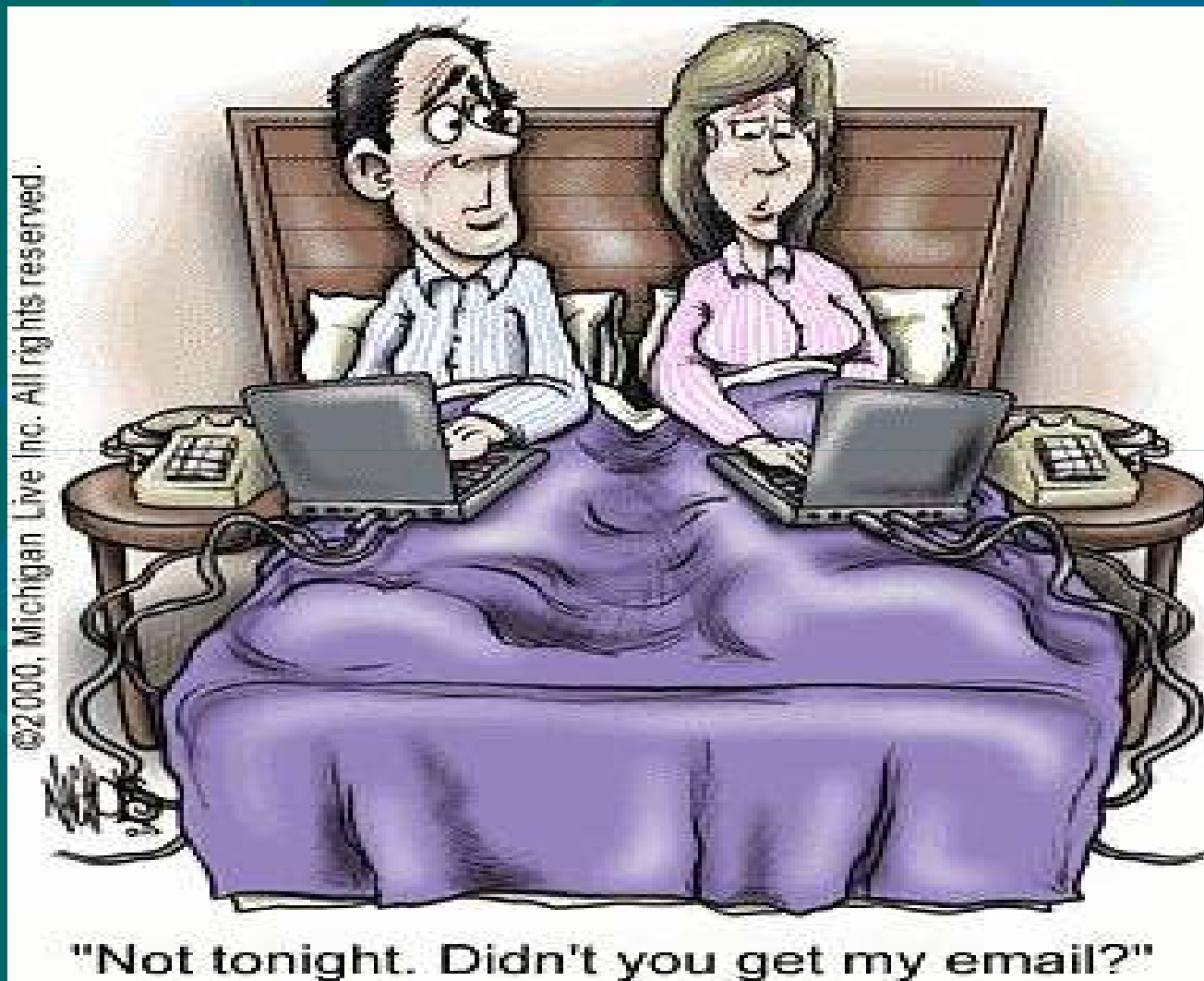
- Emergence of health care CIO and CMIO roles
- Credible information resources - CIHI
- Major national/provincial initiatives – Infoway
- Growth of academic programs – UVic+
- Industry associations, COACH, ITAC Health
- Standards development & compliance
- Etc.



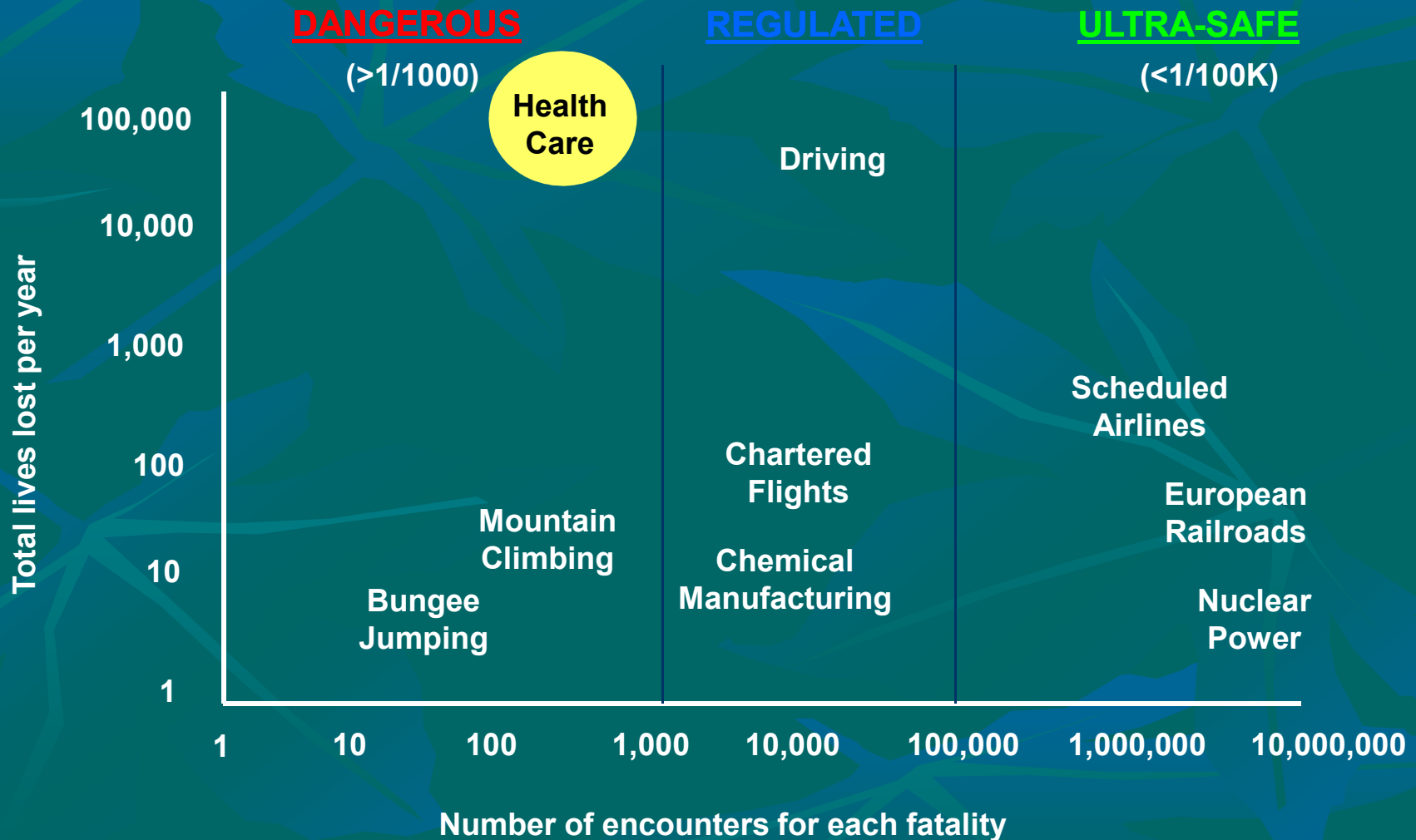
Notwithstanding our accomplishments

We still have a number of challenges
to overcome and catching up to do

Technology is changing the way we live



How Hazardous Is Health Care?



8-Dec-14

Denis Protti - University of Victoria

56

Risk of Death as an Airline Passenger and as a Patient Admitted to an Acute Care in Hospital in Canada

Airline industry	1 death in 2 million passengers ¹
Air Canada	0.67 deaths in 2 million passengers ²
South West Airlines	0.0 deaths in 9.5million flights ²
Canadian acute care hospitals	7,400 – 19,000 deaths in 2 million patient admissions ³

1. Leape LL et al *Reducing Adverse Drug Events*, IHI, 1998.
2. According to AirSafe.com
3. By extrapolation from Baker GR, Norton PG et al *The Canadian Adverse Events Study*, *JMAC* 25 May 2004; 1684.

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In Conclusion

What have I observed over the past
~50 years in Health Informatics?

**Why have some jurisdictions
very successfully introduced
information technology into
their health care organization
or system?**

Globally, some jurisdictions have succeeded in sharing data electronically

Nationally

Denmark
Hong Kong
New Zealand

England
Scotland
Wales
Taiwan

Regionally

USA (VA, Kaiser,
Geisinger, Allina)
Spain (Andalucía)
Italy (Lombardia)
Sweden (Norrbotten)
Israel (Maccabi)

Common critical success factors

2. Active Clinician Involvement
3. Reliable, Rapid, and Flexible Infrastructure
4. Competent Health Informatics Professionals
5. Robust Project Management
6. Commitment to Standards and Certification
7. Performance Measurement and Transparency
8. Comparative Culture and Feedback
9. Commitment to Privacy and Confidentiality
10. Acknowledgement of Patient Involvement

Common critical success factors

1. **Leadership** – Political, Organizational, Clinical, Technical
 - Vision, Shared Values, Courage, Stamina
 - Environment for Change
 - Solid Governance Structures
 - Resourcing and Incentives
 - Communicate, Communicate, Communicate
 - Process Improvement and Quality
 - Adapt Legislation, Policy and Regulations
 - Pragmatic Priority Setting
 - Commitment to Training and Support
 - Patience (ROI takes time)



A critical success factor?

A single unifying organization/entity

(e.g. Denmark, Spain, New Zealand, Hong Kong, Italy, Canada)

Somber realities

- Outcome is correlated with Change
 - Policies, Processes and Practices

Somber realities

- **Outcome** is correlated with **Change**
 - Policies, Processes and Practices
- **Worth** is correlated with **Time**
 - Payback takes at least 4 years

Somber realities

- **Outcome** is correlated with **Change**
 - Policies, Processes and Practices
- **Worth** is correlated with **Time**
 - Payback takes at least 4 years
- **Value** is correlated with **Connectivity**
 - Value is synergistic

Somber realities

- **Outcome** is correlated with **Change**
 - Policies, Processes and Practices
- **Worth** is correlated with **Time**
 - Payback takes at least 4 years
- **Value** is correlated with **Connectivity**
 - Value is synergistic
- **Success** is correlated with **Size**
 - **Less than 10 million people**

Bottom line in my experience

- “Champions may initiate improvement, but it *depends on top level organizational leaders to create an institutional culture ready to accept change*, and to spearhead the spread of particular improvements.”

Thomas Bodenheimer

The Science of Spread: How Innovations in Care Become the Norm

California Healthcare Foundation

September 2007



Arrigato
Danke
Gracias
Grazie
Merci
Tubind Tak
Tapadh leibh
Thank you
Xie xie

Discussion Questions

1. What has been our two greatest health informatics accomplishments in Canada over the past 50 years?
2. Why are we not as advanced in our use of Health Information Technology than other jurisdictions around the world?