St George's University of London

Improving data quality & clinical records:

Challenges of structure, process + utility

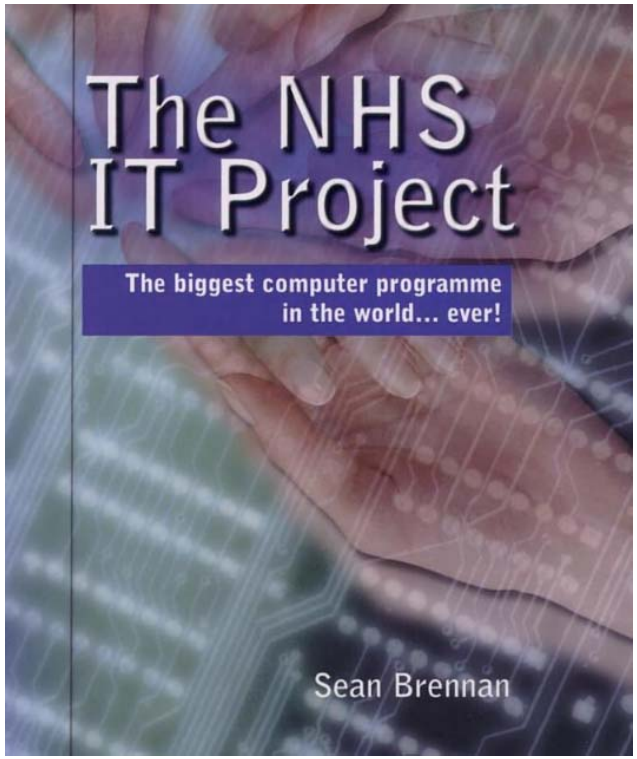
Presented to
ITI conference - Dubrovnik

Presented by
Simon de Lusignan

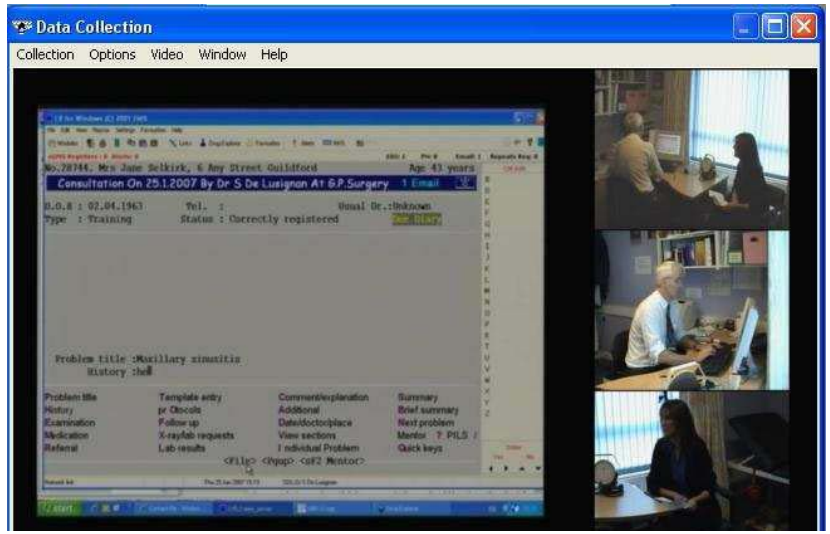
22nd June 2009

What this talk is about....

St George's University of London



meets



World's biggest Computer programme

>>

Complexity of clinical practice

Abstract:

- **Background:**
  - Sharing of “coded” health data should improve patient safety + efficiency
  - These data can also be used for research
  - Existing models to improve records + data quality (DQ) are descriptive
- **Objective:**
  - A model to appraise if lessons from the computerisation of UK to improve medical records + DQ can be applied in another
- **Method:**
  - Combines Donnabedian & Realistic Review evaluation methods
  - Identify causal links between inputs + clinical process that change DQ
- **Results:**
  - Structural change capable of integration into the clinical process improves DQ. Others are not adopted unless large financial incentives.

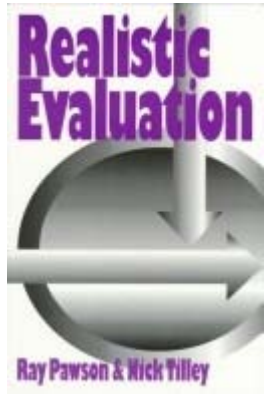
    Niche improvement of DQ is possible + pertinent
- **Conclusion:**
  - This approach may help other health systems appraise which of the UK initiatives they should adopt

St George's
University of London

OVERVIEW

Overview:

St George's University of London



- **About me!**
  - My practice + My research interests
- **Introduction / what is data quality + why does it matter?**
  - The big – picture, why computerise + code data to improve records
- **Background**
  - 2 previous models to improve computerised clinical records...
- **Method / Framework**
  - Donnabedian's classic approach to evaluation: structure process + outcome
  - \+ Pawson's "Realistic Review" CMO = Context + Mechanism = Outcome
- **Results / Analysis**
  - Analysis of causative links between structural initiatives + process >> DQ in UK
- **Discussion**
  - Framework for developing a computerised research network
  - Accurate denominator – Focussed clinically relevant DQ improvement - Linkage
- **Conclusion**
  - Align DQ initiatives with the strategic direction / role of the network..

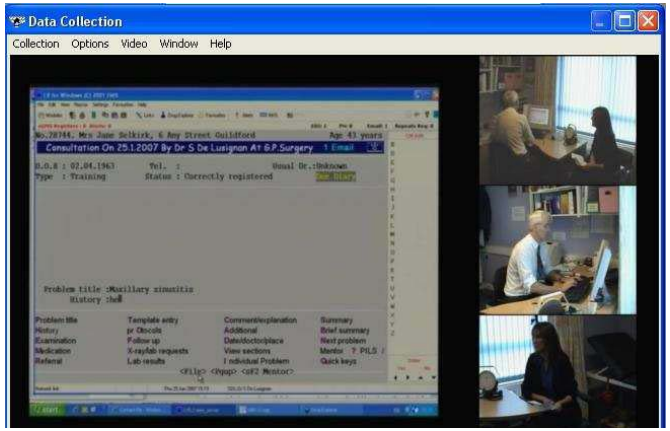
About me

St George's University of London

- **GP in Guildford** (30 miles SW of London)
  - 11,800 patient practice
  - 6.5 Whole time equivalent GPs / 8 partners
  - Computerised since 1988 – EMIS brand since 1994
  - Involved in "Practice Based Commissioning" and UK's First ICO (integrating Care Organisation)

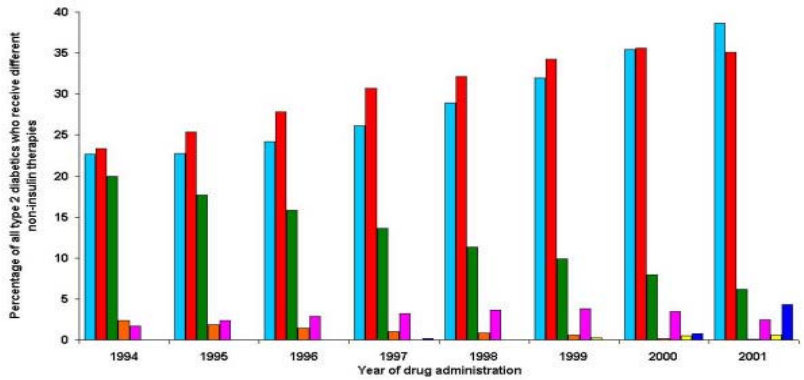
- **Head of Primary Care, St. Georges, London**
  - Primary Care Informatics (PCI) research group 2 interests:

(1) Impact of IT in the consultation



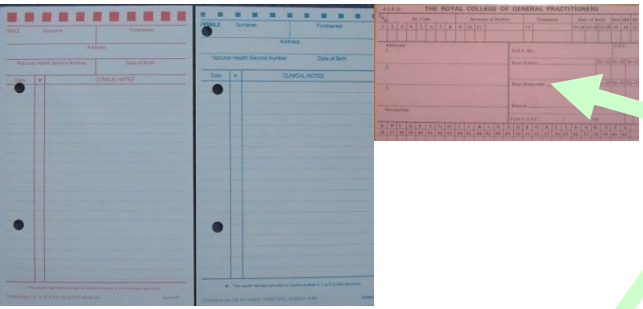
de Lusignan S, Kumarpeli P et al., ALFA open source toolkit. JMIR 2008 http://www.jmir.org/2008/4/e27/

(2) Using routinely collected data for QI



Lusignan S, Sismanidis C, Carey IM, et al.,. Trends in type 2 diabetes BMC Fam Pract. 2005 Mar 22;6(1):13.

Increasing secondary use of clinical data



Historic card system
-Research was carried out
-manually – e.g.MSGP4

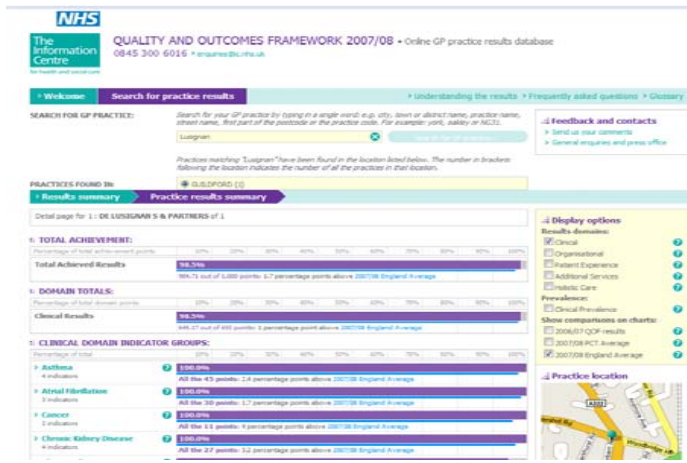
Public Health Notification of disease & death

Prescribing + referral data

Data provided to research data bases

1. **RCGP Spotter practice** *www.rcgp.org.uk/bru*
2. **Q-Research** *www.research.org*
3. **Ad hoc research projects**

QOF – Quality based payments



Inspection, appraisal & Re-validation

Royal College of General Practitioners

St George's
University of London

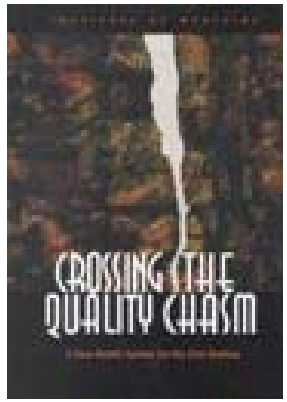
INTRODUCTION

Introduction (1):
Computerised records should reduce medical errors

St George's University of London

- **Two key publications highlighted problems with patients safety**
  - **44 – 98,000 preventable medical deaths (USA)**
    - *To Err is Human (IOM 1999)*

- **The potential role of informatics – To provide a shared EPR…**
  - **Need a National Health Information infrastructure**
    - *Crossing the quality chasm (IOM 2001)*



- **Following these reports many countries have invested in health IT infrastructure hoping to improve patient safety + improve the efficiency of their healthcare systems**

de Lusignan S, Teasdale S. Achieving benefit for patients in primary care informatics: the report of a international consensus workshop at Medinfo 2007. Inform Prim Care. 2007;15(4):255-61.

Introduction (2)
Components of the computerised record (EPR)

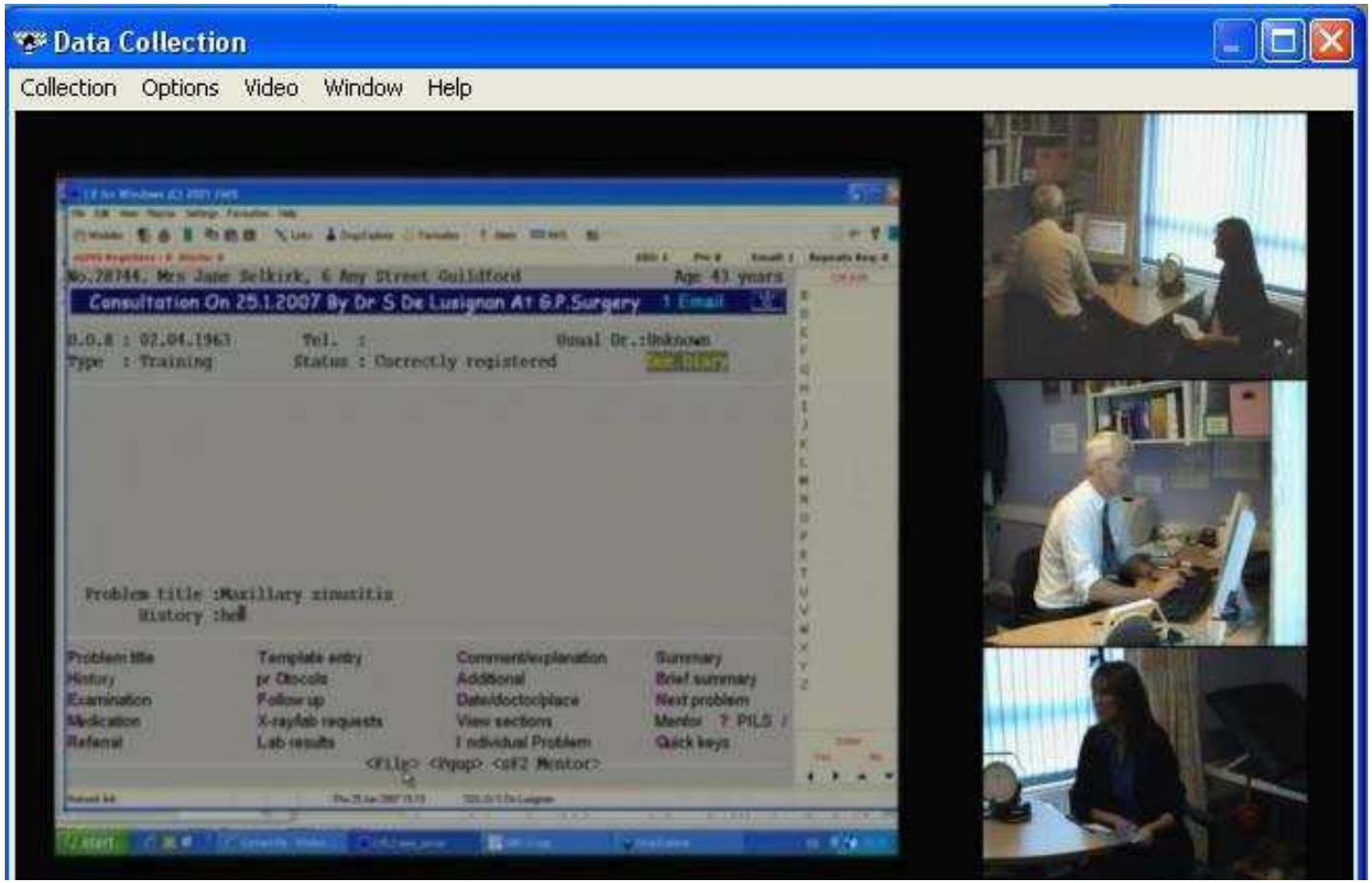
St George's University of London

- **Administrative data**
  - Practice ID + Users + rights etc.
- **Patient details**
  - Unique patient ID
  - Demographic details - *Age, Gender, Ethnicity, Address, etc.*

- **Structure**
  - Coded data and free text may belong to different tables in the record
    - E.g. The journal (current consultations) / medication data / etc.
- **"Coded data"**
  - (1) Recorded using a coding interface – usually a "picking list"
  - (2) Happens automatically when data are entered into a data entry form
- **Free-text**
  - Narrative entered into set fields with the EPR

- **In most systems only coded data can be processed + analysed for patient care**
  - Context + multiple synonyms make free-text hard to analyse safely

Introduction (3)
Recording structured data and free text...



Clinical records made in real time – in a 10 minute consultation – ***Exemplar at: www.biomedicalinformaitcs .info/alfa/***

Sheeler I, Koczan P, Wallage W, de Lusignan S. Low-cost three-channel video for assessment of the clinical consultation. Inform Prim Care. 2007;15(1):25-31.

Introduction (4)
Coding is not a neutral action

- **Coding is part of a complex social interaction & many factors distort coding**

de Lusignan S, Wells SE, Hague NJ, Thiru K. Managers see the problems associated with coding clinical data as a technical issue whilst clinicians also see cultural barriers.Methods Inf Med. 2003;42(4):416-22.

Reason for difference	Recorded diagnosis	True diagnosis	Comments
Perceived patients view	Headache	Depression	Patient does not want "stigma"

Introduction (5)
So what is data quality?

- **Data quality = data "*Fit for purpose*"**

- **Historic definitions focussed on mathematical concepts:**
  - **Pringle et al., *Completeness + accuracy* of the data.[1]**
  - **Williams, *Currency***
  - **Thiru et al: *Positive predictive value + sensitivity***
  - ***Data quality probes* provide a Boolean method for looking at data quality (e.g. Salbutamol + asthma; Asthma Not B-blocker etc.)**

- **It is not feasible to apply mathematical definitions to all data**

1. Pringle M, Ward P and Chilvers C. Assessment of the completeness and accuracy of computer medical records in four practices committed to recording data on computer.British Journal of General Practice 1995;45:537–41.
2 Williams JG. Measuring the completeness and currency of codified clinical information. Methods of Information in Medicine 2003;42:482–8.
3 Thiru K, Hassey A and Sullivan F. Systematic review of scope and quality of electronic patient record data in primary care. BMJ 2003;326(7398):1070.
4 Brown P and Warmington V. Info-tsunami: surviving the storm with DQprobes. Informatics in Primary Care 2003;11:229–33; commentary 234–7.
5. de Lusignan S. The optimum granularity for coding diagnostic data in primary care: report of a workshop of the EFMI Primary Care Informatics Working Group at MIE 2005. Inform Prim Care. 2006;14(2):133-7.

Introduction (6)
Summary

- **UK general practice has been computerised since the 1990s (though hospital practice lags behind**

+ now it is given further impetus by:

1. **National priorities for care & statutory duty of "Clinical Governance"**
   - **Hard to measure except by computer**
2. **Linkage of GP computer systems to other parts of the NHS**
3. **Financial subsidies for initial purchase – now computers are NHS funded**
4. **Financially incentivised quality targets – based only on computer records**

- **This presentation describes why + how clinical records have changed in response to these initiatives**
  - **Which should you adopt & which should you ignore?**

de Lusignan S, Teasdale S, Little D, Zapp J, Zuckerman A, Bates DW, Steele A. Comprehensive computerised primary care records are an essential component of any national health information strategy: report from an international consensus conference. Inform Prim Care. 2004;12(4):255-64.

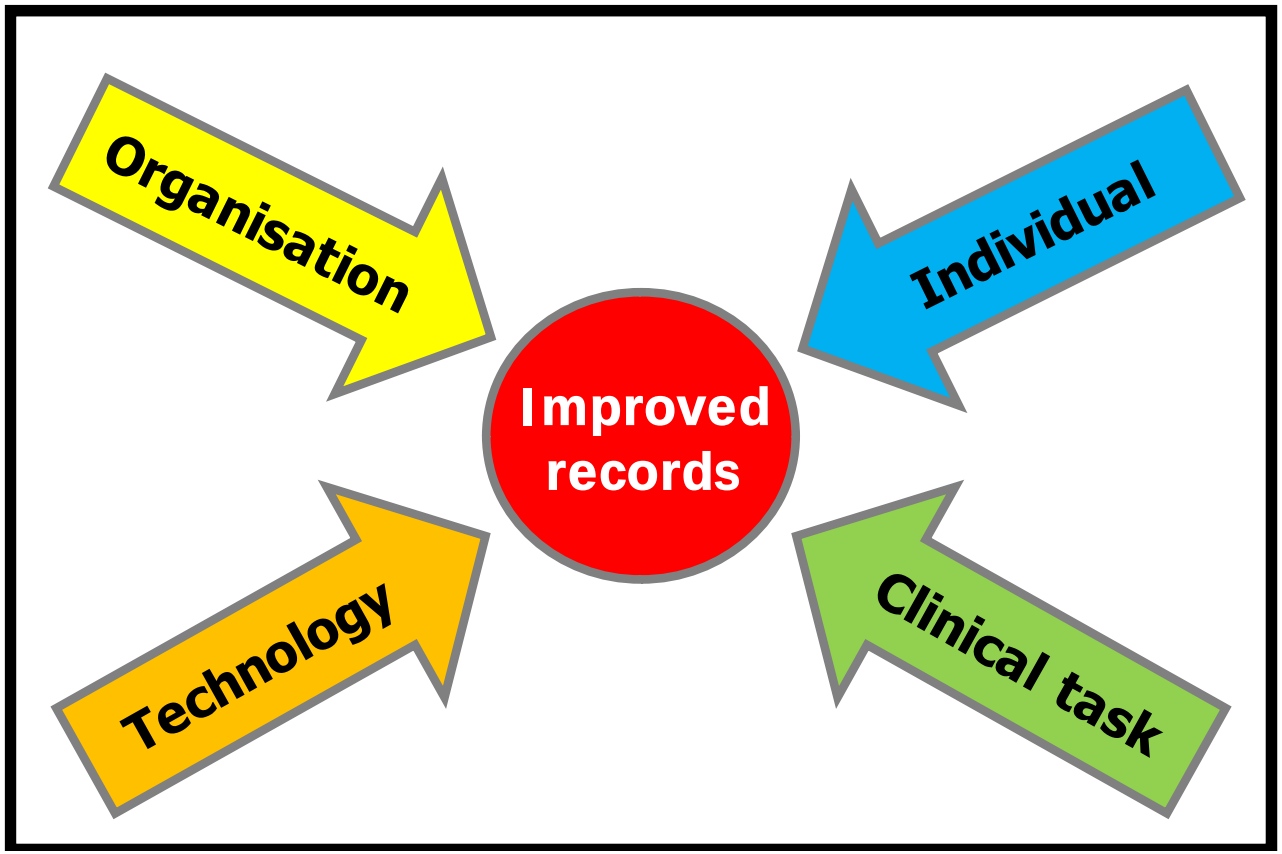
St George's
University of London

BACKGROUND

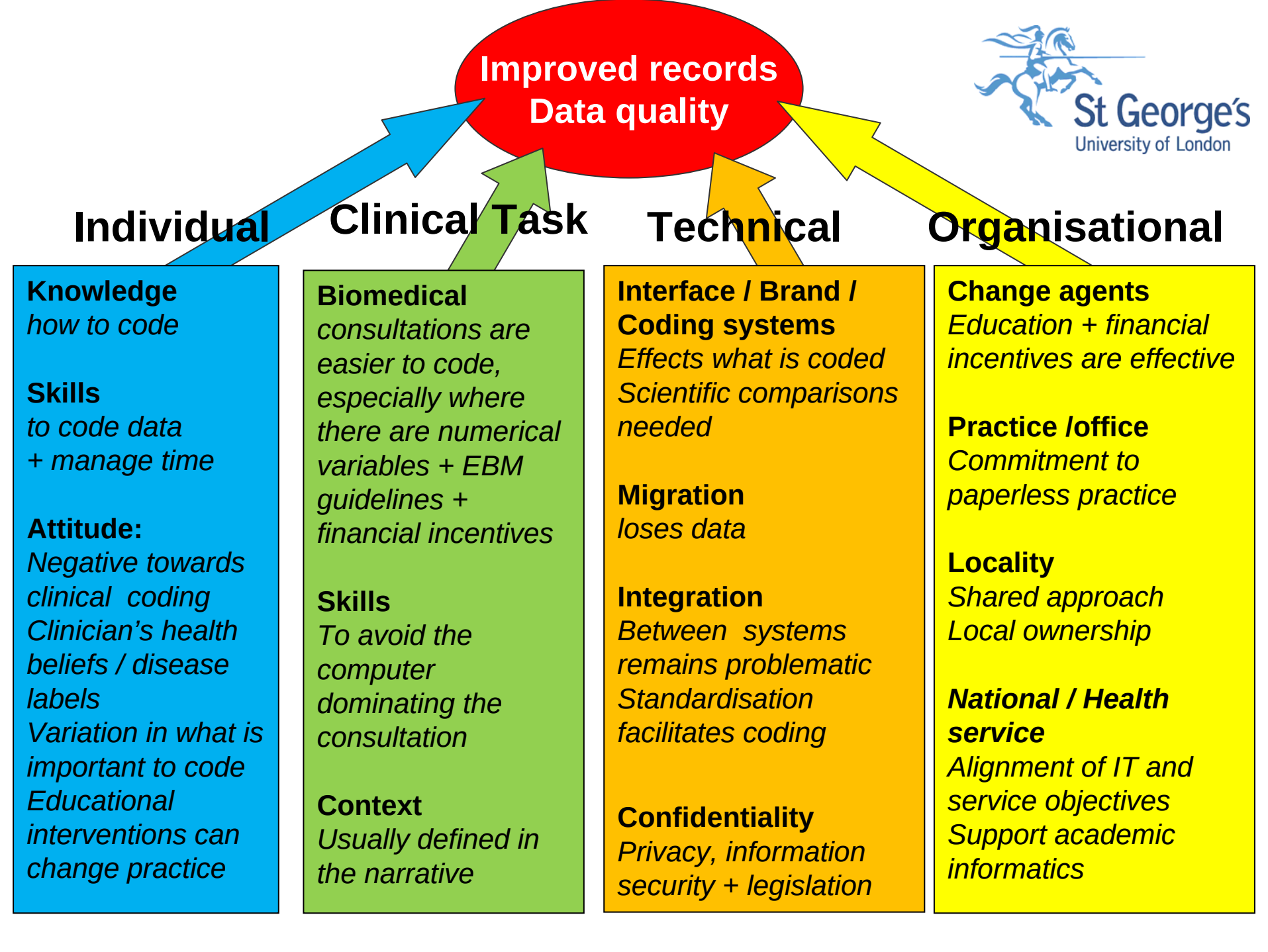
Background (1)
Previous models provide insight... ...but limitations

St George's University of London

- **Model 1:** **Four factors should be tilted in favour of clinical coding...**



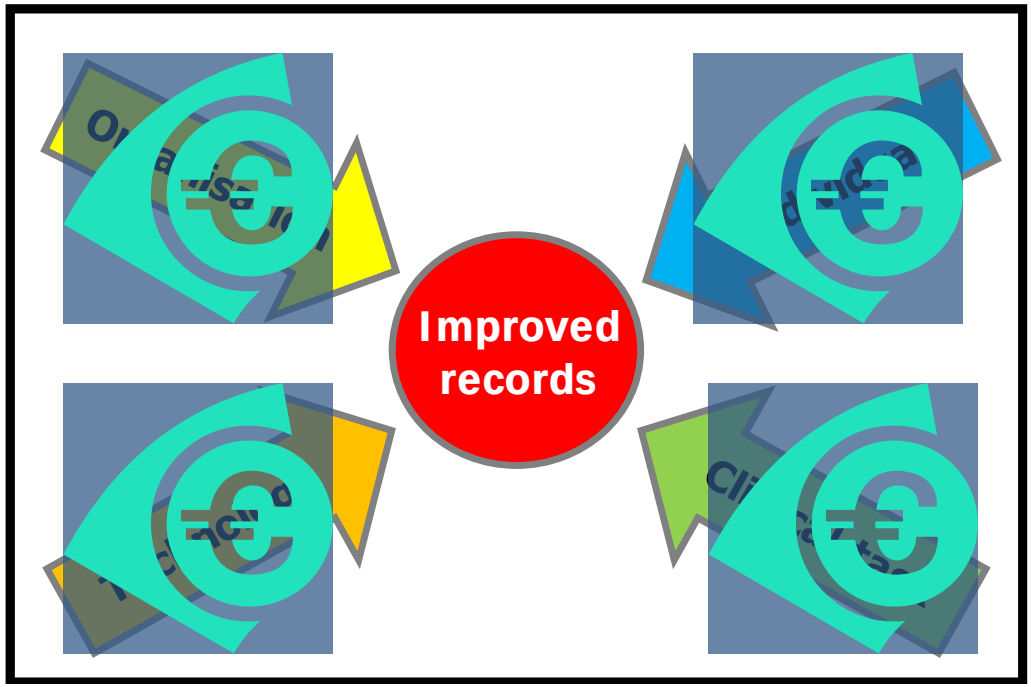
de Lusignan S. The barriers to clinical coding in general practice: a literature review. Med Inform Internet Med. 2005;30(2):89-97.


Improved records
Data quality
St George's
University of London
Individual
Clinical Task
Technical
Organisational
Knowledge
how to code
Skills
to code data
+ manage time
Attitude:
Negative towards clinical coding
Clinician's health beliefs / disease labels
Variation in what is important to code
Educational interventions can change practice
Biomedical
consultations are easier to code, especially where there are numerical variables + EBM guidelines + financial incentives
Skills
To avoid the computer dominating the consultation
Context
Usually defined in the narrative
Interface / Brand / Coding systems
Effects what is coded
Scientific comparisons needed
Migration
loses data
Integration
Between systems remains problematic
Standardisation facilitates coding
Confidentiality
Privacy, information security + legislation
Change agents
Education + financial incentives are effective
Practice /office
Commitment to paperless practice
Locality
Shared approach
Local ownership
National / Health service
Alignment of IT and service objectives
Support academic informatics

Background (1)
Previous models provide insight... ...but limitations

St George's University of London

- **Model 1:** **Four factors should be tilted in favour of clinical coding...**



- **However this model may not be valid – as € trump all barriers**

de Lusignan S. The barriers to clinical coding in general practice: a literature review. Med Inform Internet Med. 2005;30(2):89-97.

Background (2)

Listed strengths + weaknesses – but not predictive..

Opportunities:

(1) Growing volumes of routinely recorded data.

(2) Improving data quality.

(3) Technological progress enabling large datasets to be processed.

(4) The potential to link clinical data in family practice with other data including genetic databases.

5) An established body of know-how within the international health informatics community.

Challenges:

1) Research methods for working with large primary care datasets are limited.

(2) How to infer meaning from data.

(3) Pace of change in medicine and technology.

(4) Integrating systems where there is often no reliable unique identifier and between health (person-based records) and social care (care-based records-e.g. child protection).

(5) Achieving appropriate levels of information security, confidentiality, and privacy.

de Lusignan S, van Weel C. The use of routinely collected computer data for research in primary care: opportunities and challenges. Fam Pract. 2006 Apr;23(2):253-63.

St George's
University of London

METHOD

Method (1)
Combined Donabedian & Realistic review:

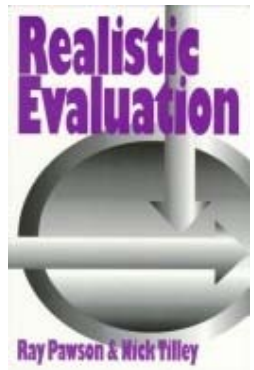
- **Donnabedian proposed three elements to evaluation:**
  - **Structure**
  - **Process**
  - **Outcome**
- **Holzemer et al., created an outcomes model for healthcare research (OMHS) based on the Donnabedian model; but adding 3 rows**

	Inputs /Structure	Process	Outcome
Provider			
Setting			
Client / Patient			

Holzemer WL, Reilly CA. Variables, variability, and variations research: implications for medical informatics. *J Am Med Inform Assoc.* 1995;2(3):183-190.

Method (2)
Which inputs improve data quality?

- **Pawson & Tilley's realistic review approach has been extended into the healthcare setting**
  - Realistic review is based on a CMO model where:
  - Mechanism (M) "+" Context (C) = Outcome (O).
- **O = M + C**
  - The "+" is not simple addition but more implies interacts in a causal way
  - In this case study:
    - M = structure or inputs;
    - C = clinical context it needs to be incorporated into (Process)
    - O = The outcome on data quality
- "The three Ws" or "the realist mantra";
  - "*What works for whom in what circumstances?*"
  - The advantage of this approach is that it recognises that inputs may interact differently in other clinical contexts...



Pawson R, Greenhalgh T, Harvey G, Walshe K. Realist review--a new method of systematic review designed for complex policy interventions. J Health Serv Res Policy. 2005 Jul;10 Suppl 1:21-34.

Method (3)
Final approach...

- **The final approach is to review impact of any change on the UK clinical context (process) + report the outcome in improving records**
- **The approach is represented in the following grid:**

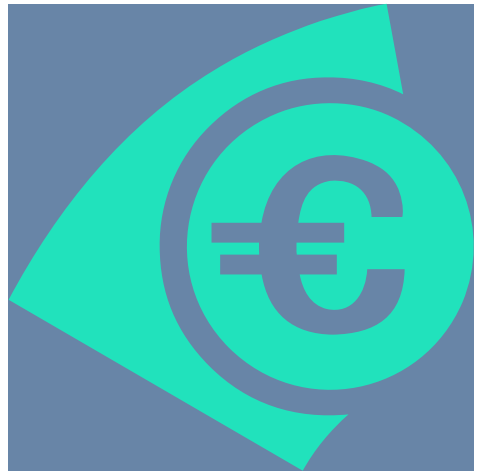
		Donabedian >>>>		
Holzemer >>		Structure Input Mechanism	Process Context	Outcome: Improved data quality = Utility of data
	Health service			
	System vendor			
	Regional / locality			
	Practice			

St George's
University of London

RESULTS

Results

- **Funding trumps all other data quality initiatives!!!**
  - Screening targets
  - Cervical cytology
  - Data quality payments
  - Token incentives to link-data
  - Incentives to complete audits (e.g. Equity audits)
  - Chronic disease management



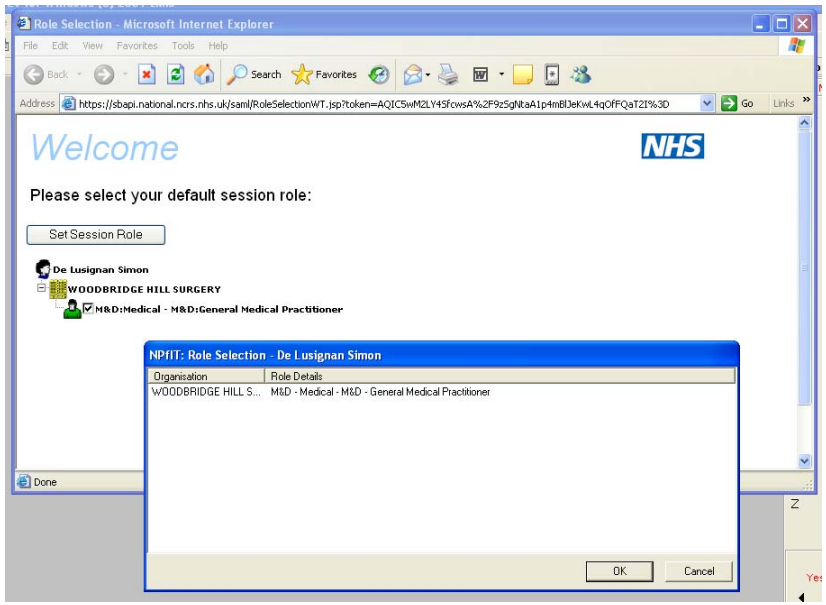
de Lusignan S, Stephens PN, Adal N, Majeed A. Does feedback improve the quality of computerized medical records in primary care? J Am Med Inform Assoc. 2002 Jul-Aug;9(4):395-401.

Results - Inputs at health service level (1)....

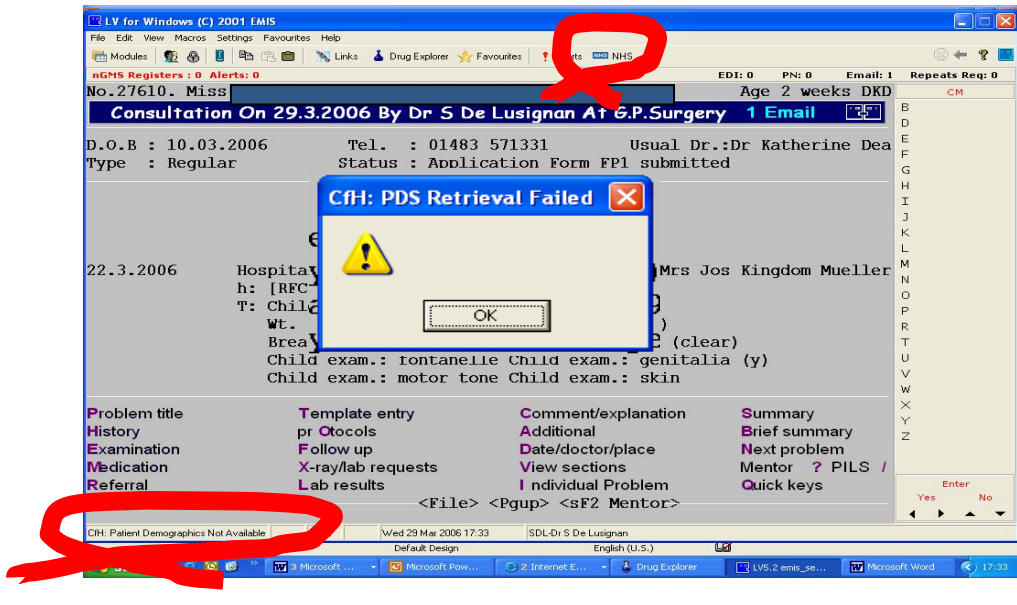
St George's University of London

Structure Input	Process Context	Utility	Implications
Authenticate users	Much longer to log on	Clumsy system mean smart cards left in one machine	- - Use system where staff can be mobile
National demographic service	Any mismatches added to workflow	Much more accurate denominator	+++++ Provides a denominator
On-line clinic booking	Impossible to include in workflow	Does not use national codes	- - - Redesign
Lab-tests results on-line	Less social process Rapid access to rest of record	Vastly increased capacity for QI, Audit + Research	++++++

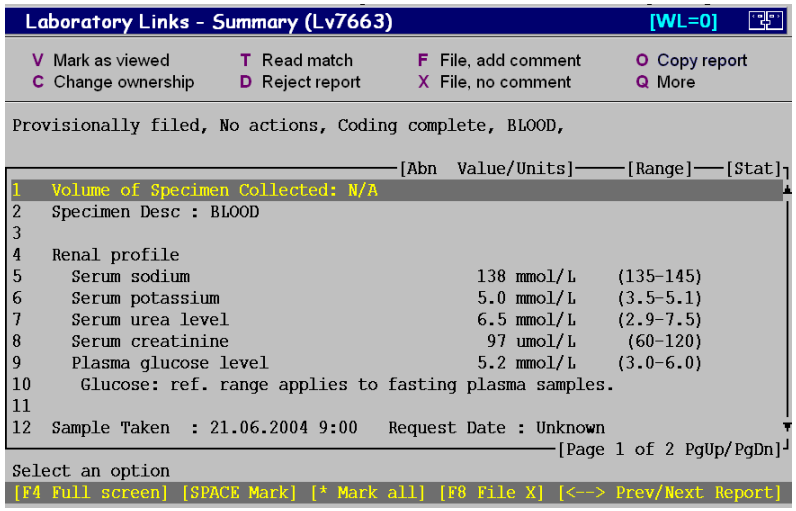
Examples of national programmes linking to desktop EPR systems



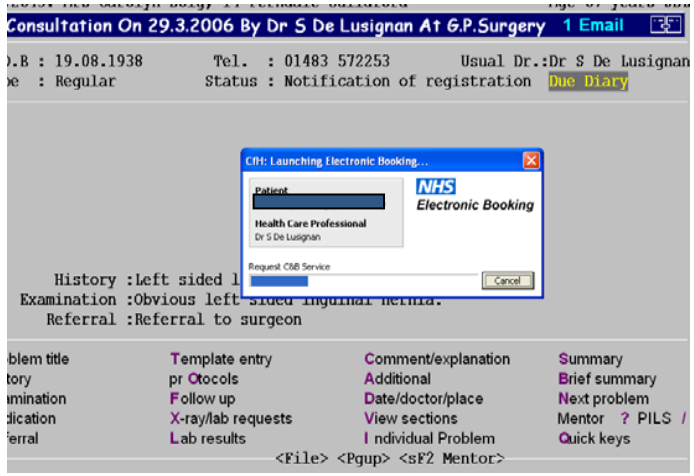
Logon + authenticate + smart card



Patients on national demographic service



On-line lab results posted into system



Choose + Book for referral

Results - Inputs at health service level (2)....

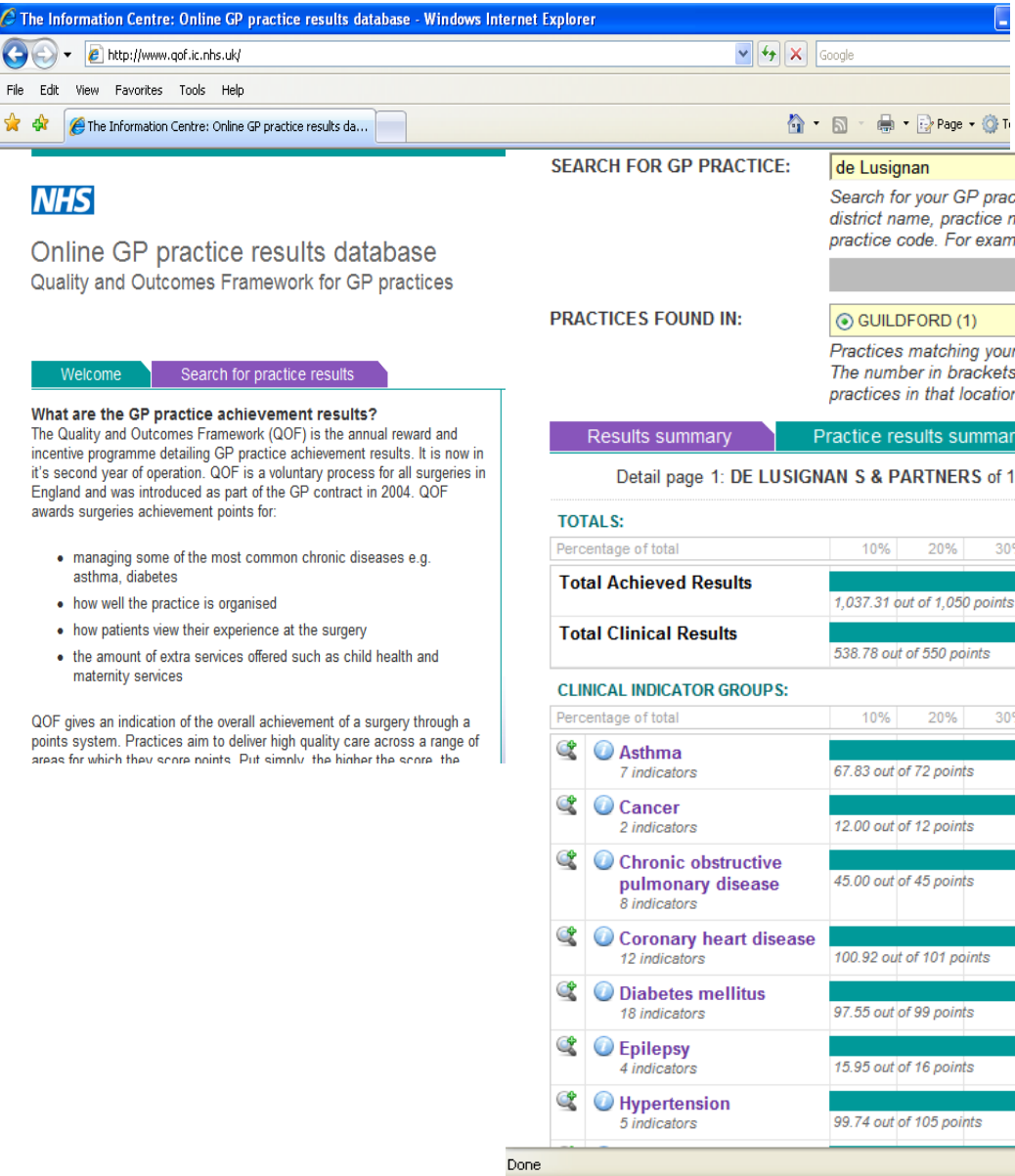
St George's University of London

Structure Input	Process Context	Utility	Implications
Choice of coding system	Larger > any concept but harder to find	Limited list imposed for quality payments	+ ICPC + ICD + procedures
Same data used for billing + care	Distorts coding	Boosts some recording	+ / - Appraise effect
Summary care record + online "My health space"	Poor organisational fit	No positive influence	-- - On-line records less researched niche?
Electronic record transfer "GP2GP"	Shock! Who wrote that narrative!	Will greatly improve data quality	+++
On-line performance data	No effect apparent Distorts record	Unsure	+ / -

On-line GP quality scores

http://www.qof.ic.nhs.uk/

St George's University of London



Results - Inputs at health service level (3)....

Structure Input	Process Context	Utility	Implications
DMD Dictionary	Standard dictionary of drugs + devices	Logical hierarchy of drugs	+++
RCP records initiative	Structure + content standards	Admission, handover, discharge	+++
OpenEHR	Standard models of clinical archetypes	More clinically useful records	+
NHS national guidance	Selectively adopted	Audit-based education useful	+ + ? Evidence-base

Dictionary of Medicines + Devices

St George's University of London

www.dmd.nsh.uk

dictionary of medicines + devices

NHS

Home | Useful Links | Background | Helpdesk | Governance

- Home
- What is the dm+d?
- SNOMED CT UK Drug Extension
- dm+d Release
- Issues Form
- Implementation of dm+d
- Key Documentation
- Past Projects
- ISB

Welcome to the dm+d website

The dm+d is a vocabulary dictionary containing unique identifiers and associated textual descriptions for medicines and medical devices.

The **dm+d** has been developed and delivered through a partnership between NHS Connecting for Health and the NHS Business Services Authority.

During its development the product was previously known as the UK Standard Clinical Products Reference Source (UKCPRS), and its components were previously known as the Primary Care Drug Dictionary (PCDD) and the Secondary Care Drug Dictionary (SCDD).

Information Standards Board for Health and Social Care (ISB HaSC) Approval for dm+d

dm+d is currently working towards becoming an Information Standards Board for Health and Social Care (ISB HaSC) fundamental standard. On the way to achieving this goal in March 2009 the dm+d was approved at the Requirement stage of a Fundamental Standard by ISB HaSC.

Top

The NHS preferred terminology for referencing medicines and devices is delivered by the NHS Business Services Authority and NHS Connecting for Health.

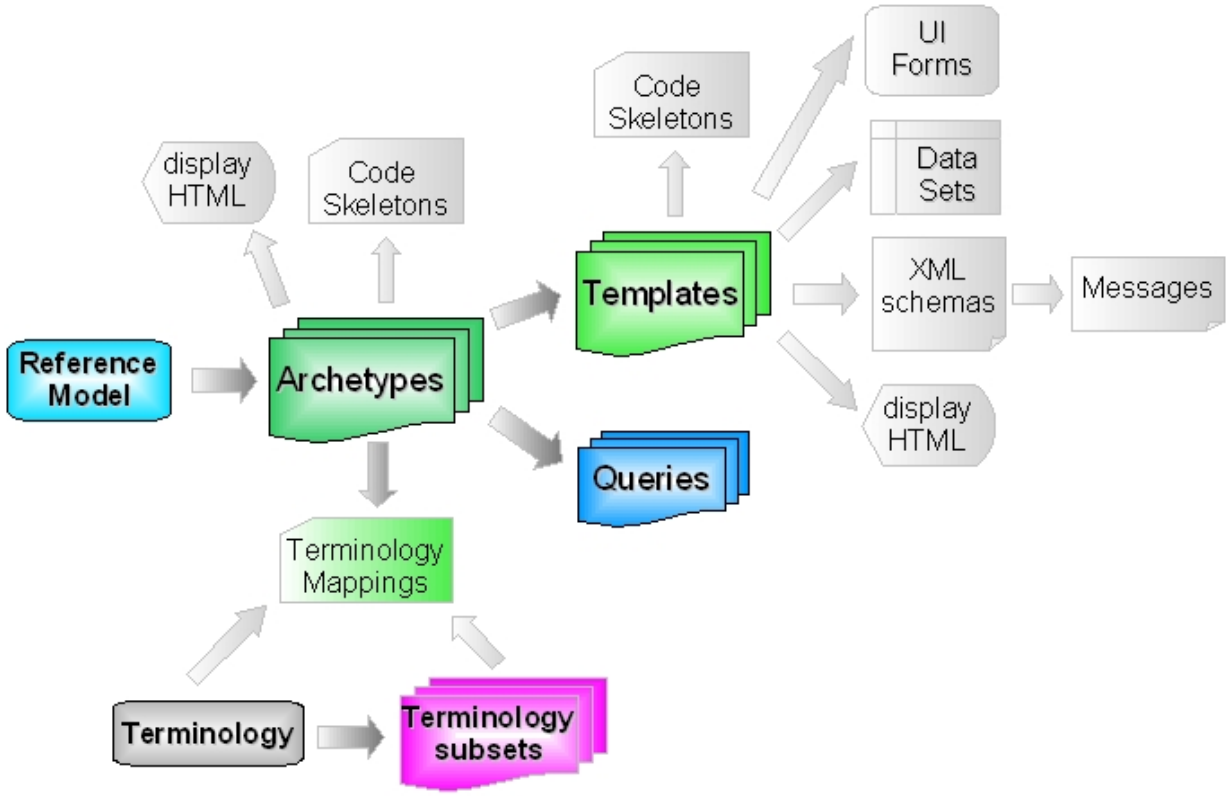
NHS Connecting for Health

Addresses the problem of non-standard drug dictionaries

OpenEHR

http://www.openehr.org

- **Conceptual approach to the medical record**
- **Separates**
  - **Coding system / Terminology**
  - **Database technology**
  - **Clinical Archetype**
  - **Interface / data entry**



http://www.openehr.org/shared-resources/getting_started/openehr_primer.html

RCP – HIU

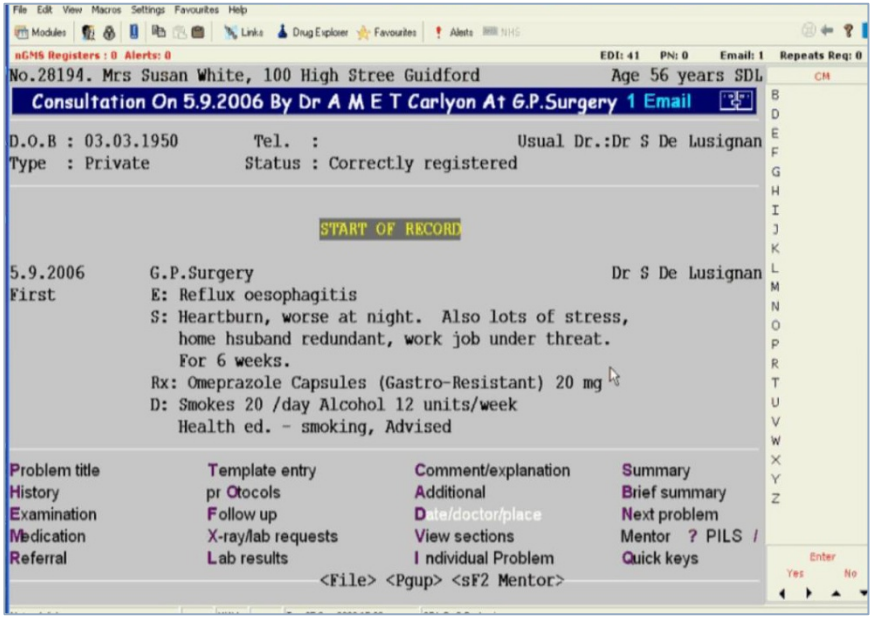
Royal College of Physicians – Health Informatics Unit

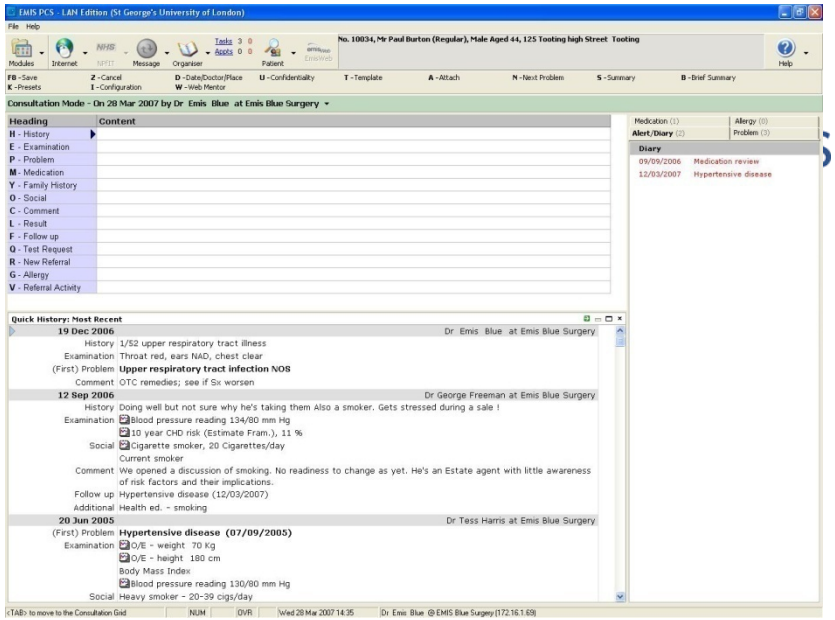
www.rcplondon.ac.uk/hiu

- **Standards for**
  - Admission
  - Handover
  - Dischage

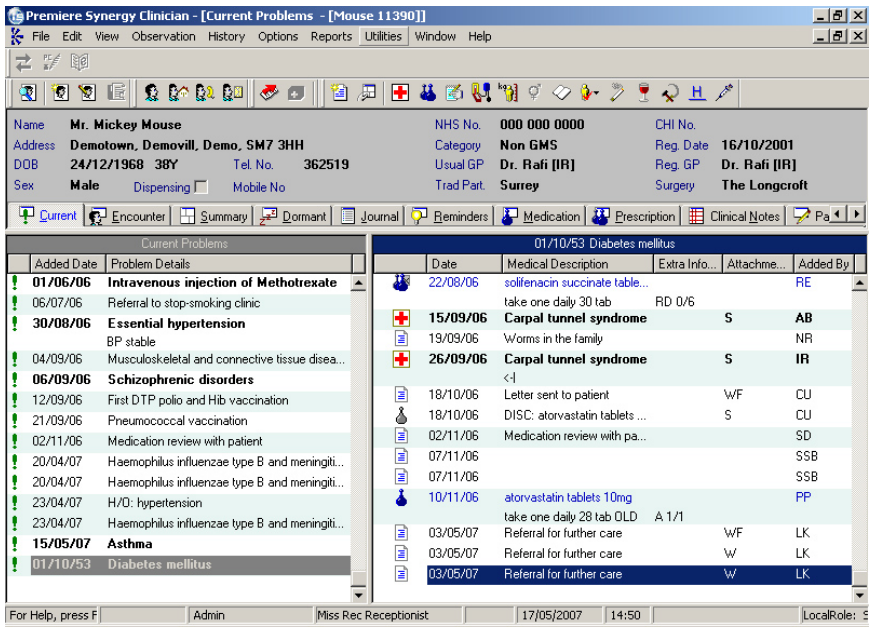
Results - Vendor level

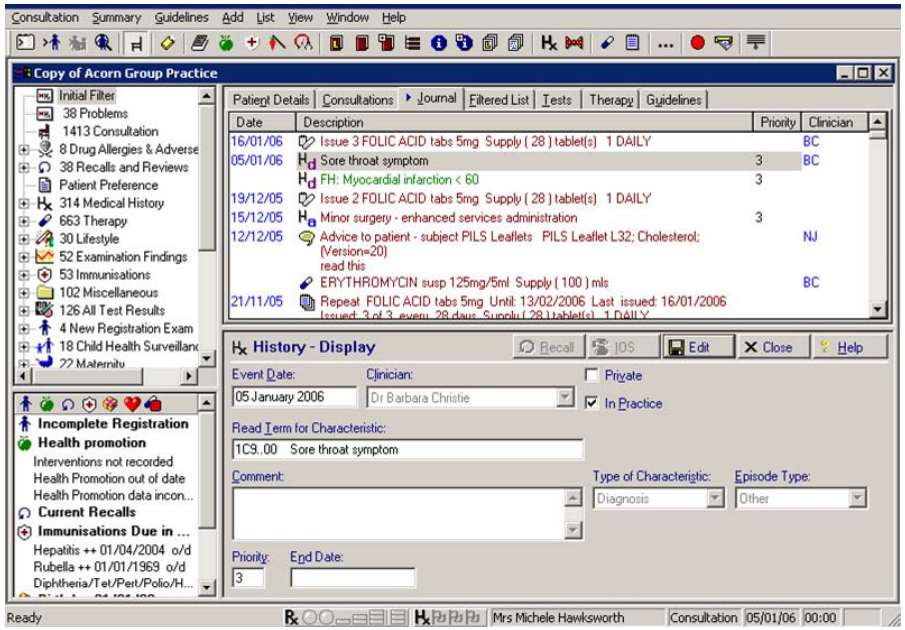
Structure Input	Process Context	Utility	Implications
Vendors produce very different systems	Varying effect on clinical consultation • Picking lists • CHUI vs. GUI • Data entry forms • Search functions	Best features of each could aid coding	++ Use simulations to choose a vendor CHUI sometimes better
Single vendor based research networks	Focussed interventions to improve quality	Improves data quality in areas of focus Networks include: • GPRD • Qresearch •THIN	+ Advantages with one supplier Concentrate on strengths of data





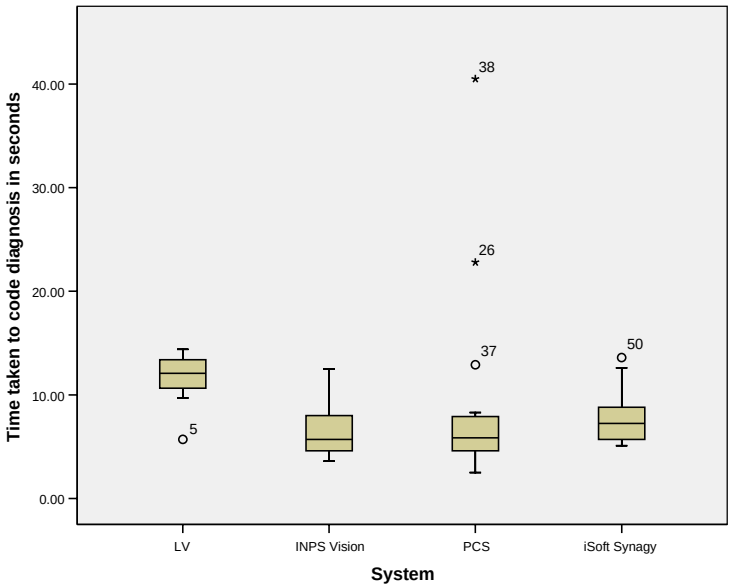
Examples of the four commonest used systems in the UK

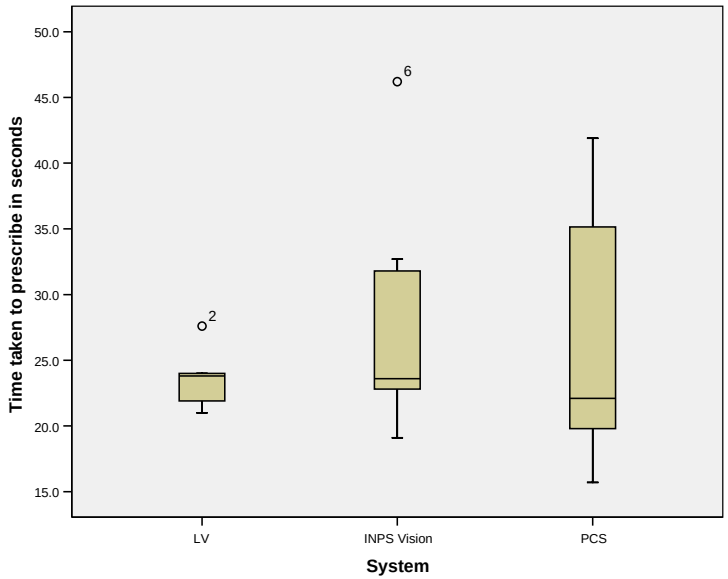




Results: Character user (EMIS LV) v. GUI (the rest!)

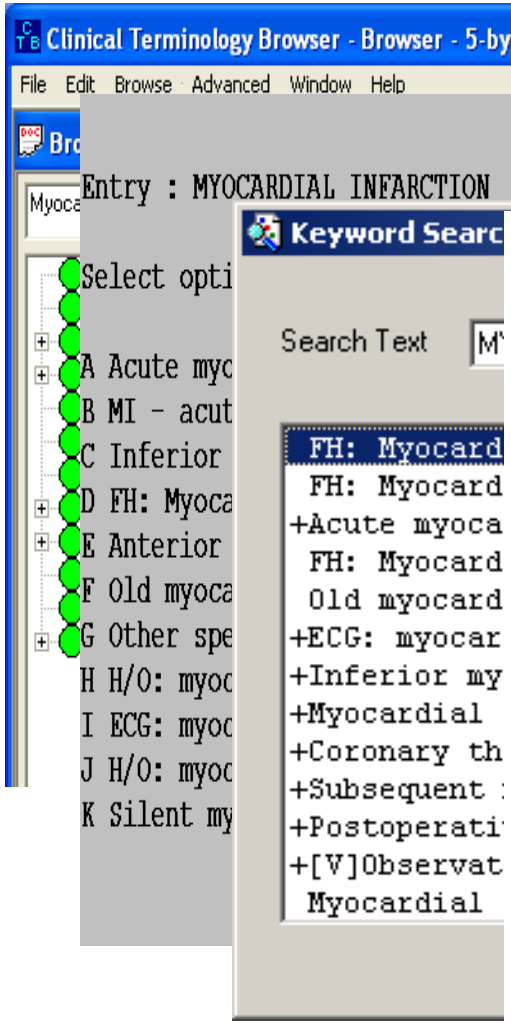
	Coded data entry				Acute Prescribing			Repeat Prescribing		BP recording			
	EMIS LV	EMIS PCS	INPS Vision	iSoft Synergy	EMIS LV	EMIS PCS	INPS Vision	EMIS LV	INPS Vision	EMIS LV	EMIS PCS	INPS Vision	iSoft Synergy
N	7	24	14	18	5	7	9	1	4	1	1	5	3
Mean (SD)	11.5 (3.0)	8.1 (8.0)	6.8 (2.9)	7.9 (2.5)	23.7 (2.5)	27.1 (10.1)	27.5 (8.5)	21	8.4(3.2)	7.1	9	9.8 (3.4)	6.7 (1.3)
95% CI	8.7 -14.2	4.7- 11.5	5.1 -8.5	6.6 -9.2	20-5 -26.8	17.7 -36.5	20.9 -34.0	-	3.3- 13.5	-	-	5.6- 13.9	3.5- 9.8
Median (IQR)	12.1 (2.8)	5.9 (3.2)	5.7 (3.3)	7.2 (2.7)	23.8 (2.1)	22.1 (15.4)	23.6 (9)	21 -	9.4 (3.8)	7.1 -	9 -	8.8 (1)	7.3 (1.1)
MIN	5.7	2.5	3.6	5.1	21	15.7	19.1	21	4	7.1	9	6.7	5.2
MAX	14.4	40.5	12.5	13.6	27.6	41.9	46.2	21	10.7	7.1	9	15.5	7.5
NPAR* p		0.007	0.006	0.012		0.71 (NS)	0.64 (NS)						





Refsum C, Kumarapeli P, Gunaratne A, Dodds R, Hasan A, de Lusignan S. Measuring the impact of different brands of computer systems on the clinical consultation: a pilot study. Inform Prim Care. 2008;16(2):119-27.

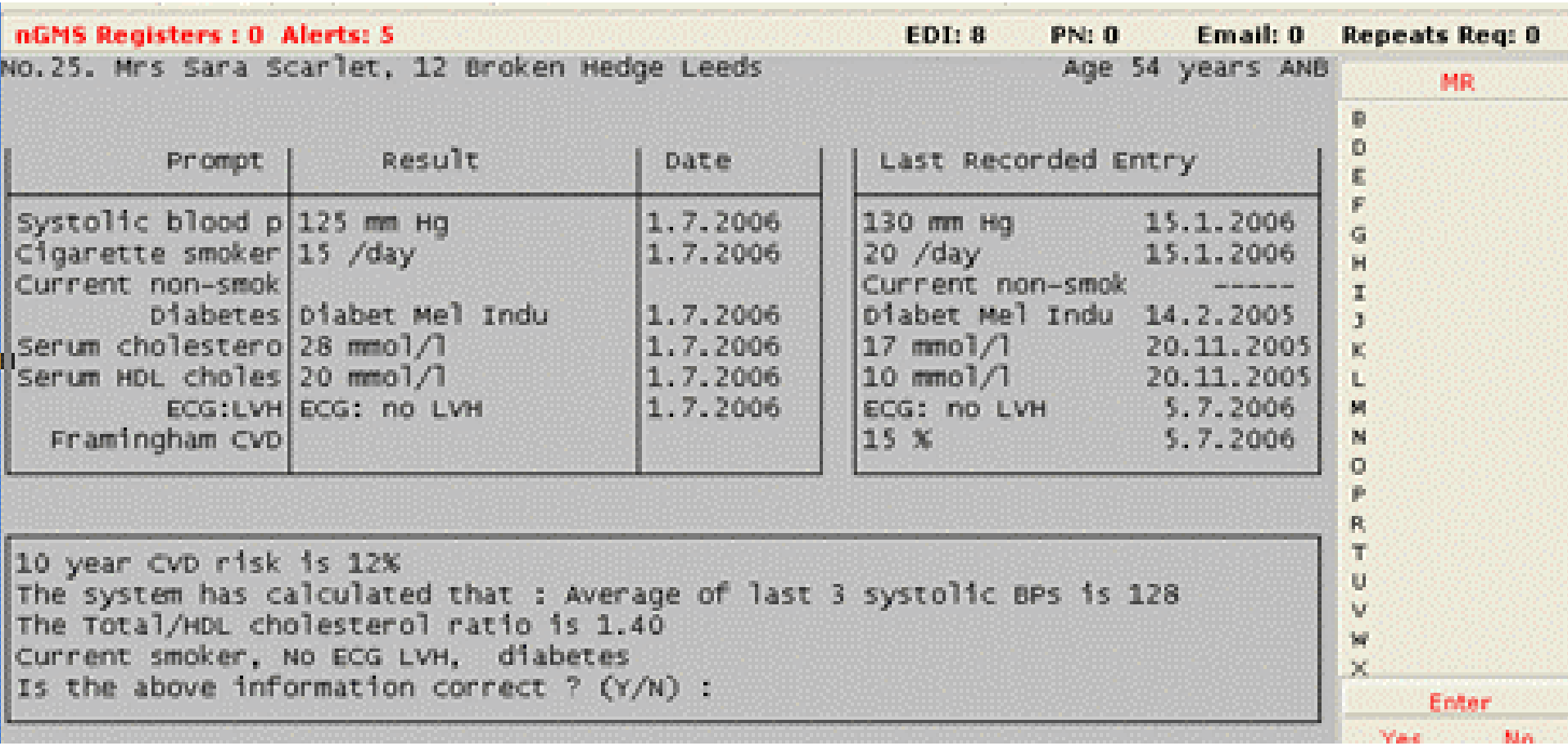
Picking lists...
Variable views of the same clinical concept



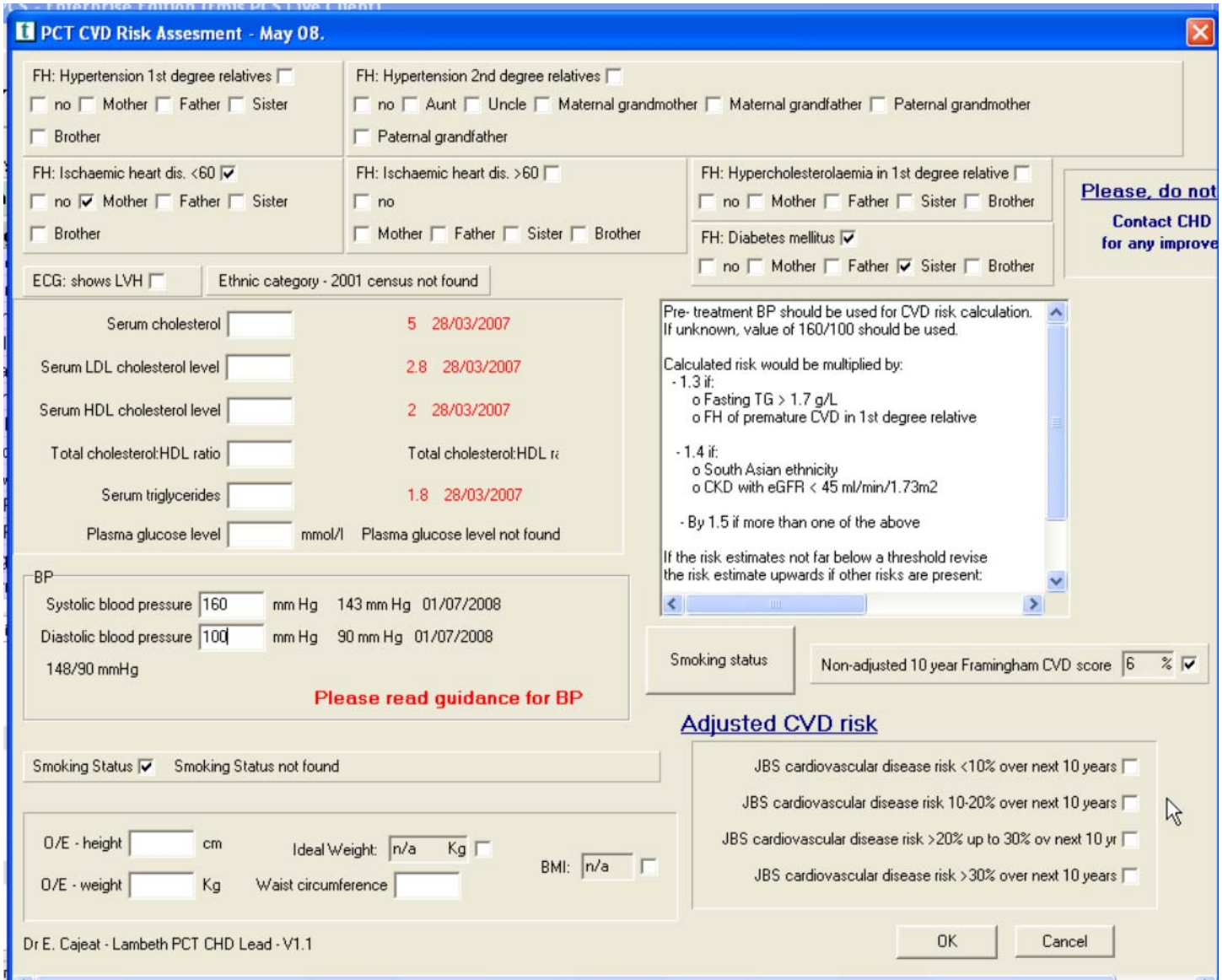
MI	TRISET	EMIS	GPASS	IPS	TOREX
Total No of items	12	54	9	11	13
Total No of pages	1	5	2	1	2
No of diagnostic term	8	42	6	7	9
No of symptoms term	3	10	2	3	3
System specific code	0	0	0	0	0
Review codes (8)	0	0	0	0	0
Admin codes (9)	0	0	0	0	0
No of other terms	1	2	1	1	1
No of EU codes	0	0	0	0	0

Tai TW, Anandarajah S, Dhoul N, de Lusignan S. Variation in clinical coding lists in UK general practice: a barrier to consistent data entry? Inform Prim Care. 2007;15(3):143-50.

CVD risk calculation – EMIS LV template

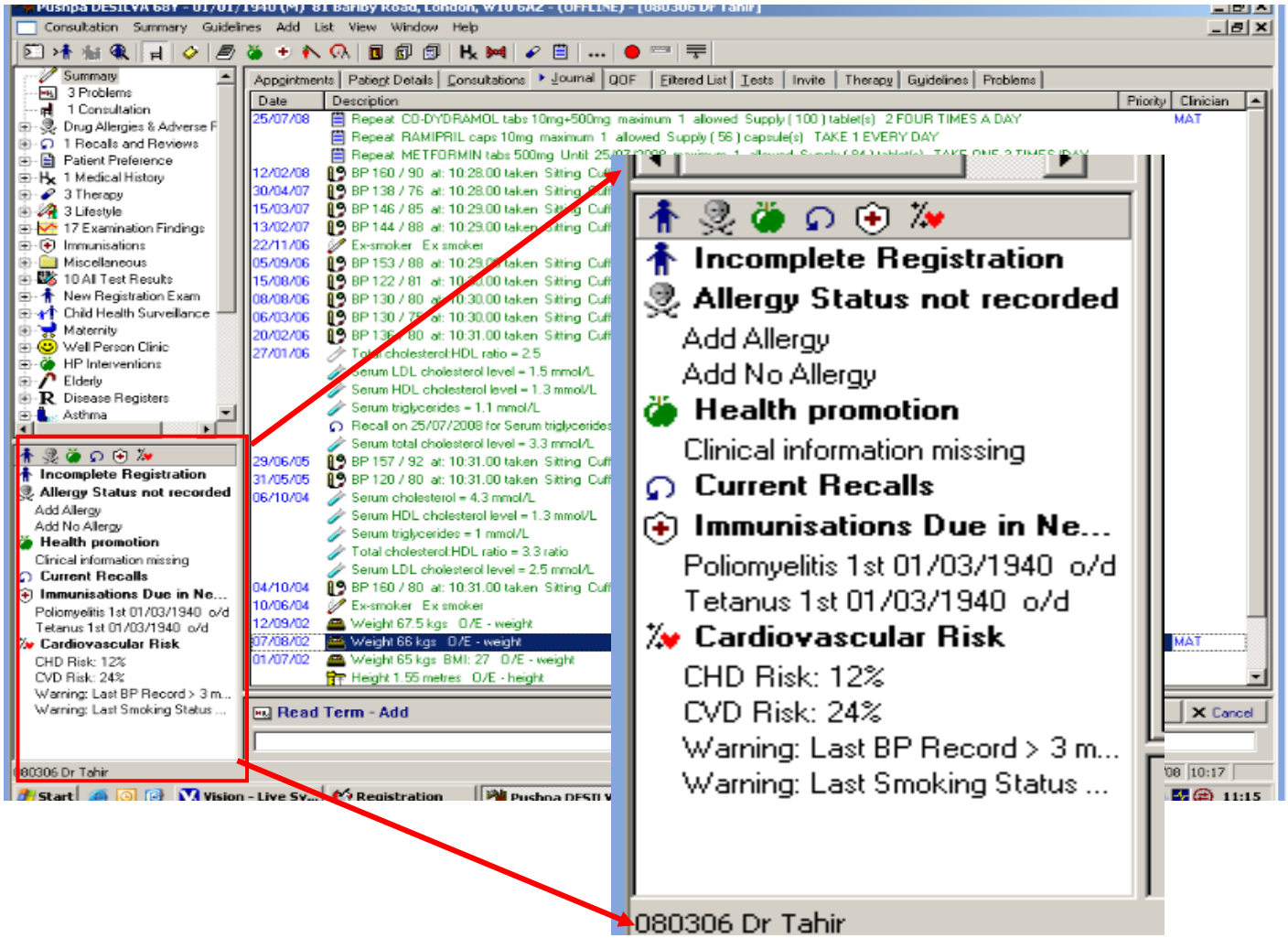


Example of a data entry form...
CVD risk calculation – EMIS PCS template



CVD risk calculation – INPS Vision CVD risk scores

-Displayed in the main consultation page within ‘Reminders and prompts’ sub window



Results - Locality level

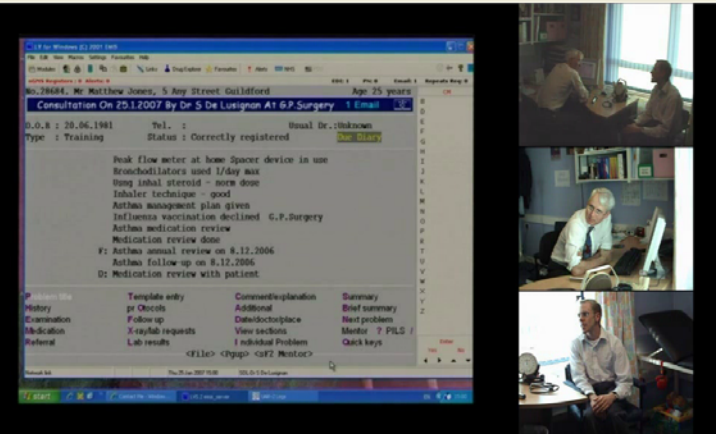
Structure Input	Process Context	Utility	Implications
Equity audits	Separate data collection (not in GP consultation) Payments	Enables specialist audit + research	+++++ Target specific research areas
specialist cross-sectional data	Needs mechanism for collection -e.g. Nasal swabs for influenza surveillance - e.g. Diabetes specialist data network	Very selected data quality improvement	+++++ If correct area is targeted

Results - Inputs at practice level

St George's University of London

- **Practices and practitioners will make use of computerised systems**
  - Completely changes workflows + often practice staff
  - Secondary uses is hardest to predict – beyond payment systems
- **Secondary uses of data**
  - Prescribing audits (+)
  - High cost patients (+)
  - Own research (+)
- **Primary use of data**
  - Prescribing – the one item that saves time (++++)
  - Prescribing alerts – most over alert (+)
  - CDSS (Computerised decision support) (++) in niche areas (e.g. Warfarin dosage)
  - IR (information retrieval) link clinical data to information support (++)
  - Flagging patients – recall, disease registers, screening (++)
  - Reducing admin burden – no "pulling notes," electronic appointments, self check-in, Internet booking of appointments (++) – (+++++ if into encounters!)

“Paperless” practice !!



Clinical records made in real time – in a 10 minute consultation

On-site computer hold EPR

Still written records

Scan in post

Post into trays

Mark for coding

Clinical coding

Results summary

Effect on DQ	Input / structural change / mechanism		
	Health service level	Vendor / locality	Practice
+++++	Demographic service Lab test on-line	Equity audit Specialist X-section Surveillance	Prescribing
+++	GP2GP record transfer		Admin data (+/-)
++	National clinical standards – ABE / QI initiatives	Work with vendors to Improve interface	Niche CDSS + IR Flagging patients
+	ICPC (need ICD + procedure codes)	Single vendor	Audit, research, personal development
+/-	Same data billing + care National performance data		
-			
- -	Authentication system Summary care record On-line health space		
- - -	On-line OPD booking		

Unlisted problems:

- Cost
- More time – except Px
- Change + new skills required
- Vendor tie-in

St George's
University of London

DISCUSSION

Discussion

- Development of electronic patient record systems for needs to be driven by the required outcome/use of the records.

- Developing systems remote from usage does not work
  - Choose and book + summary care record + first on-line health records
  - “Agile” rather then “Waterfall” development of systems is essential

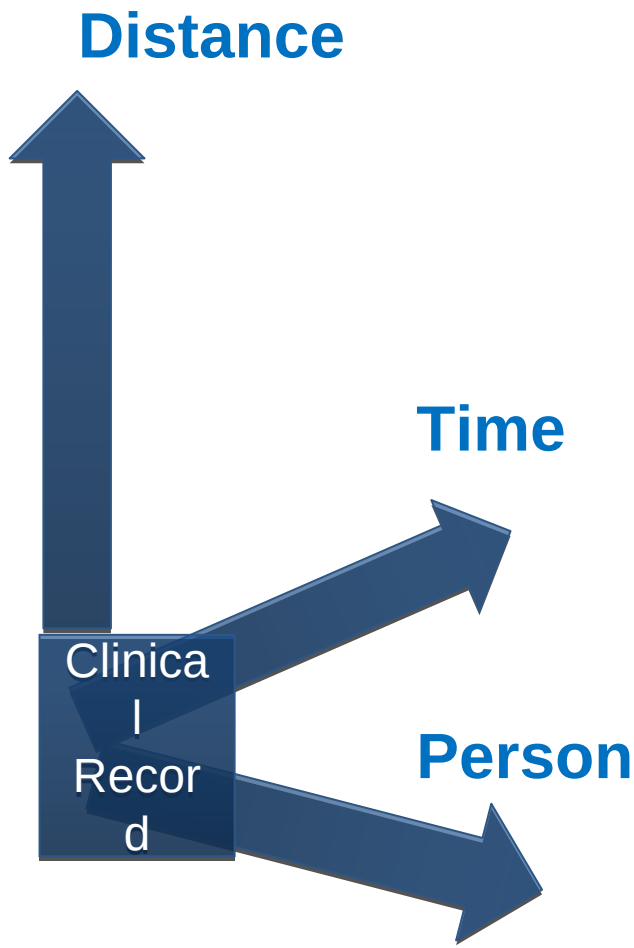
- Improve record quality through:
  - (1) Getting the denominator right – or hard to give feedback on quality;
  - (2) Focusing on exercises which raise quality in clinically relevant areas;
  - (3) Have a strategy for improved linkage.

- There is no single formula for raising record quality – instead focus on raising standards in areas of strategic interest and where your data are most robust

Discussion (2) – Understanding change

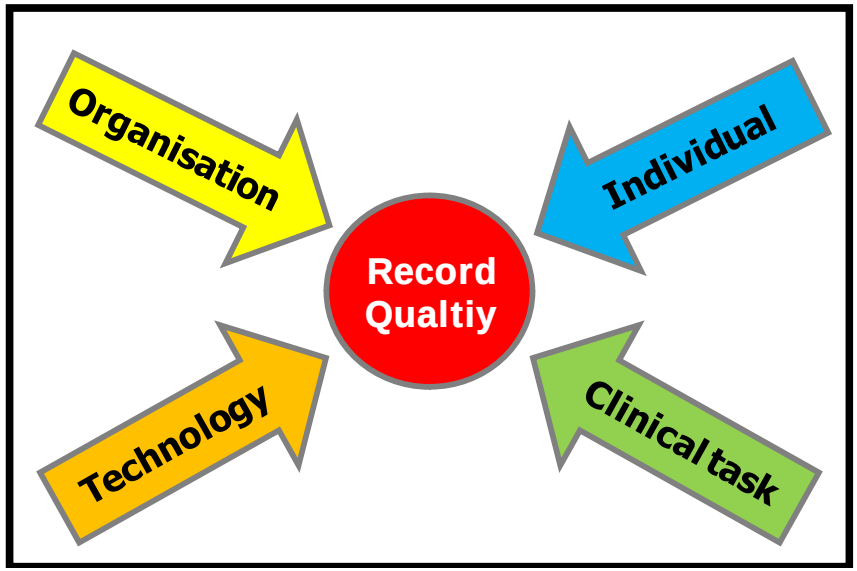
Evolution of the clinical record

- Physician aide memoire
- Individual patient record
  - (Mayo clinic)
- Registration system
  - (record follows patient)
- Shared across larger practices
- Secondary use of data
- Linkage
- "Enterprise-wide" EPR systems
  - Much more data – semantic challenges
- Patient held record



Discussion (3) - Realism

- Clinical coding & using a computer takes longer
- Trade-off between additional effort improving the record + IR, CDSS, search & audit
- Feedback & data linkage further improves data quality
- Not all coded data means the same thing! (e.g. Asthma)
- Brands & coding systems vary
- Strategic support, including financial is essential



Key point:

Much quality improvement has been underpinned by IT

The four elements of the model have been tilted towards data improving data quality

Conclusions:

- The easy wins for health IT are:
  - Accurate denominator
  - Linking systems holding quantiative data
  - Clinical audit
- Fixed user requirements are an illusory
  - Can't develop systems remote from clinical workflow.
- No single formula for improving data quality + clinical records
- Focus instead on:
  - Raising standards where there are health priorities
  - Use routinely collected data to implement and monitor quality improvement.

- Structures and processes are only of value if they have utility in clinical care.

The End!

St George's University of London

- **Thanks for listening...**
  - **Simon de Lusignan**
  - **slusigna@sgul.ac.uk**