Achieving the vision for e-health across Asia – Using global lessons learned for timely and scalable delivery

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Disclaimer

- This is a personal view
- I am not representing:
  - NEHTA, The NHS or NHS Connecting for Health
  - Any other government body
- I work as the Clinical Architect to ASE Consulting UK Ltd.
- I have an academic role in Canada
- I am currently working on the NEHTA PCEHR programme (but not talking about it today). I worked for the last 10 years on the Uk programme
- I was a GP / Family Doctor for 25 years
- I designed and built commercial clinical systems for 14 years
- I have no commercial interests in any Health IT related company

“THIS MAY BE A LITTLE UNCOMFORTABLE….”

Lesson 1

SOLVE THE CORRECT PROBLEM WITH THE RIGHT VISION

What is the vision?

But is this the right question any more ?

- How do *we* collaborate to *deliver ? :*
  - Safe
  - Effective
  - Reproducible
  - State-of-the-art
  - 21st Century medicine
  - Wherever I am
  - Whatever the time
  - Whatever is wrong with me
- And better still:
  - Prevent me getting ill
  - And don't harm me in the process

Given time constraints

WE ARE GOING TO HAVE TO TAKE SOME THINGS AS ‘READ’

It’s no longer a technical problem, It’s a cultural problem

TAKEN AS READ...

Taken as read

HEALTH REFORM IS NOT POSSIBLE WITHOUT TAKING ON AND EMBRACING E-HEALTH

Taken as read

E-HEALTH REFORM IS NOT POSSIBLE WITHOUT PROPER AND RELIABLE FUNDING

“Spending on information technology should be doubled, with IT budgets protected to prevent the money being siphoned off into other areas.”

“Stringent **central standards** [should be] laid down to ensure NHS technology systems are compatible throughout the UK.”

Society Guardian, Wednesday 17 April 2002 – Accessed 21-Apr-2009

“IT spending should represent 4% of total health budget by 2008”

Securing our future health: Taking the long term view - Derek Wanless 2002
http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/consult_wanless_final.htm

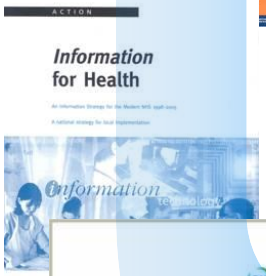
Taken as read...

COMPLEXITY COMES IN MANY DISGUISES

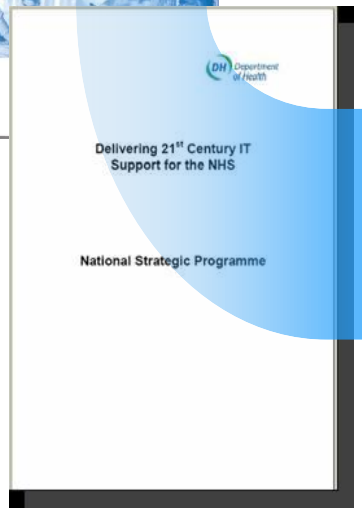
What the UK programme was asked to do in 2002

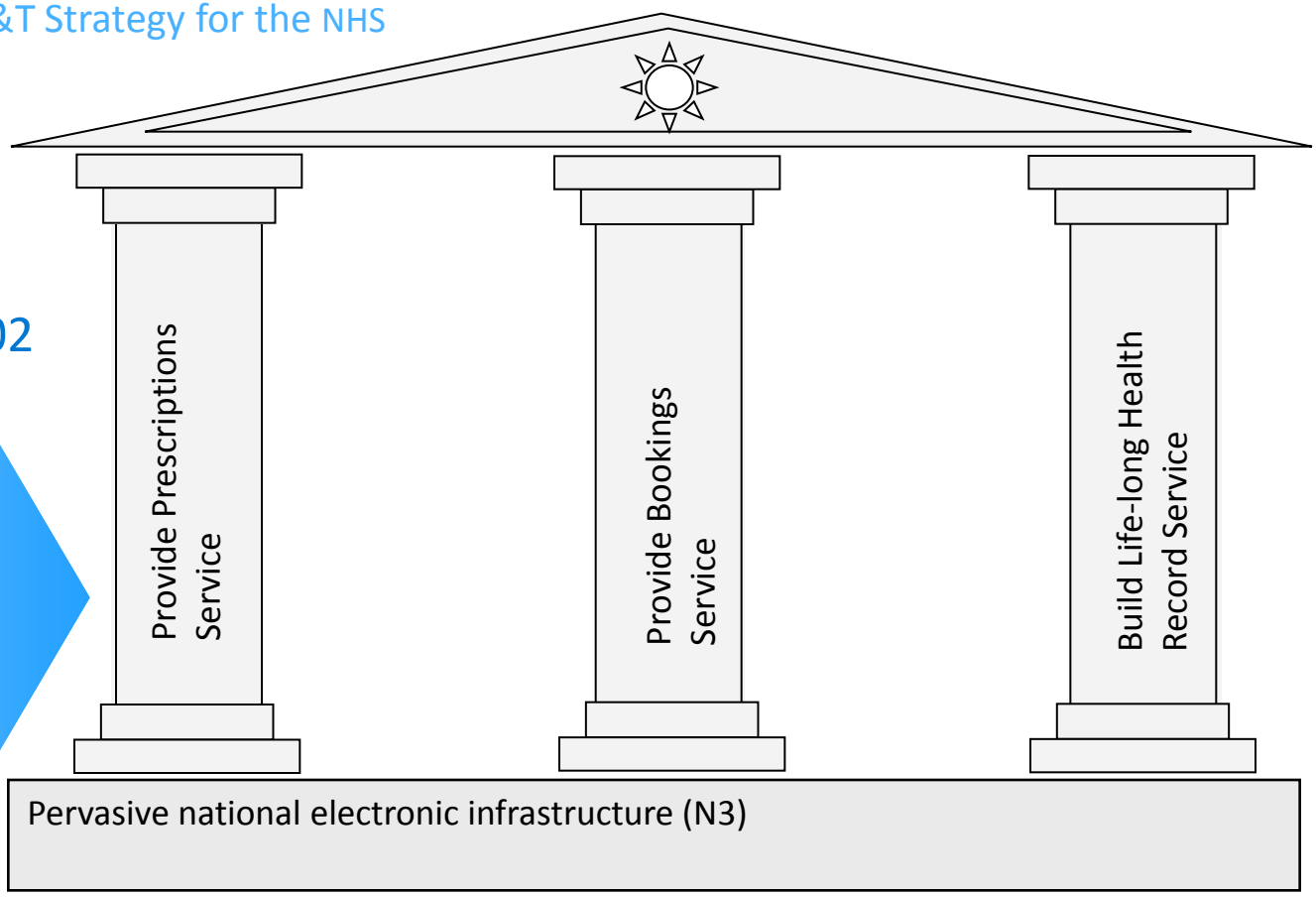
1994 IM&T Strategy for the NHS

1998



2002





As it turned out.....

Commissioning

Payment by Results

Plurality of provision

Provide Prescriptions Service	Provide Bookings Service	Build Life-long Health Record Service	Patient Choice	Digital Imaging	Secondary Uses Service	NHS Email System	Transfer of records between GPs	Quality Management Analysis System	NHS Numbers for Babies	Bowel Cancer Screening
1.4m precriptions	43,000 bookings	4.2m enquiries	43,000 bookings	2m new images	2m new records	5m messages	5,000,000 transfers	£750,000 paid	1,850 babies registered	8,000 screenings

Daily usage

Daily usage

Pervasive national electronic infrastructure (N3)

Key: Original Scope | Additional Scope

WE WILL RETURN TO COMPLEXITY LATER

Taken as read

AGING POPULATION AND INCREASING NUMBER OF YOUNG CHRONIC SICK

The sky is falling..

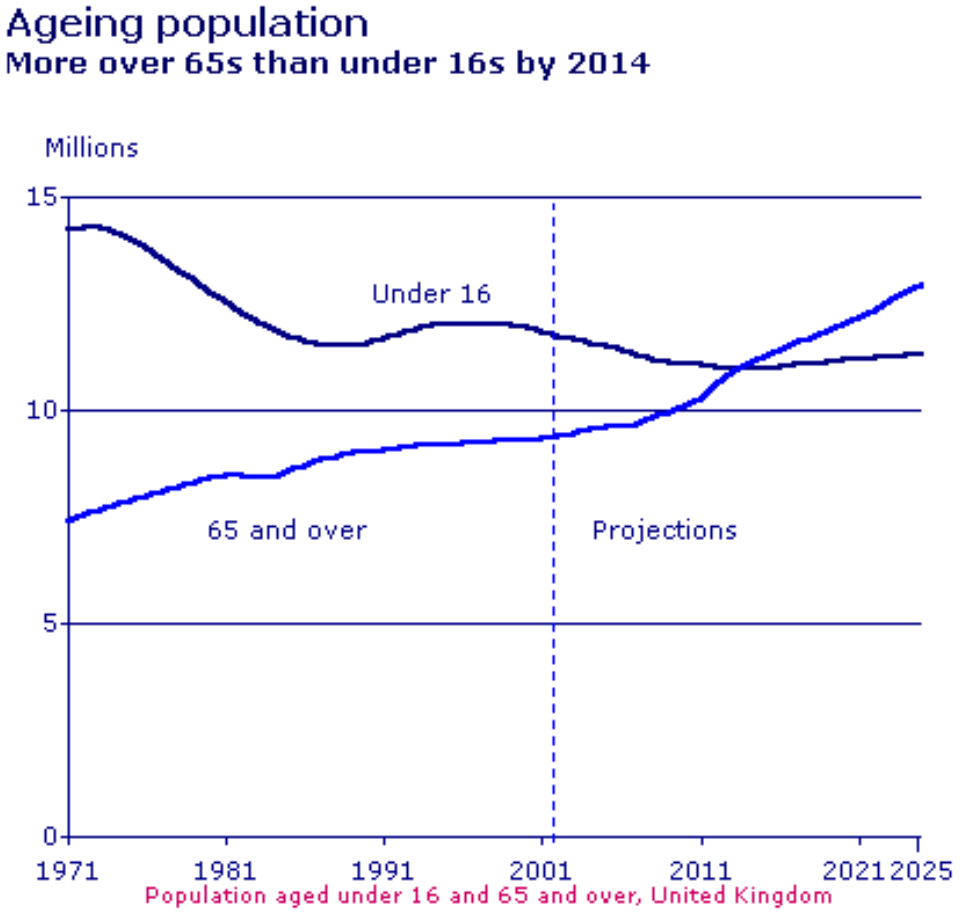
Ageing Population

2001 – over 60s > than under 18s

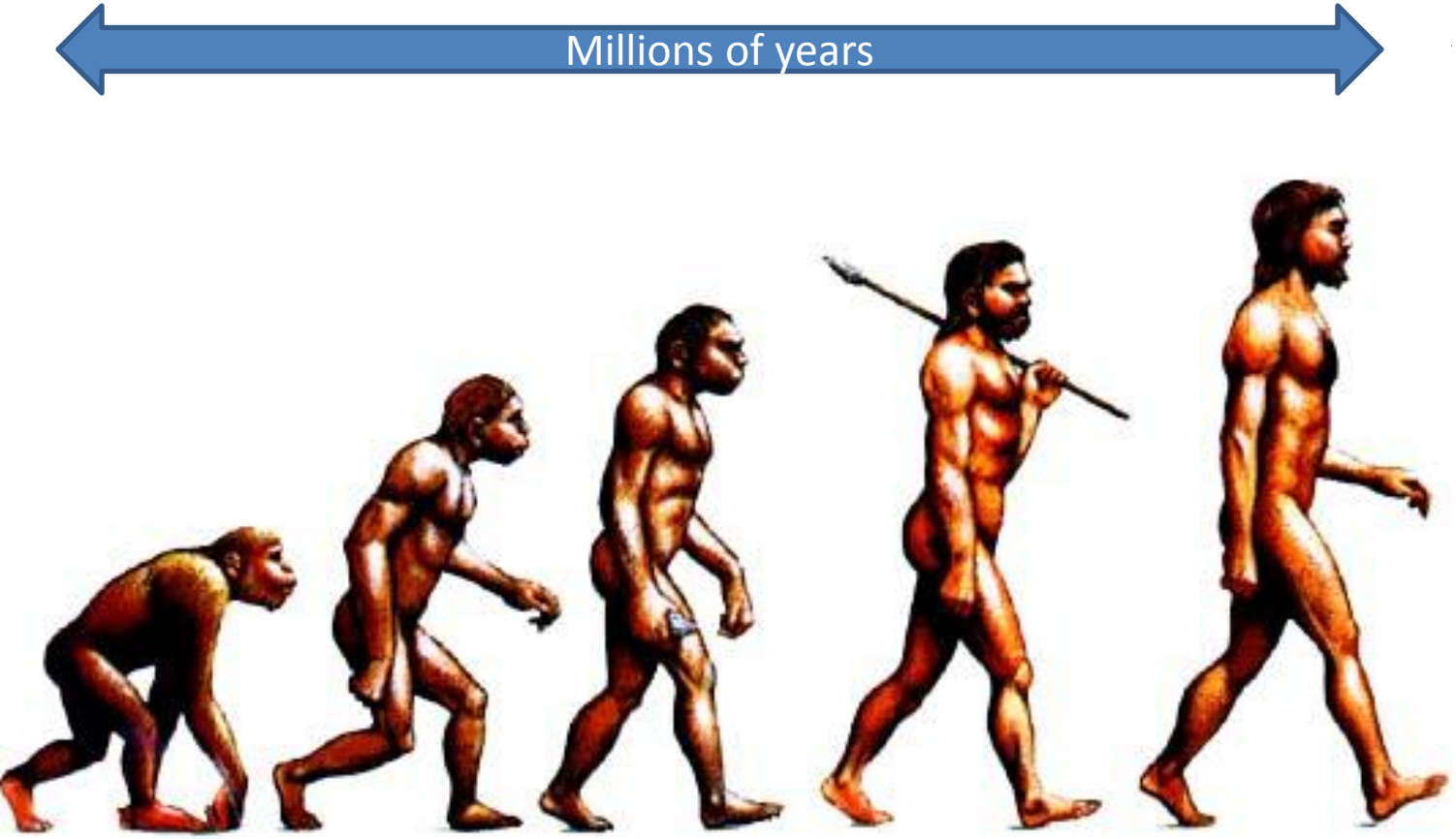
2050 – 4 times as many needing care

At 4 times the current cost

Remember hidden costs of caring



Source OPCS 2003



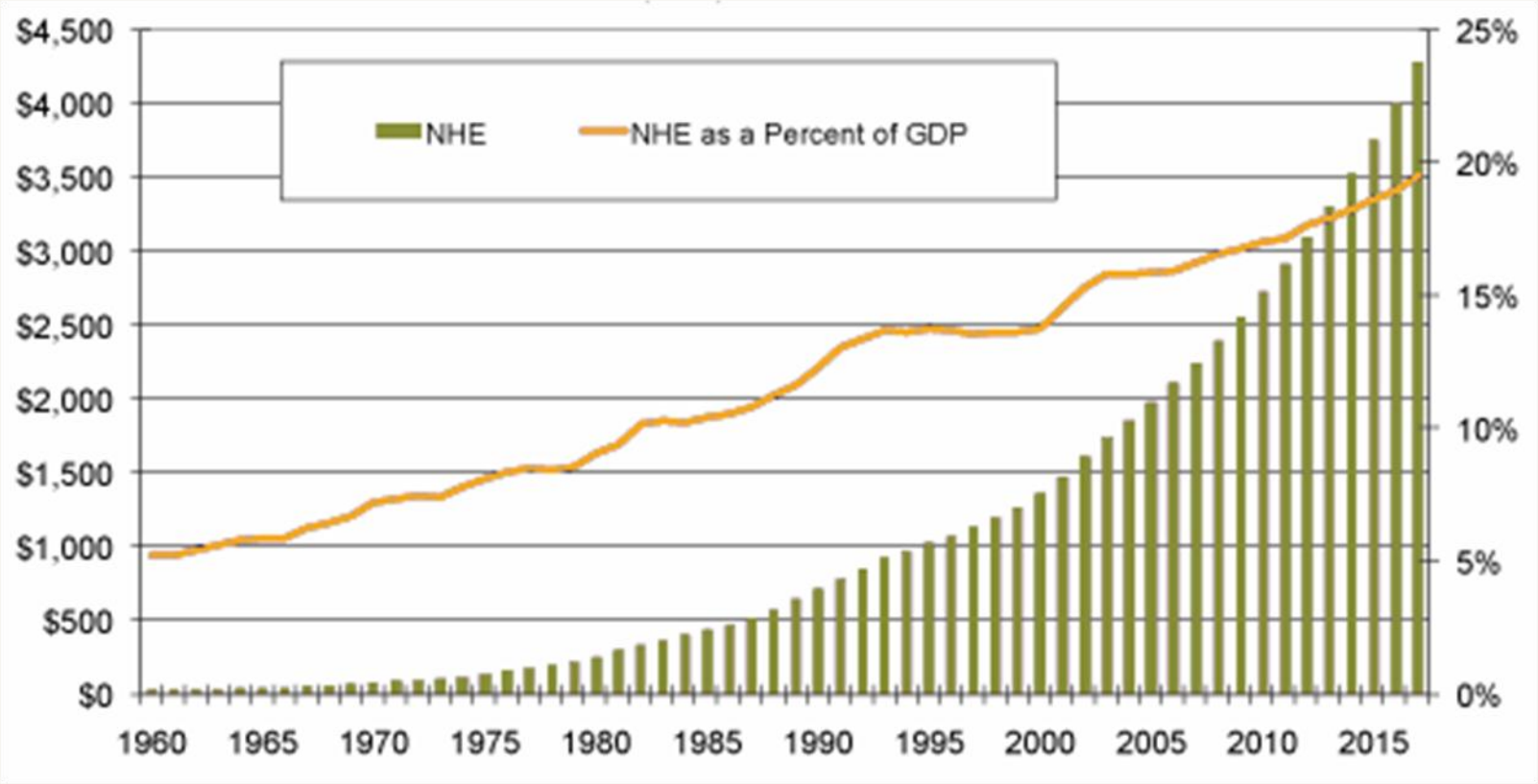
The Economist – The shape of things to come 2003

Taken as read

THE NEED TO CONTROL EXPENDITURE ON HEALTH

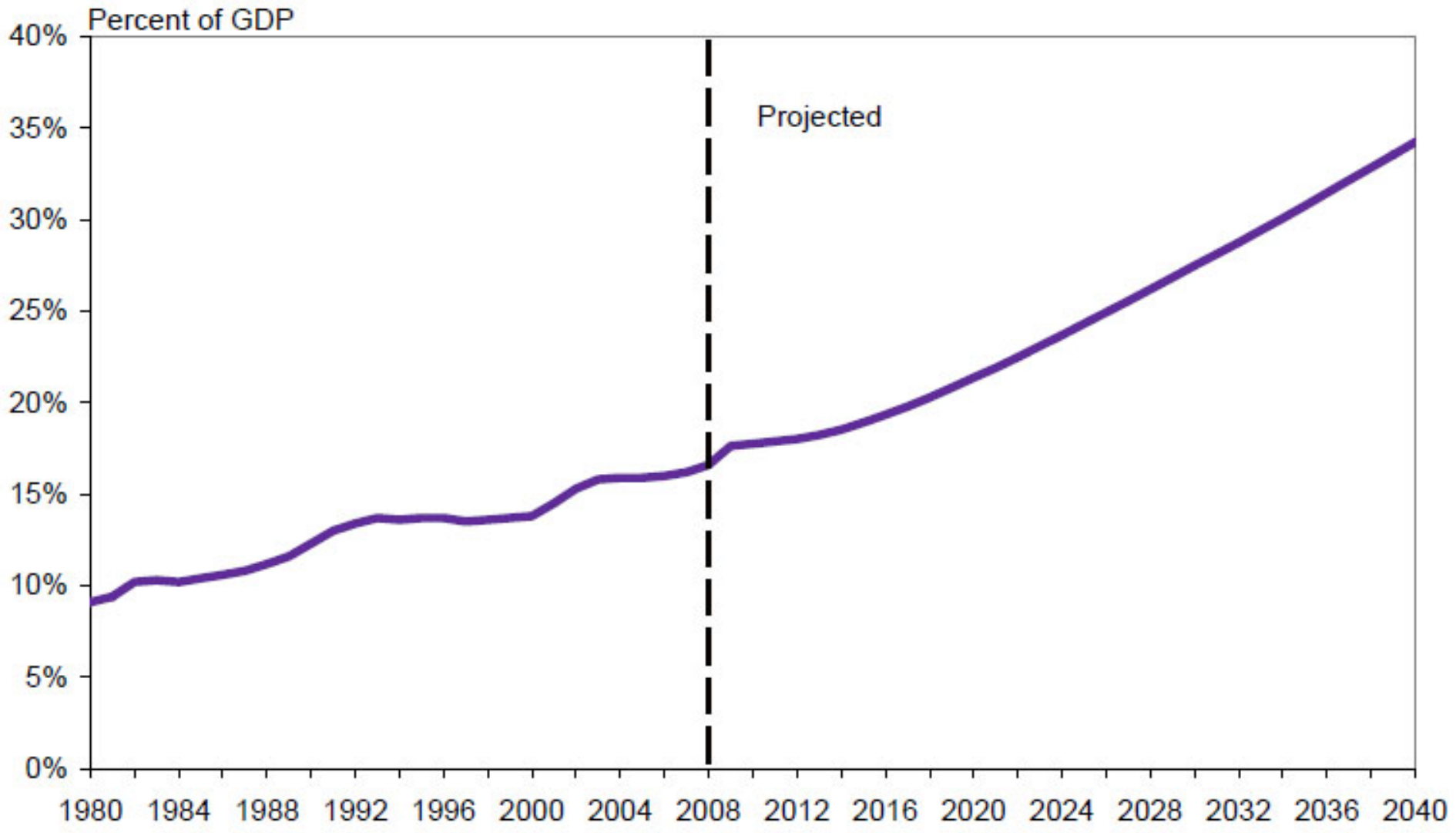
All health economies are on the same trajectory

National Health Expenditures, Aggregate and Share of Gross Domestic Product (GDP), 1960-2017



Source: Employee Benefit Research Institute estimates from Centers for Medicare and Medicaid Services and U.S. Department of Commerce.
Last Updated: January 6, 2008

Figure 1: National Health Expenditures as a Share of GDP, 1980-2040



Eric Dishman – Intel Corp. Presentation to US Senate April 2010

Taken as read

IT’S TIME FOR A RADICAL CHANGE TO THE DESIGN OF THE HEALTHCARE DELIVERY MODEL

Challenge – *"Major" Medical Advances 1600 to 2000*

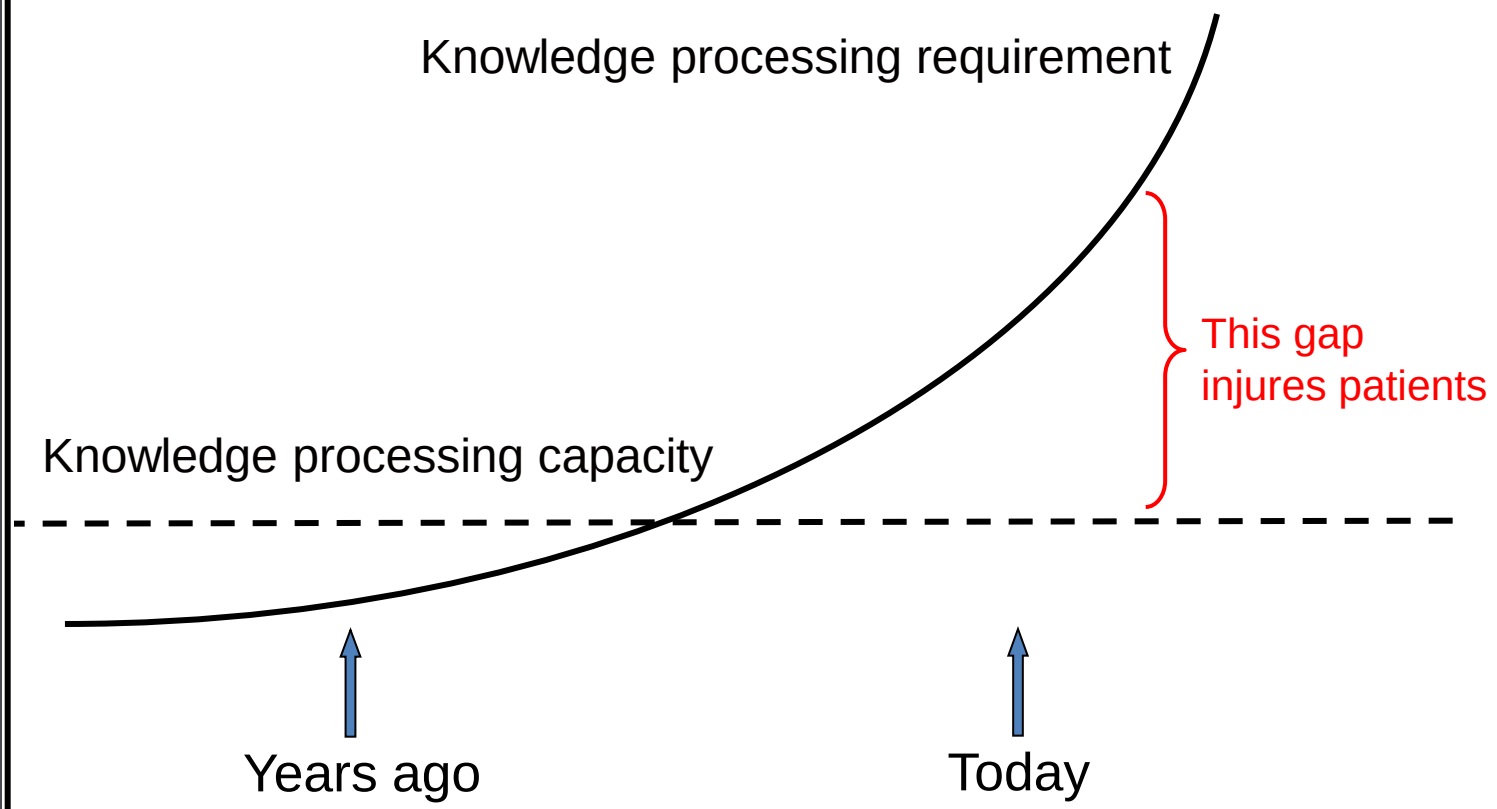
Source: Harvard Medical School, 2001

Challenge – *Clinical Knowledge-Processing Burden*

"Current medical practice relies heavily on the unaided mind to recall a great amount of detailed knowledge – a process which, to the detriment of all stakeholders, has repeatedly been shown unreliable"

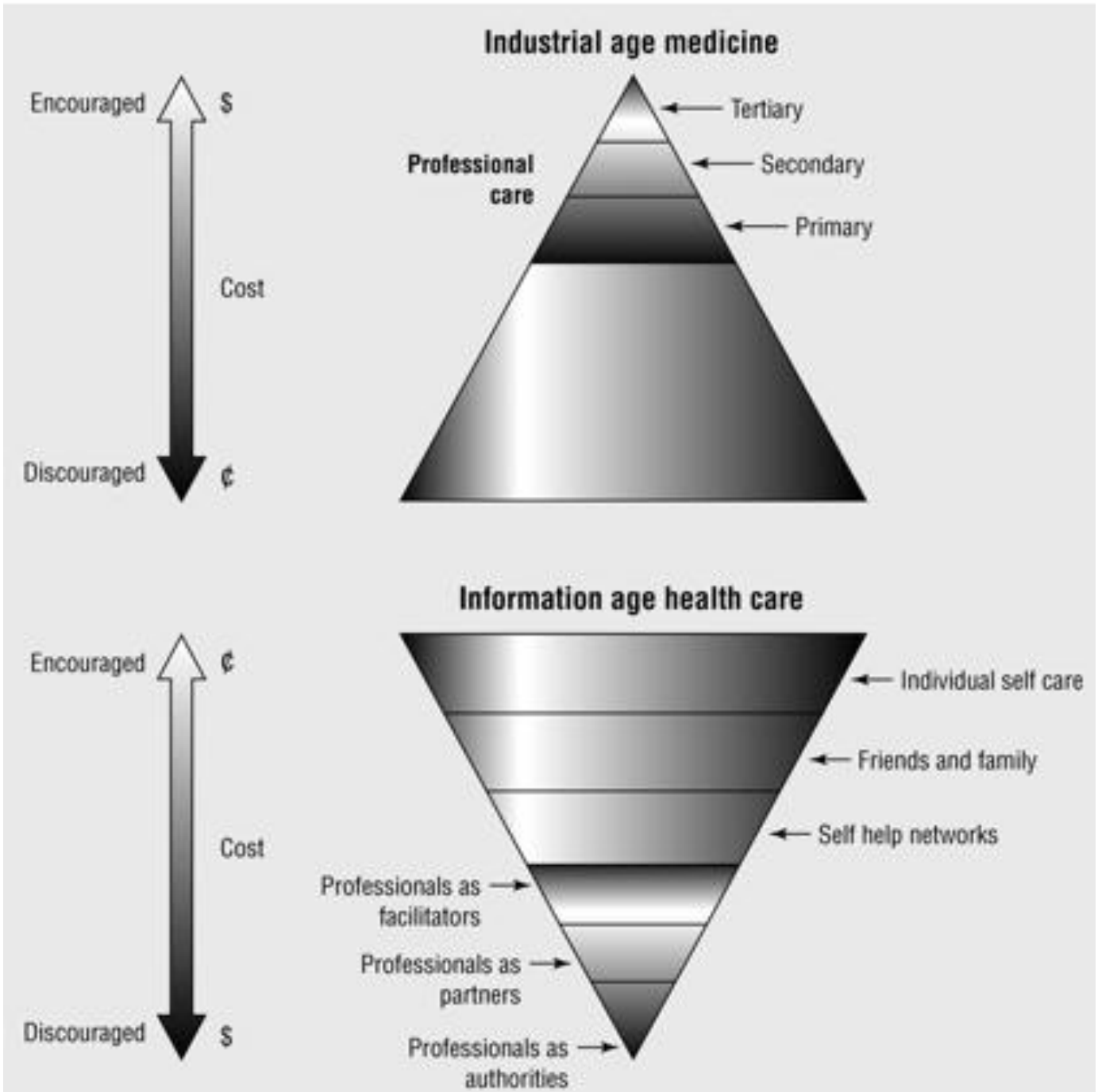
Crane and Raymond

The Permanente Journal
Winter 2003 Volume 7 No.1
Kaiser Permanente Institute for Health Policy



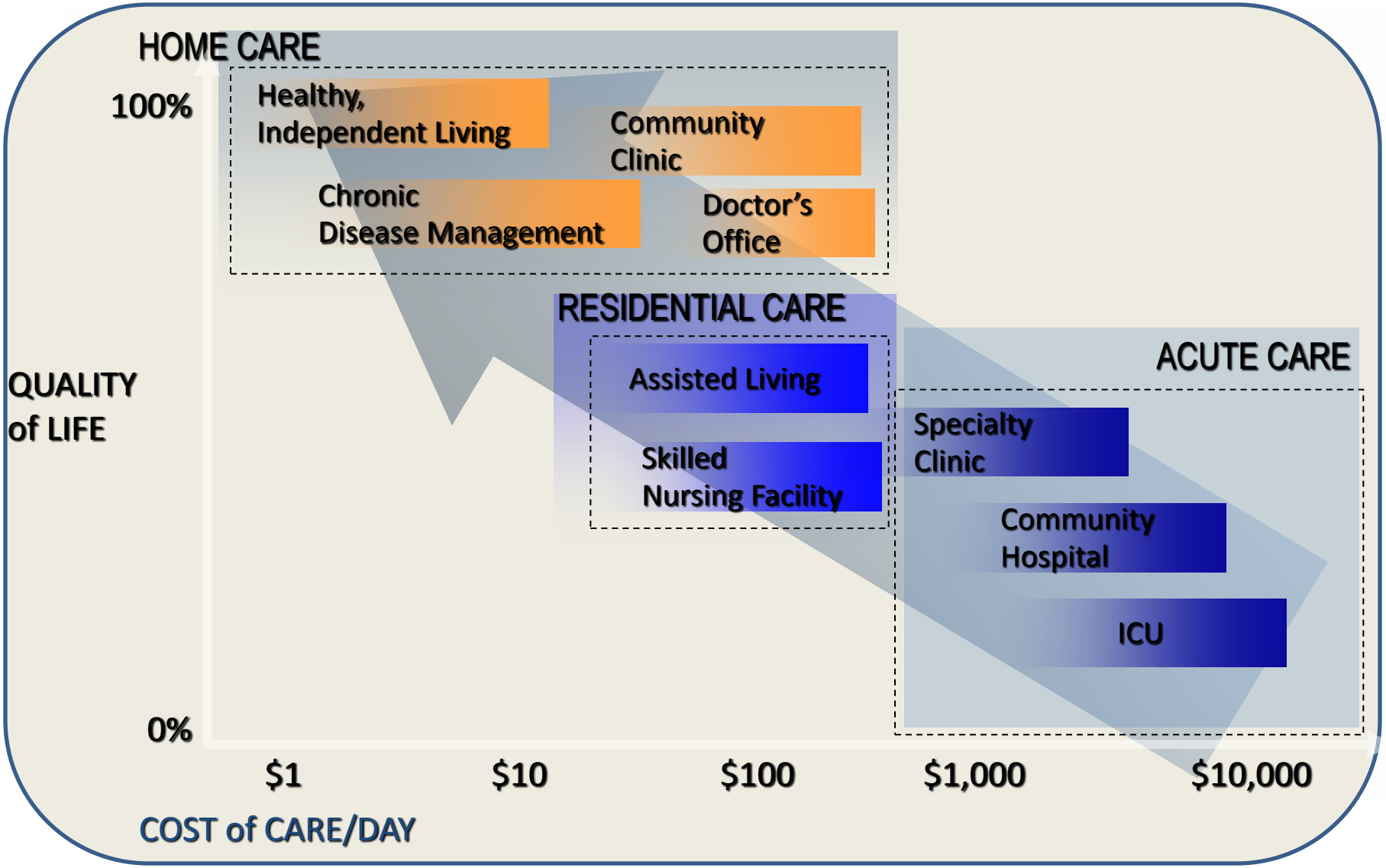
Taken as read

YOU AND I ARE THE NEW HEALTHCARE DELIVERY RESOURCE



[Jennings, Miller, Materna 1997] after Tom Ferguson -Healthcare Forum Journal Jan/Feb 1995 pp28-33

To deliver this change the focus Areas must change



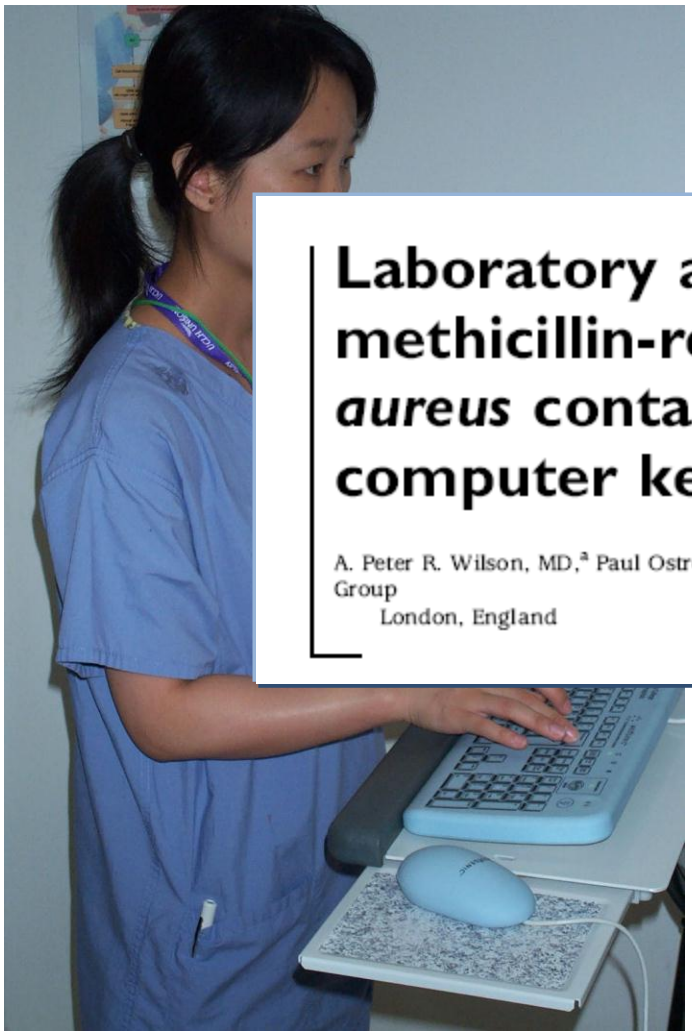
Source: Intel Corp. 2006

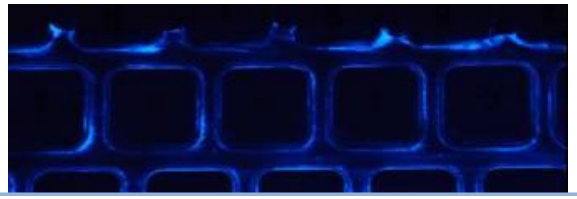
THIS MEANS EMBRACING AND INNOVATING WITH NEW TECHNOLOGIES

Appropriate devices....

Hardware for the mobile clinician

Design and research is now part of mainstream clinical care





Laboratory and in-use assessment of methicillin-resistant *Staphylococcus aureus* contamination of ergonomic computer keyboards for ward use

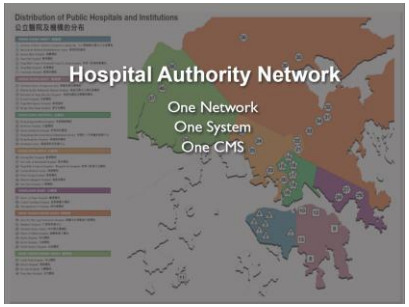
A. Peter R. Wilson, MD,[a] Paul Ostro, PhD,[b] Marita Magnussen, MSc,[a] and Ben Cooper, PhD,[c] for the Keyboard Study Group
London, England

…useable

This implies a significant change to Healthcare software

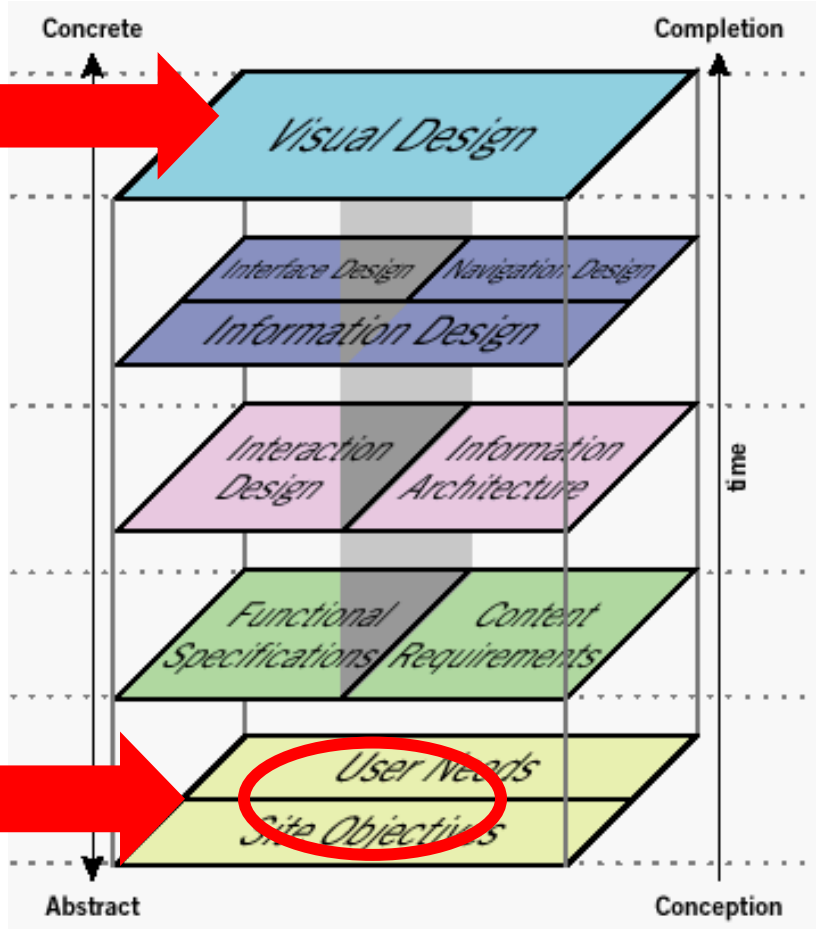
- Interoperability and sharing are now prime motivations
- Standards are required
- Detail is required but in new and more appropriate places and built on new software paradigms

醫院管理局
HOSPITAL AUTHORITY



Address the problem from the correct ‘end’

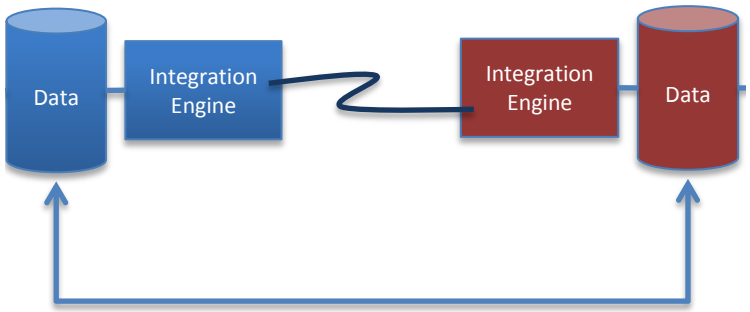
Your needs are met here



You are here

- Jesse James Garrett’s “The Elements of User Experience”
- `www.jjg.net/ia/elements.pdf`

The Real Interoperability Challenge



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The Traditional View of Integration

!!

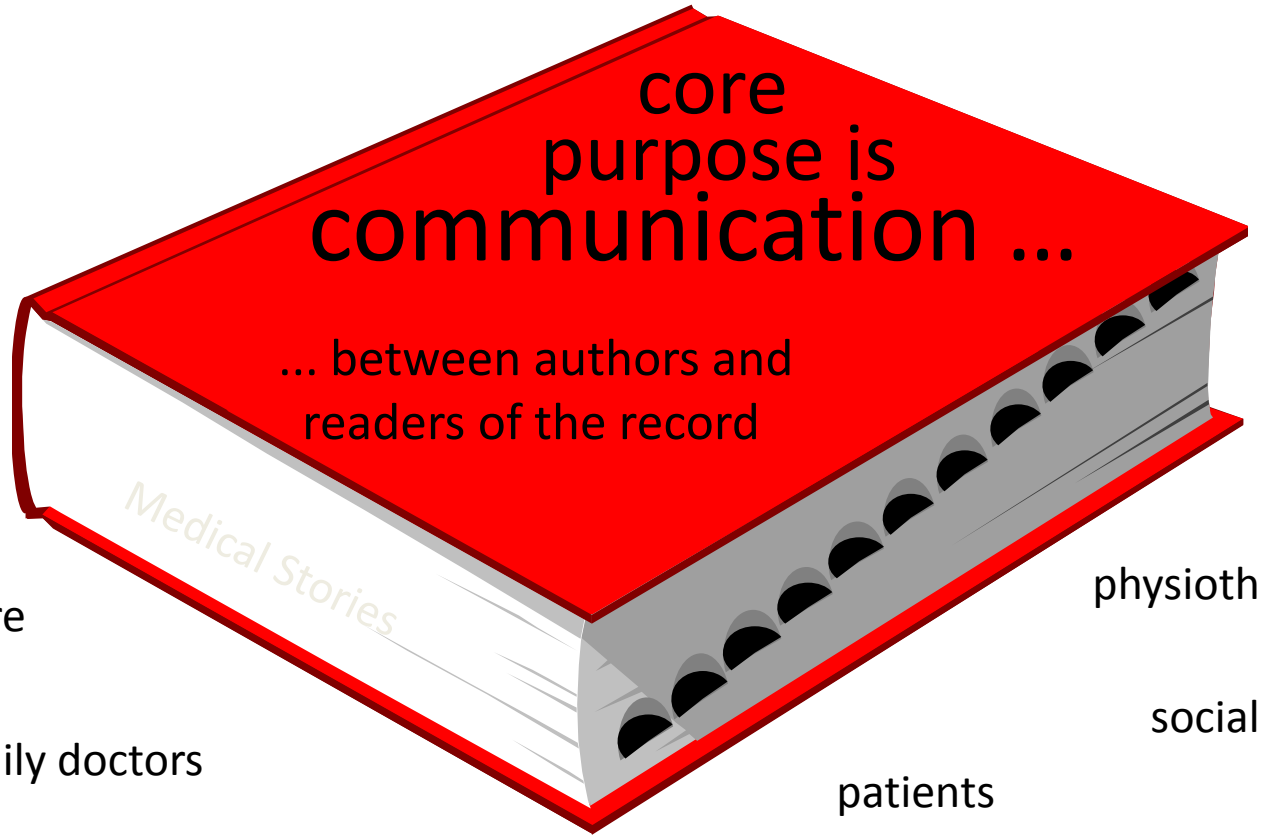
Current Medication

Primary Diagnosis

Allergy and ADR

Presenting complaint

“Standards for Clinical Records”



secondary care

family doctors

computers

nurse practitioners

patients

physiotherapists

social workers

relatives

Standards for interoperability

"We will employ a ruthless approach to standards" – Sir John Patisson 2003

- Standards are important
- Standards must help us solve the problems in front of us

- Ensure that a standards based approach also delivers
  - Integration into current workflow **or**
  - **Is so good it revolutionises and changes clinical practice**

SNOMED® INTERNATIONAL

HL7®

DICOM℠
Digital Imaging and Communications in Medicine

ISO International Organization for Standardization

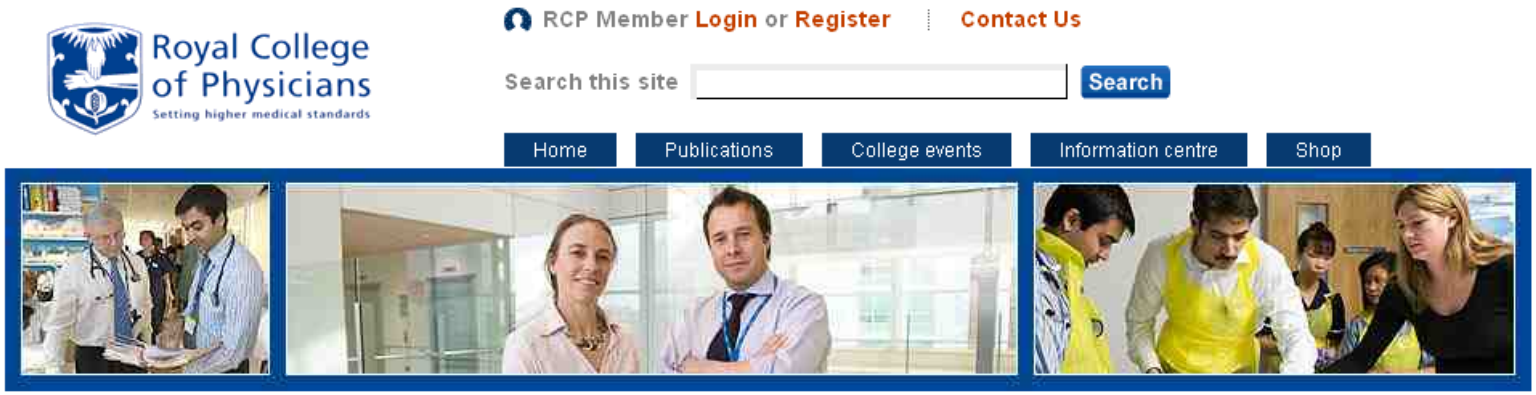
IEEE

IHE changing the way healthcare connects
www.ihe.net

Open Health Tools

An open architecture also enables plurality of provision – securing an ongoing competitive market, diversity of supply and choice

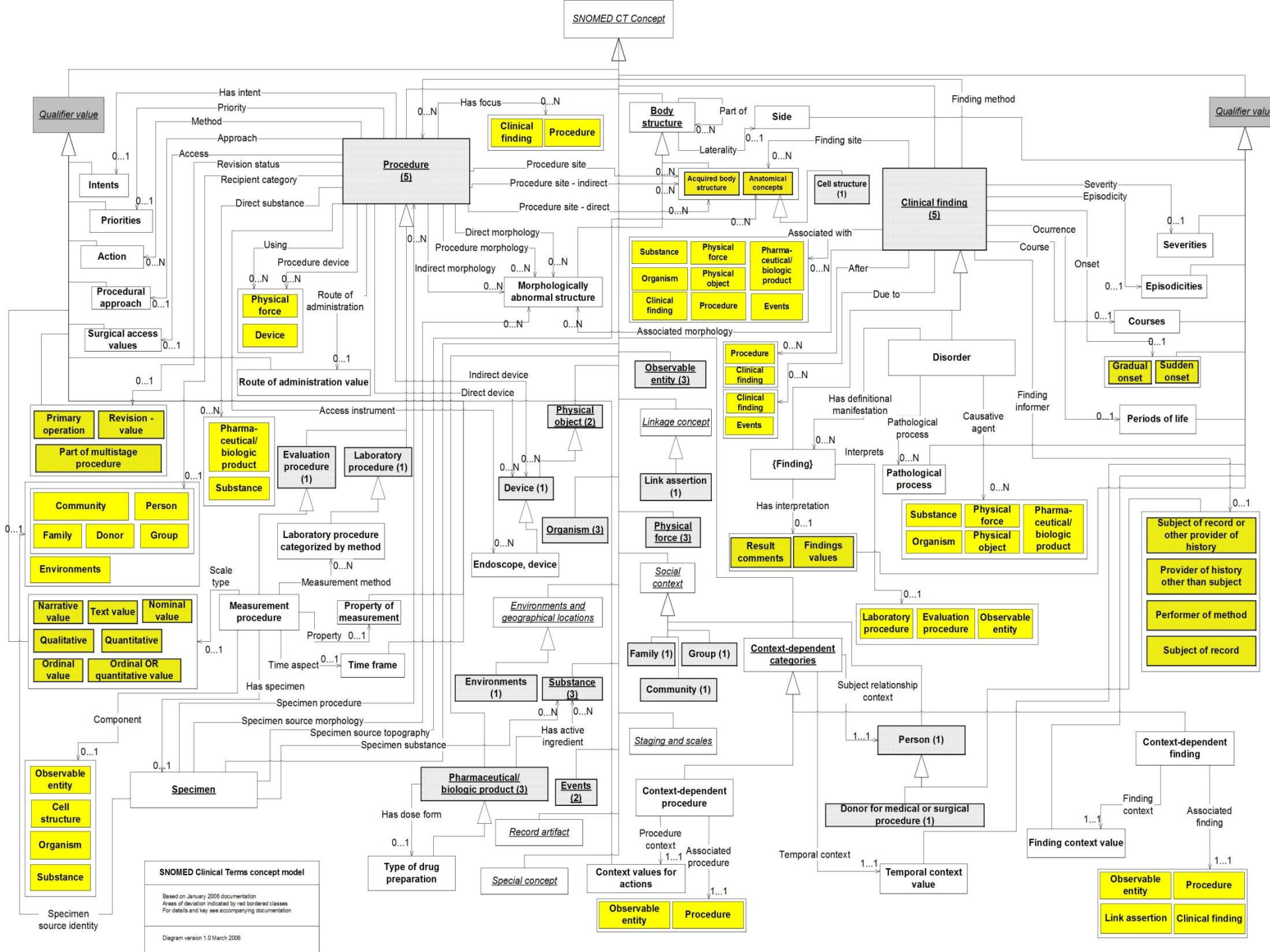
Professional Standards



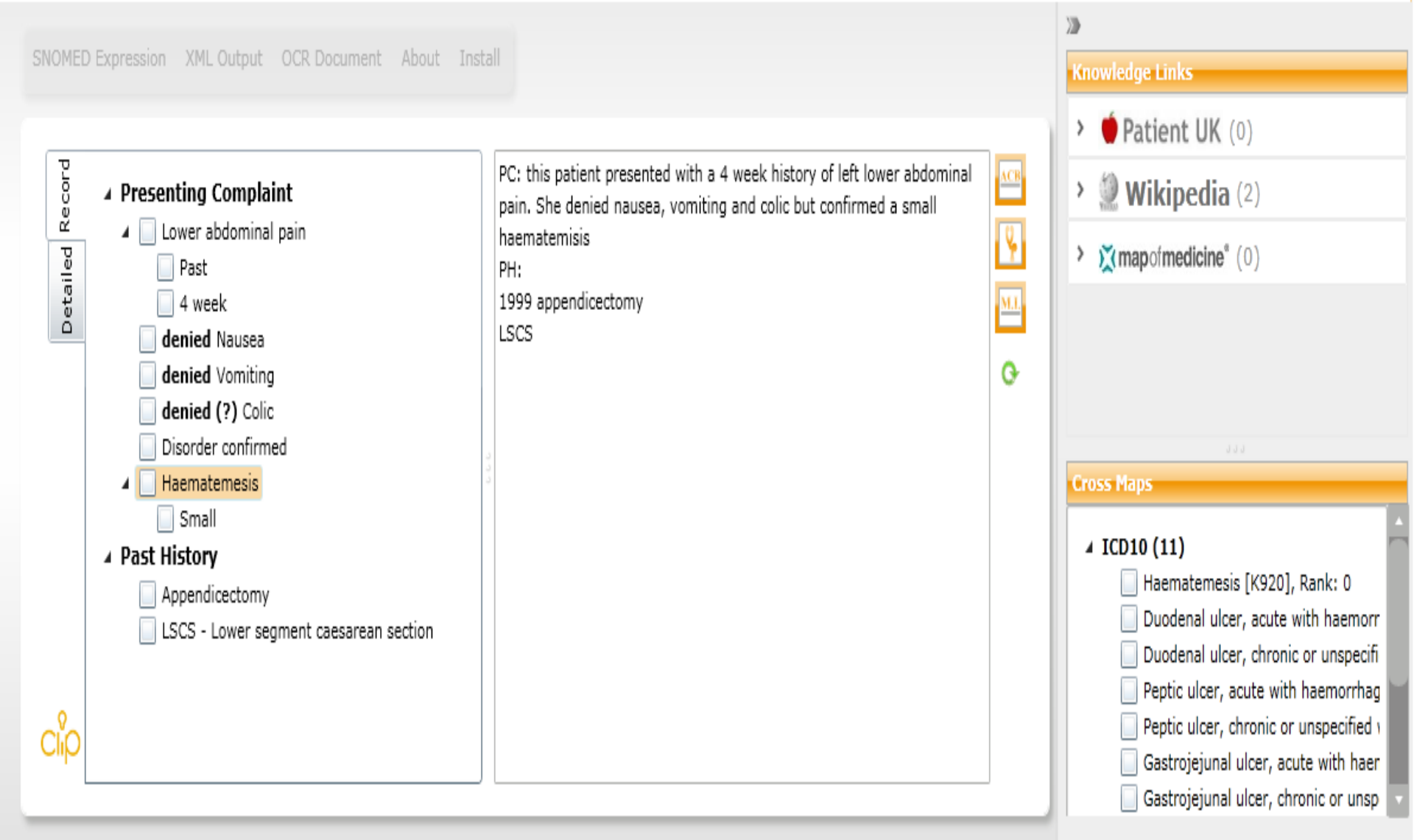
"The organisation of the medical record should be a matter of *immediate* concern to practicing physicians and students" …

"Developments…..are far more advanced and immediately applicable than many realise and concern with them is neither premature nor impractical"

Weed LL New Eng J Med Vol **278:**593-600,1968


SNOMED CT Concept
Qualifier value
Has intent
Priority
Method
Approach
Access
Revision status
Recipient category
Direct substance
Using
Procedure device
Route of administration
Procedural approach
Surgical access values
Intents
Priorities
Action
Procedure (5)
Has focus
Clinical finding
Procedure
Procedure site
Procedure site - indirect
Procedure site - direct
Direct morphology
Procedure morphology
Indirect morphology
Morphologically abnormal structure
Physical force
Device
Route of administration value
Primary operation
Revision - value
Part of multistage procedure
Pharma-ceutical/ biologic product
Substance
Evaluation procedure (1)
Laboratory procedure (1)
Access instrument
Indirect device
Direct device
Physical object (2)
Device (1)
Organism (3)
Endoscope, device
Laboratory procedure categorized by method
Measurement method
Scale type
Measurement procedure
Property of measurement
Property
Time aspect
Time frame
Has specimen
Specimen procedure
Specimen source morphology
Specimen source topography
Specimen substance
Component
Specimen
Observable entity
Cell structure
Organism
Substance
Specimen source identity
Community
Person
Family
Donor
Group
Environments
Narrative value
Text value
Nominal value
Qualitative
Quantitative
Ordinal value
Ordinal OR quantitative value
Environments and geographical locations
Environments (1)
Substance (3)
Has active ingredient
Pharmaceutical/ biologic product (3)
Events (2)
Has dose form
Type of drug preparation
Record artifact
Special concept
Body structure
Part of
Side
Laterality
Finding site
Acquired body structure
Anatomical concepts
Cell structure (1)
Associated with
Substance
Physical force
Pharma-ceutical/ biologic product
Organism
Physical object
Clinical finding
Procedure
Events
Associated morphology
Observable entity (3)
Linkage concept
Link assertion (1)
Physical force (3)
Social context
Family (1)
Group (1)
Community (1)
Staging and scales
Context-dependent procedure
Procedure context
Associated procedure
Context values for actions
Observable entity
Procedure
Finding method
Clinical finding (5)
Severity
Episodicity
Ocurrence
Course
Onset
After
Due to
Severities
Episodicities
Courses
Gradual onset
Sudden onset
Periods of life
Finding informer
Disorder
Has definitional manifestation
Pathological process
Causative agent
{Finding}
Interprets
Pathological process
Has interpretation
Result comments
Findings values
Substance
Physical force
Pharma-ceutical/ biologic product
Organism
Physical object
Laboratory procedure
Evaluation procedure
Observable entity
Subject of record or other provider of history
Provider of history other than subject
Performer of method
Subject of record
Context-dependent categories
Subject relationship context
Person (1)
Donor for medical or surgical procedure (1)
Temporal context
Temporal context value
Context-dependent finding
Finding context
Finding context value
Associated finding
Observable entity
Procedure
Link assertion
Clinical finding
SNOMED Clinical Terms concept model
Based on January 2006 documentation
Areas of deviation indicated by red bordered classes
For details and key see accompanying documentation
Diagram version 1.0 March 2006

To deliver what a clinician wants...



A Common User Interface

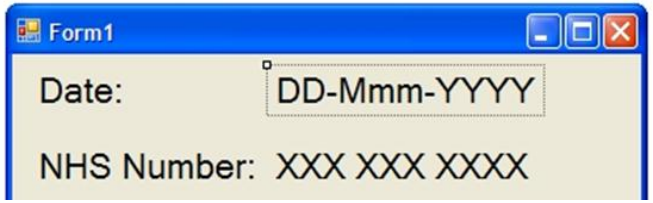
Open source programme

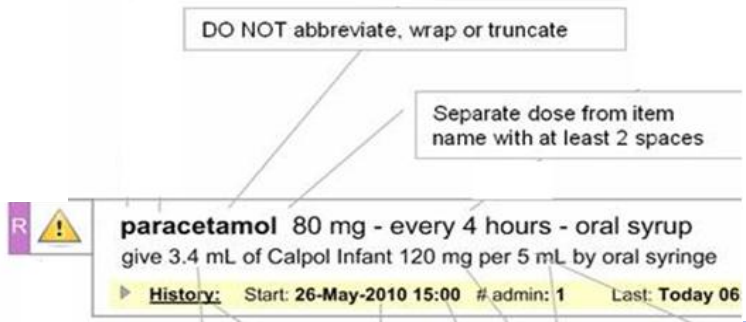
3 overarching drivers

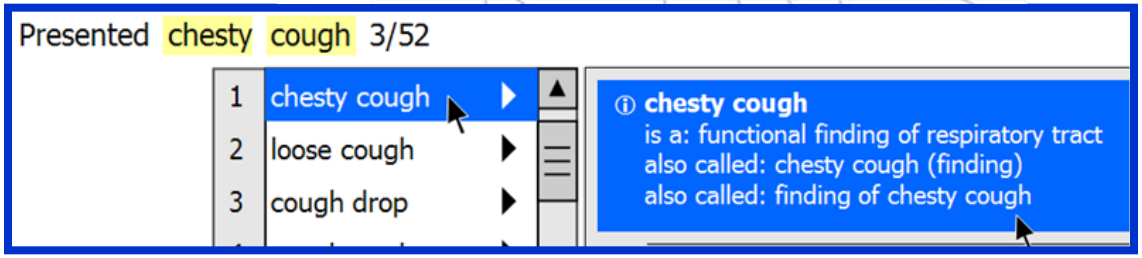
- Patient safety
- Clinical utility
- Reduced (re-) training

.. and secure a return on investment

www.cui.nhs.uk







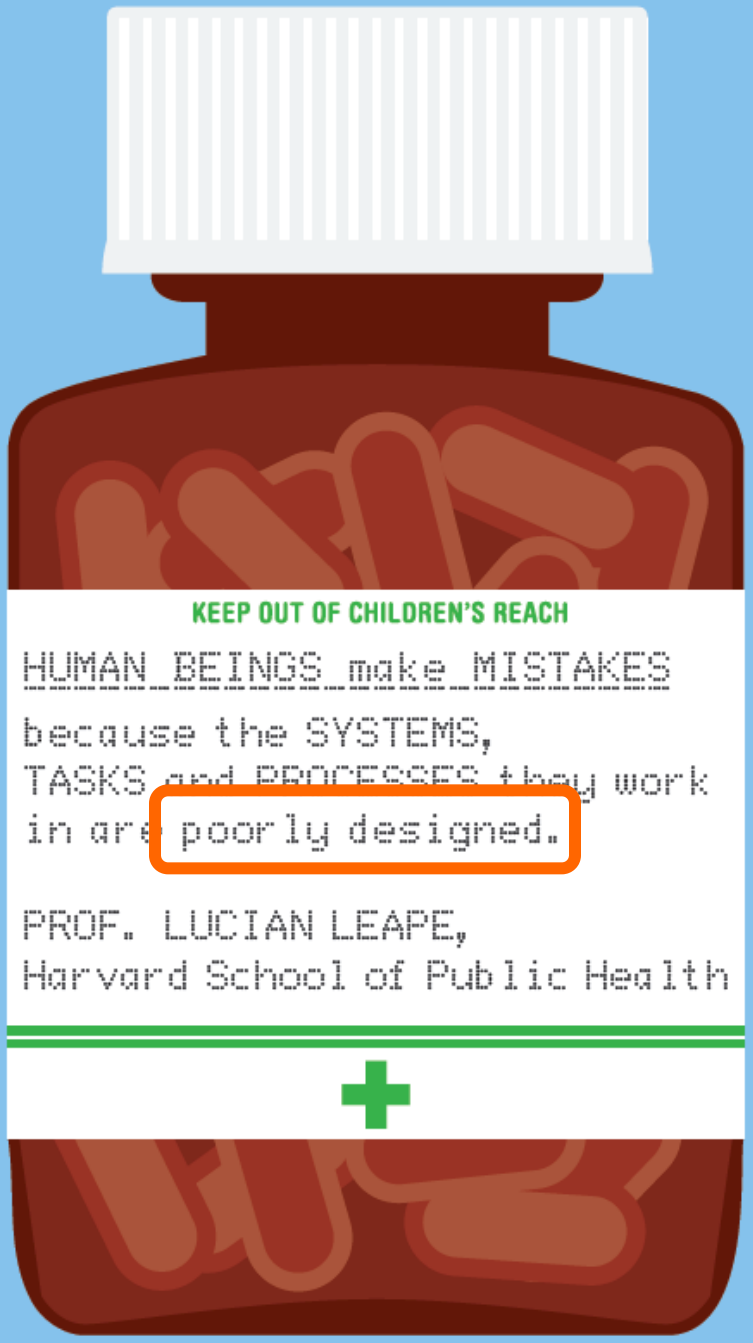
Hardware Interoperability – www.continuaalliance.org

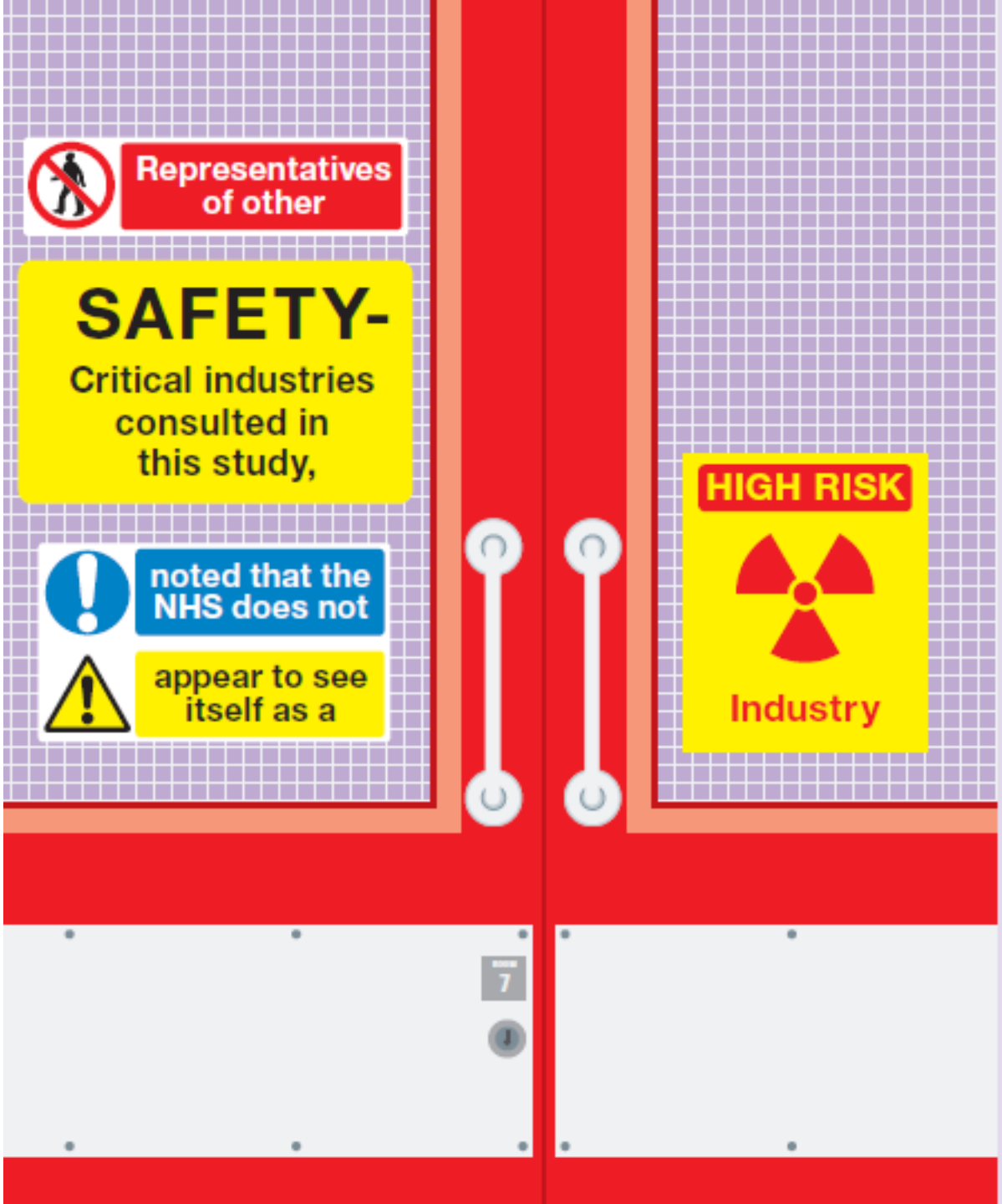
Another Lesson

DON’T SPEND THE NEXT 20 YEARS INVENTING THINGS WHICH ALREADY EXIST

Big lessons

- Starting again will take 20 years however good your team is
- Even though your market is huge taking a separate approach will isolate you from the forming global approach
- This will cost money and time


KEEP OUT OF CHILDREN'S REACH
HUMAN BEINGS make MISTAKES
because the SYSTEMS,
TASKS and PROCESSES they work
in are poorly designed.
PROF. LUCIAN LEAPE,
Harvard School of Public Health


Representatives of other
SAFETY-
Critical industries consulted in this study,
noted that the NHS does not
appear to see itself as a
HIGH RISK
Industry

Healthcare must change

SAFETY CULTURE

Windscale (U.K.), 1957

- Fire in reactor #1 resulted in radiation discharge.
- Improper fire-fighting caused 2nd discharge.
- 32 deaths, 260 cancer cases from radiation.
- Poor plant design & procedures prompted ***safety case regime*** for nuclear industry.

Windscale reactors 1 & 2 circa 1950

Flixborough (U.K.), 1974

Damage to the plant after the explosion

- Explosion at chemical plant following pipe rupture (maint. error)
- 28 killed, 36 injured
- Rupture attributed to nearby fire
- Incident prompted ***safety case regime*** for chemical industry

Piper Alpha (U.K.), 1988

- Gas explosion & subsequent oil fire at offshore drill
- 167 killed, 62 rescued
- Maintenance errors, poor evacuation cited
- Cullen report established ALARP
- ***Safety case*** regulations introduced for off-shore industry 1992

Piper Alpha rig ablaze after the explosion

Clapham (U.K.), 1988

Wreckage from the 3-train collision

- Signal failure causes three commuter trains to collide.
- 35 killed, 100 injured
- Maintenance introduced wiring fault in signal box.
- Public enquiry
- Railway ***safety case regulations*** introduced in 1994

Australia 2011

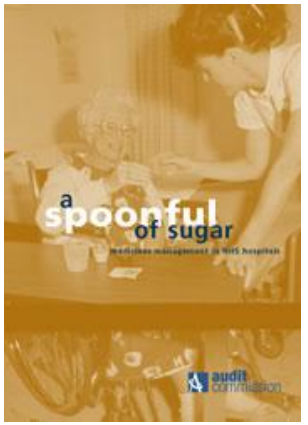
Tiger Airlines

- A whole fleet was grounded
- No one was killed or injured
- CASA concerns were enough.
- Pilots forced to retrain and some failed

LET’S USE MEDICATION AS AN EXAMPLE….

UK Drug interactions 2001

- As people get older, their use of medication tends to increase.
  - 80% of people over 75 take at least 1 prescribed medicine,
  - 36% of people over 75 take 4 or more medicines.
  - **Adverse reactions are implicated in 5% to 17% of hospital admissions of older people.**
  - Older people who are taking 4 or more medicines have an increased risk of suffering an adverse drug reaction to a medicine and being readmitted to hospital as a result. [1]



[1] A Spoonful of Sugar: Medicines Management in NHS Hospitals: Audit Commission 2001
http://www.audit-commission.gov.uk/nationalstudies/health/other/Pages/aspoonfulofsugar.aspx

Adverse events 2003

- 10.8% of patients on medical wards experience an adverse event – 46% of which are preventable.
- 12% of these relate to medicines use
- 1/3 lead to greater morbidity or death
- Each adverse event = on average 8.5 additional bed days
- Cost = £1.1bn possible £506m saving ?

[1] Vincent C., Neale, G., & Woloshynowych, M.: Adverse Events in British hospitals: preliminary retrospective record review: BMJ, vol 322, no 7285

BMJ

UK Adverse Drug Events 2004

- 1 in 16 hospital admissions are the result of an adverse drug reaction – 76% avoidable.
- This equates to 4% of hospital bed capacity At any one time 7 x 800 bed hospitals are occupied by patients admitted with ADRs
- Cost = £466m annually - £354m avoidable by putting in place e-prescribing ?

[1] Pirmohamed, M. et al: Adverse drug reactions as a cause of admission to hospital: prospective analysis of 18,820 patients: BMJ 2004; 329: 15-19

BMJ

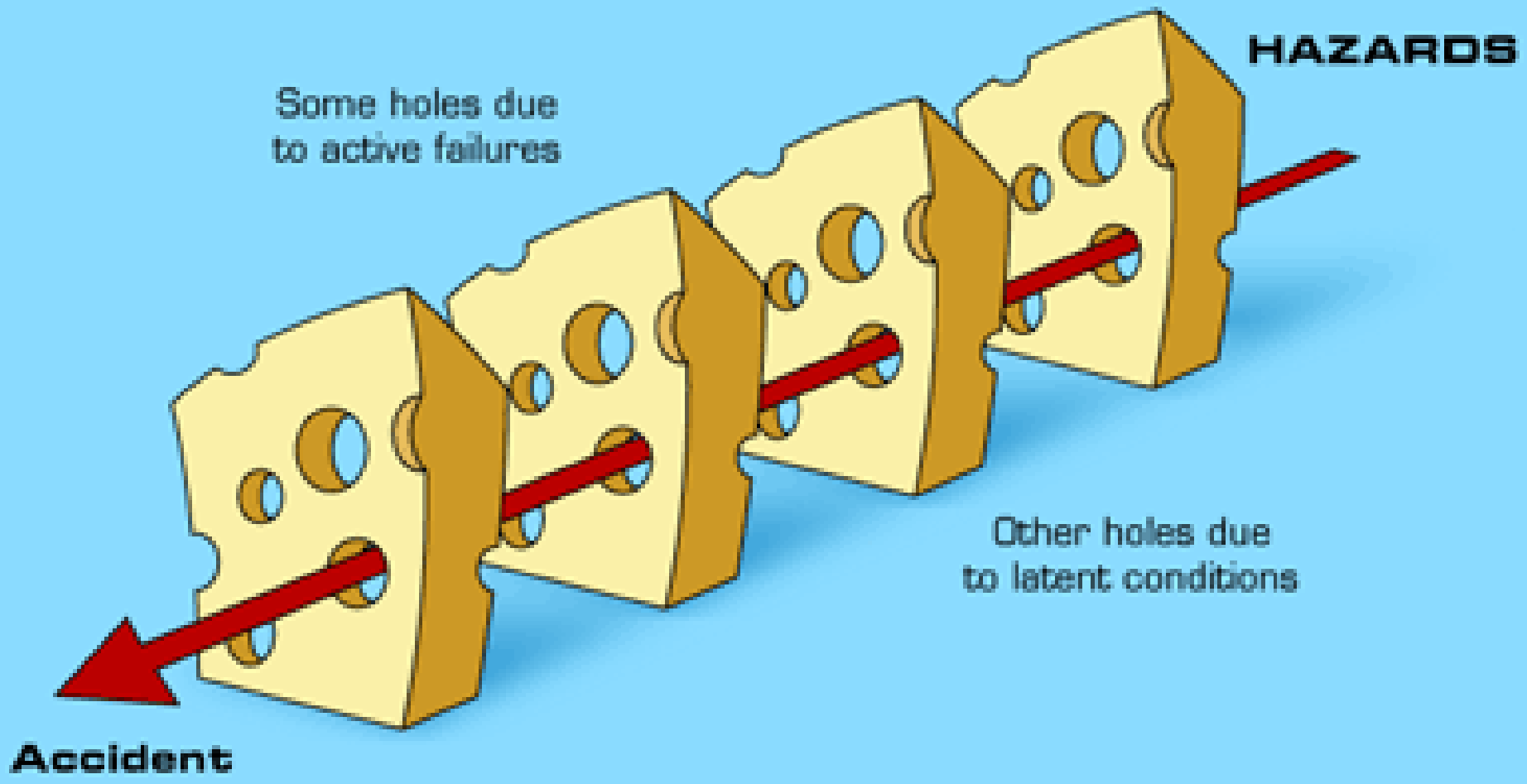
And in Australia

"We have shown that 2–4% of all hospital admissions, and up to 30% for patients >75 years of age, are medication-related;

up to three-quarters are potentially preventable."

Int J Qual Health Care (2003) 15 (suppl 1): i49-i59. doi: 10.1093/intqhc/mzg085

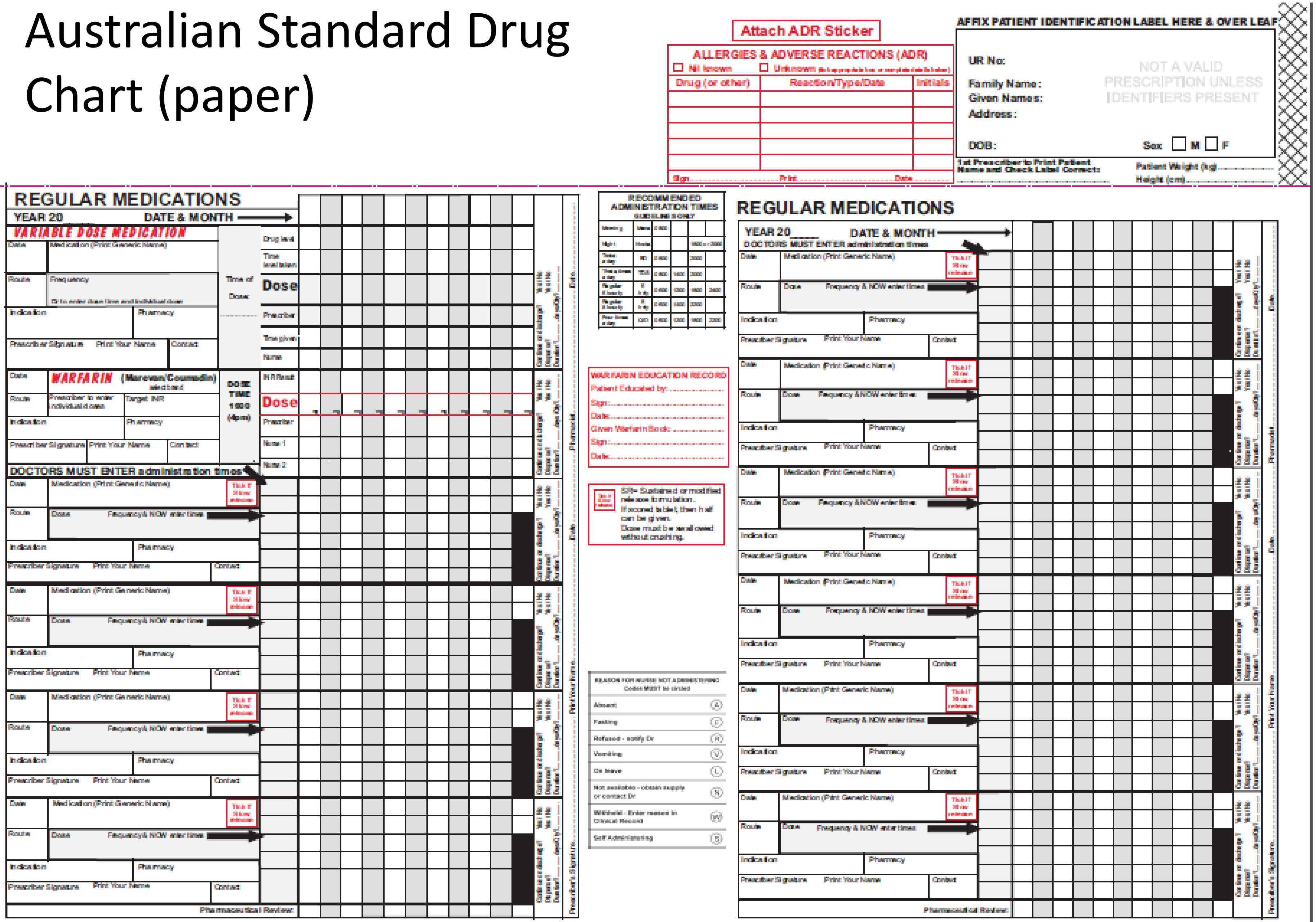
KNOW YOUR ENEMY



SUCCESSIVE LAYERS OF DEFENSES

http://patientsafetyed.duhs.duke.edu/module_e/swiss_cheese.html -accessed 02-Aug-2011

Australian Standard Drug Chart (paper)


Attach ADR Sticker

ALLERGIES & ADVERSE REACTIONS (ADR)

☐ Nil known ☐ Unknown

Drug (or other)	Reaction/Type/Date	Initials

Sign .... Print .... Date ....

AFFIX PATIENT IDENTIFICATION LABEL HERE & OVER LEAF

UR No:

Family Name:

Given Names:

Address:

DOB: Sex ☐ M ☐ F

NOT A VALID PRESCRIPTION UNLESS IDENTIFIERS PRESENT

1st Prescriber to Print Patient Name and Check Label Correct:

Patient Weight (kg) ....

Height (cm) ....

REGULAR MEDICATIONS

YEAR 20 DATE & MONTH →

VARIABLE DOSE MEDICATION

Date | Medication (Print Generic Name)

Route | Frequency

Indication | Pharmacy

Prescriber Signature | Print Your Name | Contact

Time of Dose: | Drug level | Time level taken | Dose | Prescriber | Time given | Nurse

WARFARIN (Marevan/Coumadin) select brand

Route | Prescriber to enter individual doses | Target INR

Indication | Pharmacy

Prescriber Signature | Print Your Name | Contact

DOSE TIME 1600 (4pm) | INR Result | Dose | Prescriber | Nurse 1 | Nurse 2

DOCTORS MUST ENTER administration times

Date | Medication (Print Generic Name)

Route | Dose | Frequency & NOW enter times

Indication | Pharmacy

Prescriber Signature | Print Your Name | Contact

Pharmaceutical Review:

RECOMMENDED ADMINISTRATION TIMES

WARFARIN EDUCATION RECORD

Patient Educated by: ....

Sign: ....

Date: ....

Given Warfarin Book: ....

Sign: ....

Date: ....

SR= Sustained or modified release formulation. If scored tablet, then half can be given. Dose must be swallowed without crushing.

REASON FOR NURSE NOT ADMINISTERING

Codes MUST be circled

Absent	(A)
Fasting	(F)
Refused - notify Dr	(R)
Vomiting	(V)
On leave	(L)
Not available - obtain supply or contact Dr	(N)
Withheld - Enter reason in Clinical Record	(W)
Self Administering	(S)

REGULAR MEDICATIONS

YEAR 20 ___ DATE & MONTH →

DOCTORS MUST ENTER administration times

Date | Medication (Print Generic Name)

Route | Dose | Frequency & NOW enter times

Indication | Pharmacy

Prescriber Signature | Print Your Name | Contact

Pharmaceutical Review:

Date | Pharmacist | Print Your Name | Prescriber's Signature

AS REQUIRED "PRN" MEDICATIONS

Attach ADR Sticker
See front page for details

AFFIX PATIENT IDENTIFICATION LABEL HERE

UR No:

Family Name: NOT A VALID PRESCRIPTION UNLESS IDENTIFIERS PRESENT
Given Names:
Address:

DOB: Sex ☐ M ☐ F

1st Prescriber to Print Patient Name and Check Label Correct: ....

Year 20____

Date	Medication (Print Generic Name)		Date															Continue on discharge? Yes No
Route	Dose Hourly frequency PRN	Max dose/24 hrs	Time															Dispense? Yes No
Indication	Pharmacy		Dose															Duration: ... Qty: ...
			Route															
Prescriber Signature	Print Your Name	Contact	Sign															

Date	Medication (Print Generic Name)		Date															Continue on discharge? Yes No
Route	Dose Hourly frequency PRN	Max dose/24 hrs	Time															Dispense? Yes No
Indication	Pharmacy		Dose															Duration: ... Qty: ...
			Route															
Prescriber Signature	Print Your Name	Contact	Sign															

Date	Medication (Print Generic Name)		Date															Continue on discharge? Yes No
Route	Dose Hourly frequency PRN	Max dose/24 hrs	Time															Dispense? Yes No
Indication	Pharmacy		Dose															Duration: ... Qty: ...
			Route															
Prescriber Signature	Print Your Name	Contact	Sign															

Date	Medication (Print Generic Name)		Date															Continue on discharge? Yes No
Route	Dose Hourly frequency PRN	Max dose/24 hrs	Time															Dispense? Yes No
Indication	Pharmacy		Dose															Duration: ... Qty: ...
			Route															
Prescriber Signature	Print Your Name	Contact	Sign															

Date	Medication (Print Generic Name)		Date															Continue on discharge? Yes No
Route	Dose Hourly frequency PRN	Max dose/24 hrs	Time															Dispense? Yes No
Indication	Pharmacy		Dose															Duration: ... Qty: ...
			Route															
Prescriber Signature	Print Your Name	Contact	Sign															

Date	Medication (Print Generic Name)		Date															Continue on discharge? Yes No
Route	Dose Hourly frequency PRN	Max dose/24 hrs	Time															Dispense? Yes No
Indication	Pharmacy		Dose															Duration: ... Qty: ...
			Route															
Prescriber Signature	Print Your Name	Contact	Sign															

Date	Medication (Print Generic Name)		Date															Continue on discharge? Yes No
Route	Dose Hourly frequency PRN	Max dose/24 hrs	Time															Dispense? Yes No
Indication	Pharmacy		Dose															Duration: ... Qty: ...
			Route															
Prescriber Signature	Print Your Name	Contact	Sign															

Date: ...... Pharmacist ...... Date: ...... Name (Print) ...... Prescriber's Signature ......

BINDING MARGIN - DO NOT WRITE

E

cut has been moved down 3 mm

Safety+Quality Council

Facility/Service: ____________________

Ward/Unit: ....

MEDICATION Chart No. .... **of** ....

ADDITIONAL CHARTS
☐ IV Fluid ☐ BGL/Insulin ☐ Acute Pain ☐ Other
☐ Palliative Care ☐ Chemotherapy ☐ IV Heparin

ONCE ONLY, PRE-MEDICATION & NURSE INITIATED MEDICINES

Date Prescribed	Medication (Print Generic Name)	Route	Dose	Date/Time of dose	Prescriber/Nurse Initiator (NI) Signature	Prescriber/Nurse Initiator (NI) Print Your Name	Given by	Time Given	Pharmacy

TELEPHONE ORDERS (To be signed within 24 hrs of order)

Date Time	Medication (Print Generic Name)	Route	Dose	Frequency	Nurse Initials Nr 1	Nurse Initials Nr 2	Dr Name	Dr Sign.	Date	RECORD OF ADMINISTRATION Time/Given by	Time/Given by	Time/Given by	Time/Given by

Medicines taken Prior to Presentation to Hospital
(Prescribed, over the counter, complementary) Own medications brought in? ☐ Y ☐ N Administration Aid (specify) ....

Medication	Dose & frequency	Duration	Medication	Dose & frequency	Duration

GP: Community Pharmacy:

Documented by (Sign) (Date) Medicines usually administered by

NOT FOR ADMINISTRATION

The Australian Council for Safety and Quality in Health Care acknowledge the significant contribution of the Queensland Health Medication Management Services.

NationalMed Chart 12/12 Ref NMC - TYPE E

BINDING MARGIN - DO NOT WRITE

MEDICATION CHART

DATE ⇨	4-2-4	MEDICINE (Approved Name)	DOCTOR'S SIGNATURE	SPECIAL INSTRUCTIONS COUNSELLING	PHARMACY
ROUTE ⇨	po	Lorti 2			
TIME (Specify if required)	INITALS ⇨		BLEEP NO.		
Morning		1			
Midday					
Evening					
Bedtime					

TRADITIONAL APPROACHES TO SOFTWARE DEVELOPMENT HAVE LARGELY FAILED TO DELIVER WHAT WE NEED….SO FAR

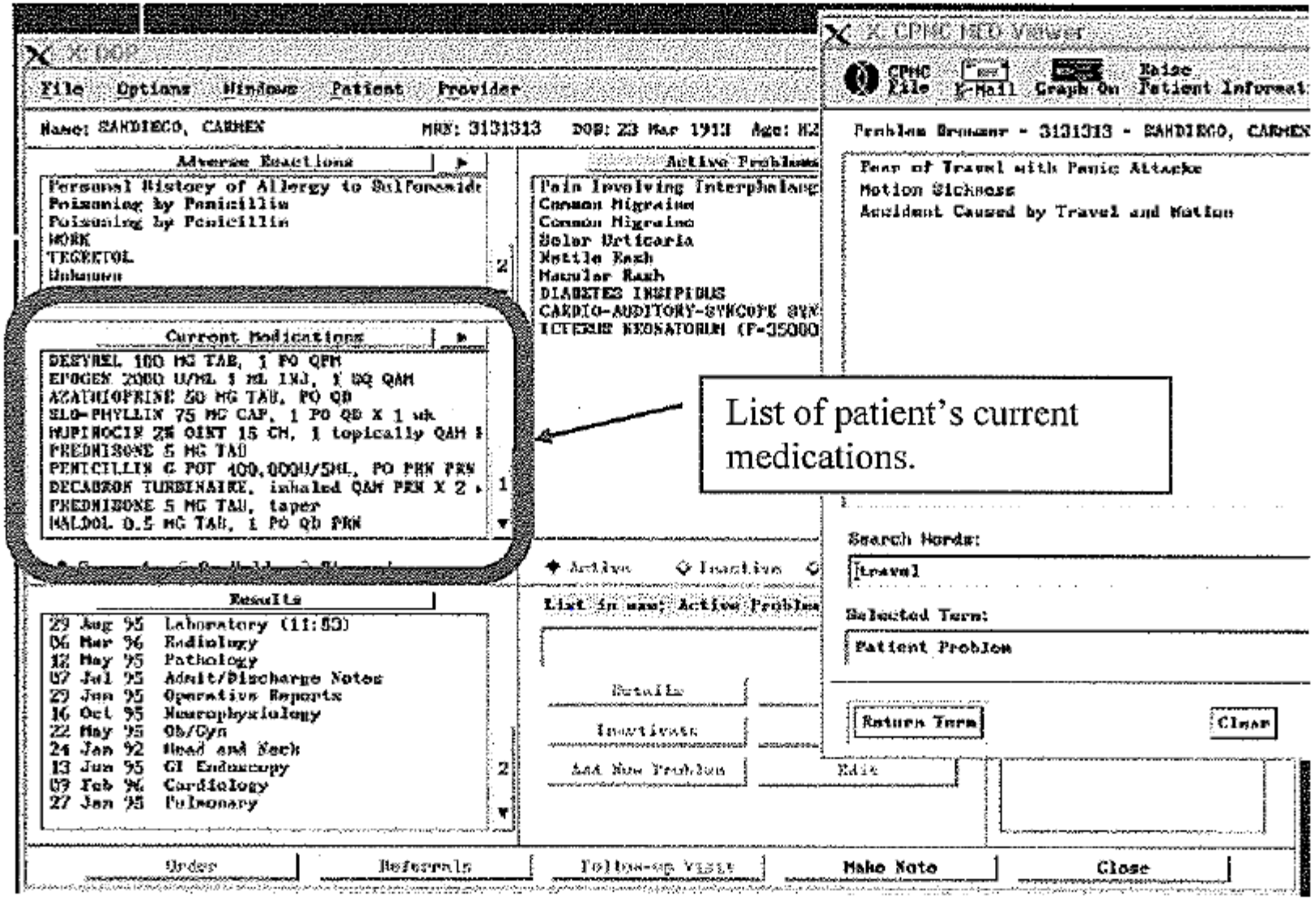
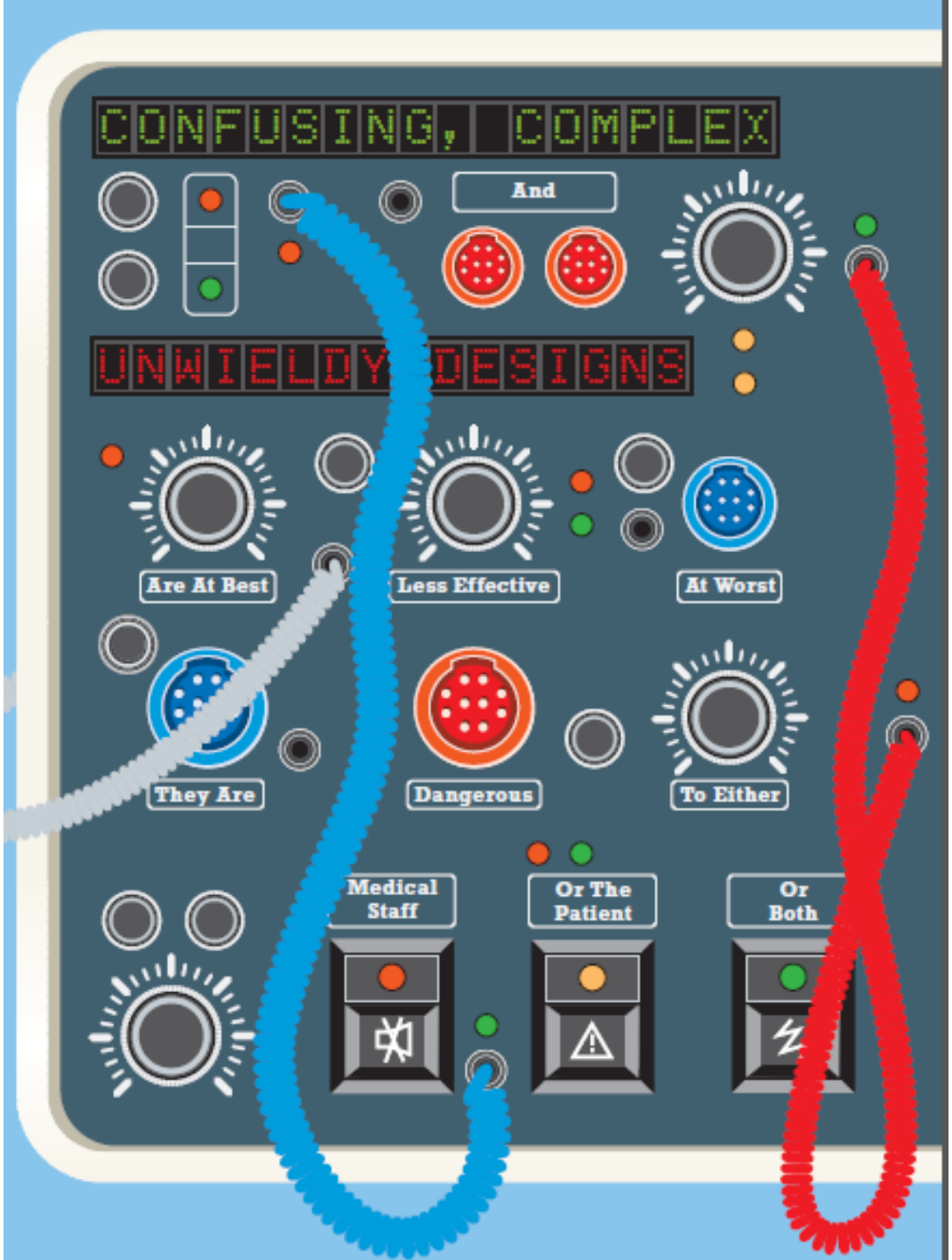


FIGURE 2 USER INTERFACE OF DOCTOR'S OUTPATIENT PRACTICE SYSTEM (DOP) [20]

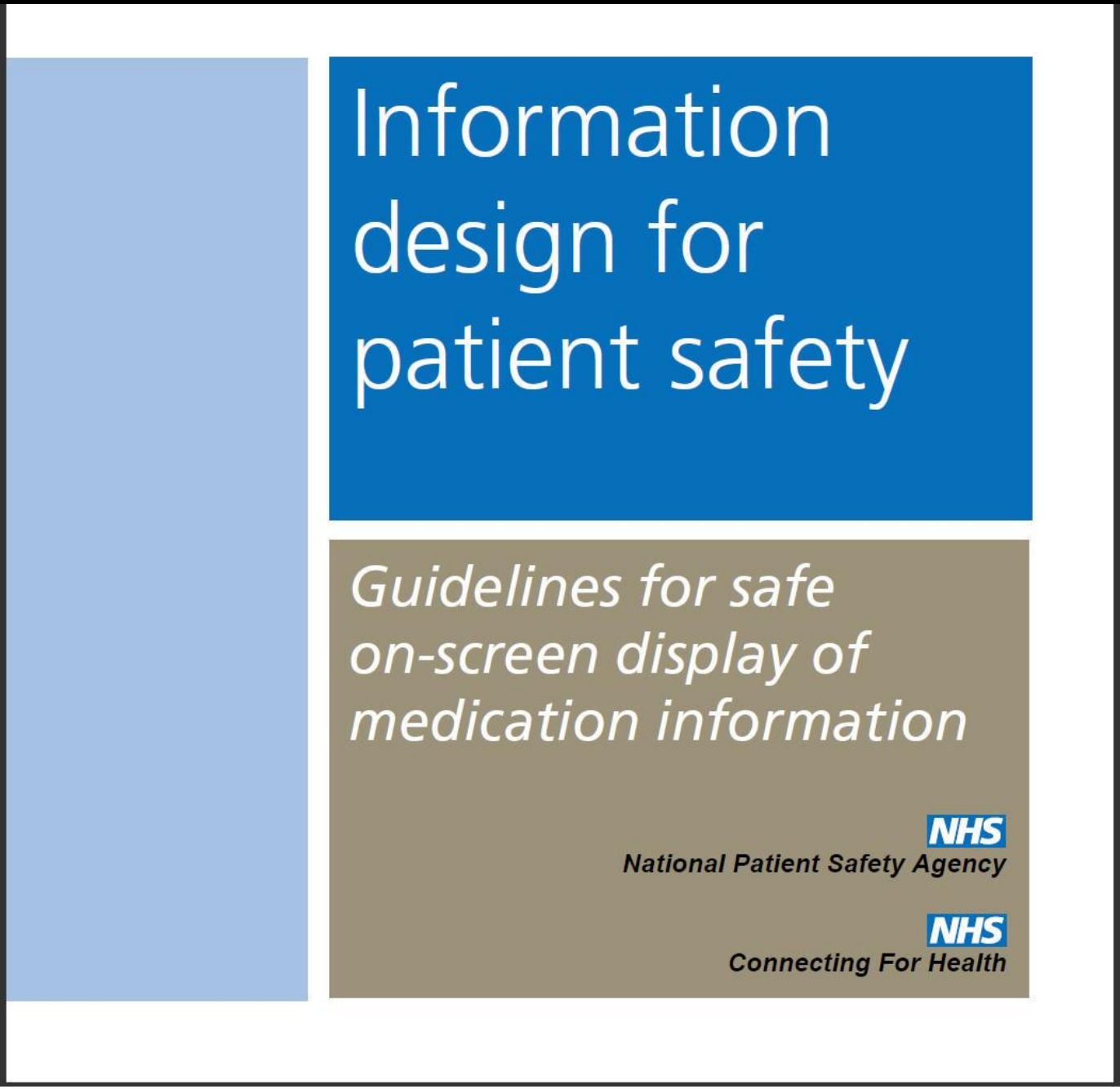
User Interface requirements for the presentation of health data HB306 2007 – Standards Australia


CONFUSING, COMPLEX
And
UNWIELDY DESIGNS
Are At Best
Less Effective
At Worst
They Are
Dangerous
To Either
Medical Staff
Or The Patient
Or Both

And a real understanding of the problem you are trying to solve

ULTRA-DETAIL IS NECESSARY IF YOU ARE GOING TO REPLACE THE PAPER

http://www.nrls.npsa.nhs.uk/resources/collections/design-for-patient-safety/



To show the size of the issue and also the change which it could catalyse

THE CONCEPTS ARE APPLICABLE ACROSS A BROAD AREA

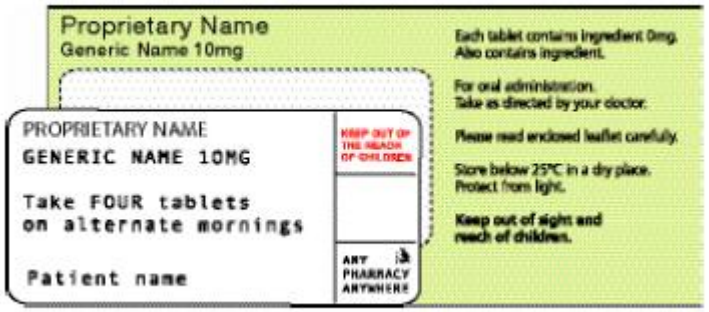
the helen hamlyn research centre

NHS National Patient Safety Agency

Design for patient safety

A guide to the graphic design of medication packaging

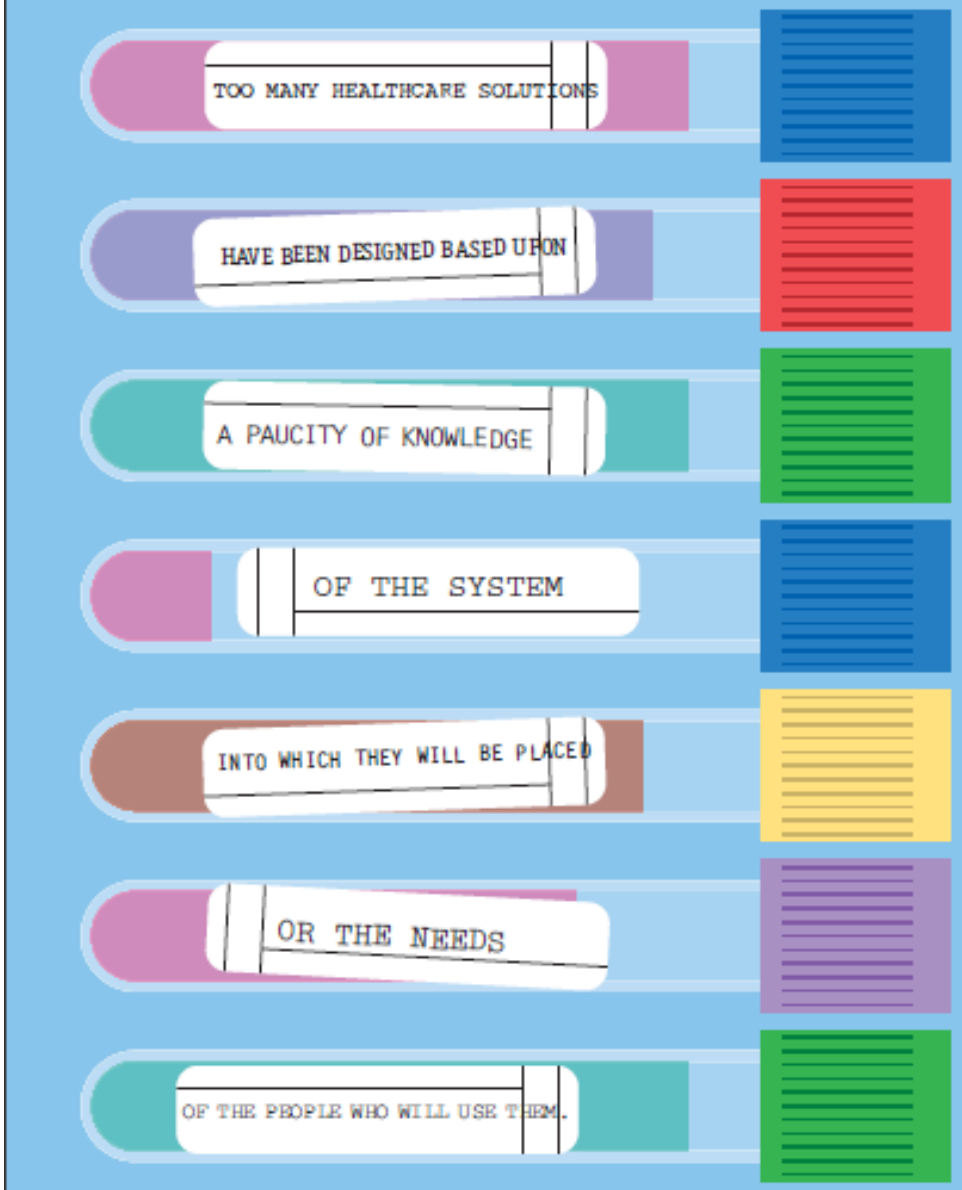
Second edition

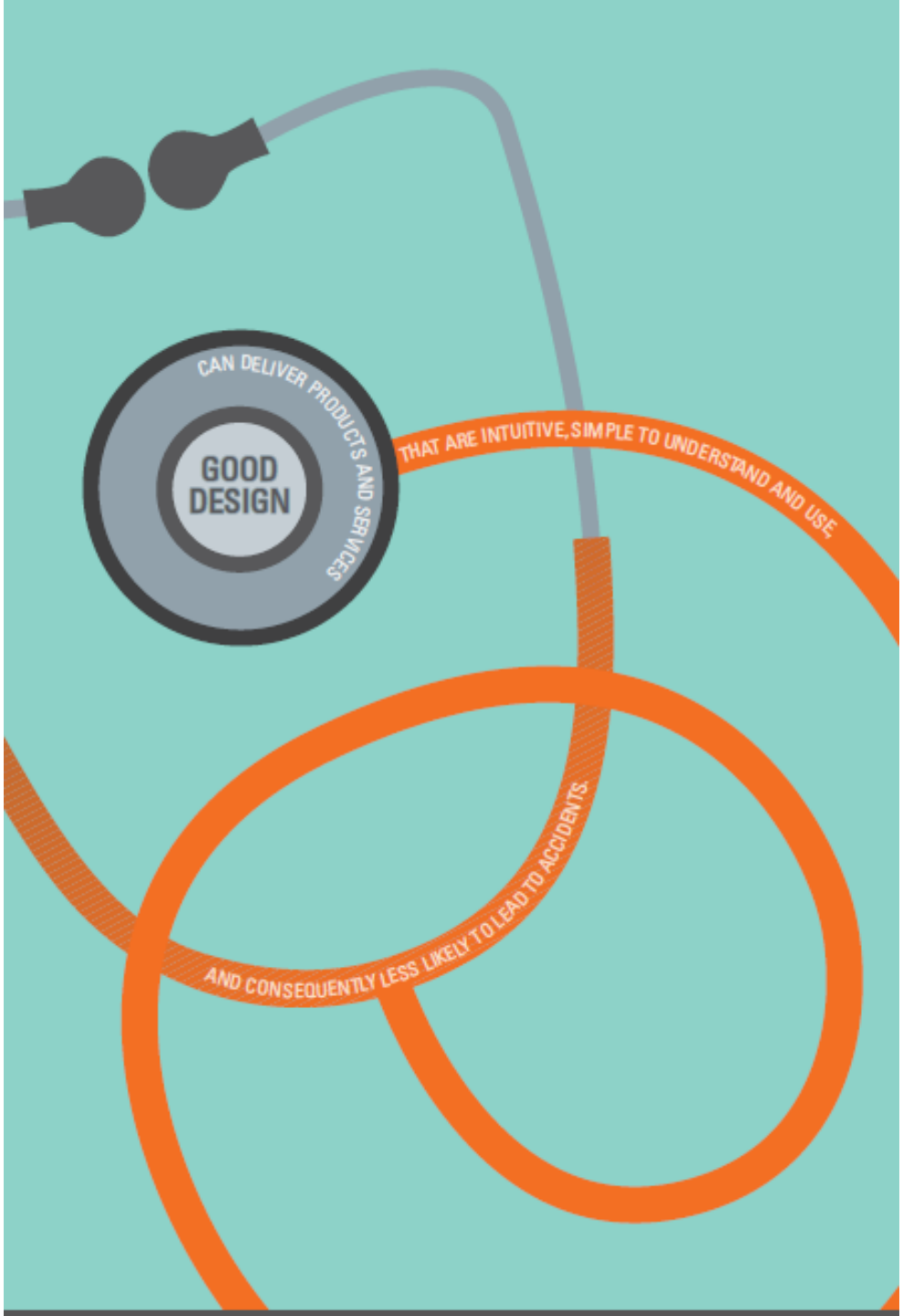


My Heresy

IF SAFETY IS THE GOAL THEN ‘IDENTICAL’ BEHAVIOUR IS REQUIRED

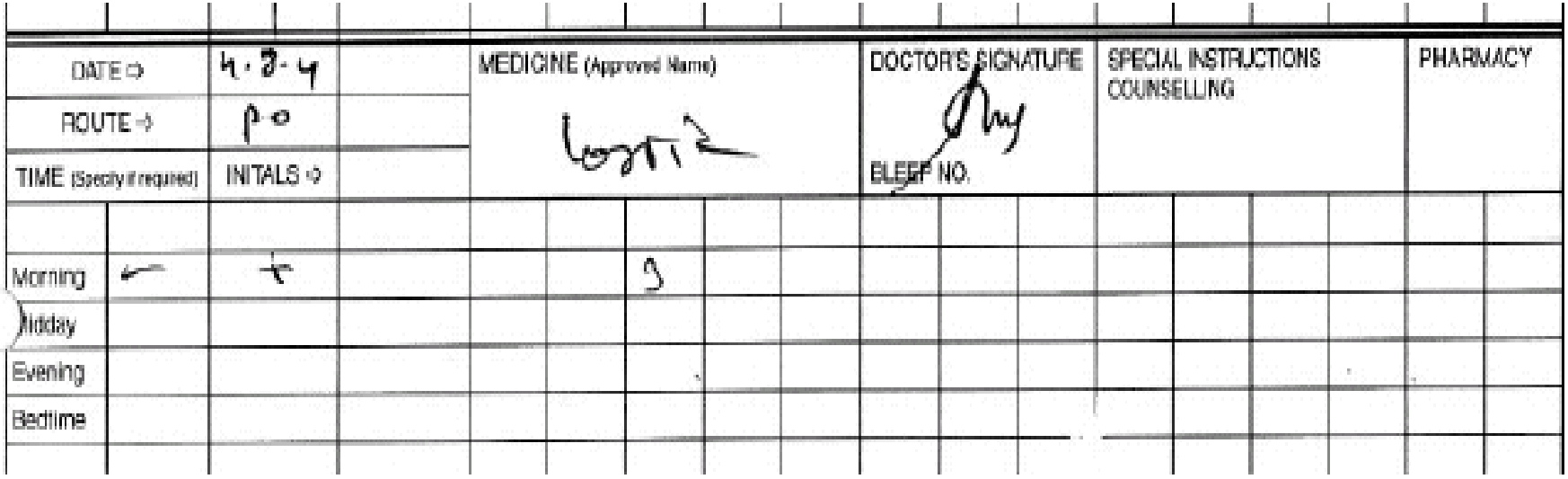
In Conclusion




GOOD DESIGN
CAN DELIVER PRODUCTS AND SERVICES
THAT ARE INTUITIVE, SIMPLE TO UNDERSTAND AND USE
AND CONSEQUENTLY LESS LIKELY TO LEAD TO ACCIDENTS.

“Strong reasons make strong actions”

– King John Act 3 Scene 4
– Shakespeare



“We are not tinkers who merely patch and mend what is broken... We must be watchmen, guardians of the life and the health of our generation, so that stronger and more able generations may come after”

Dr Elizabeth Blackwell (1821-1910)

“It is unethical to carry on doing what we are currently doing”

Professor Sir Muir Gray 01-Oct-2004

Achieving the vision for e-health across Asia – Using global lessons learned for timely and scalable delivery

Dr Michael Bainbridge
Programme Clinical Lead e-health implementation NEHTA Australia
Adjunct Professor, University Of Victoria, BC Canada
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