The Evolution of ePrescribing - The Start of the Journey

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west midlands ACADEMIC HEALTH SCIENCE NETWORK

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"He wrote in a doctor's hand – the hand which, from the beginning of time, has been so disastrous to the apothecary and so profitable to the undertaker."

Mark Twain

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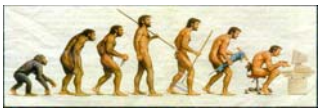
Outline



- The Innovation Journey
- The Policy Journey
- The Evidence for Safety Journey
- The Sociotechnical Journey
- The Decision Support Journey
- Successful Implementation – the end of the Journey?

Disclaimer:
The information within this presentation is based on my expertise and experience, and represents the views of the presenter for the purposes of this event

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THE INNOVATION JOURNEY

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Early days of Computerisation in Healthcare (1961)

Akron Children's Hospital, Ohio

https://youtu.be/t-aiKlIc6uk

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Early Medical Information Systems

- Kaiser Permanente group's general requirements of Medical Information Systems in 1970
  - 24 hour/day data capture at source
  - Positive patient identification
  - Redundancy of equipment
  - Instantaneous response
  - Hardware/Software backup
  - Data quality control
  - User acceptability

Collen MF. General requirements for a Medical Information System. Computers and Biomedical Research 1970; 3: 393-406.

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Who were the innovators?

Computer-Assisted Prescription Writing

Fred Levit

Daniel B. Garside

- Coded prescription:
  - Less time than writing
  - Retrieval from different terminals
  - No Latin abbreviations
  - Always legible
  - Error reduction

Levit F, Garside DB. Computers and Biomedical Research 1977; 10: 501-10.

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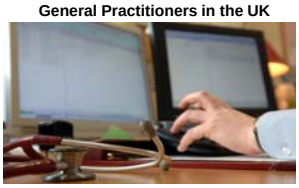
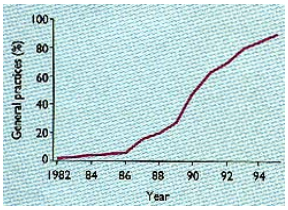
Who were the innovators?

General Practitioners in the UK



Percentage of British practices computerised.



Millman A et al. BMJ 1995;311:800-802

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On line prescribing by computer (1986)

BRITISH MEDICAL JOURNAL VOLUME 292 5 APRIL 1986

On line prescribing by computer

JOHN B DONALD

Abstract

A computer is used to produce all prescriptions for patients seen in the consulting room in this practice. This method of prescribing improves safety, saves time, decreases prescribing costs, and provides an instant audit of all important prescribing parameters. In addition, treatment is rationalised and patients are given an improved service. An analysis of my own practice prescriptions showed that only 31% were repeat prescriptions, and this concurs with national figures. This means that the savings in costs are not likely to be substantial; however, when all prescribing is done by computer from a limited drug formulary then these savings may be appreciable.

- Handwritten code
- BBC B computer
- Green screen VDU
- Dual floppy disc drives
- Patient data = continuous file size of 700 kilobytes

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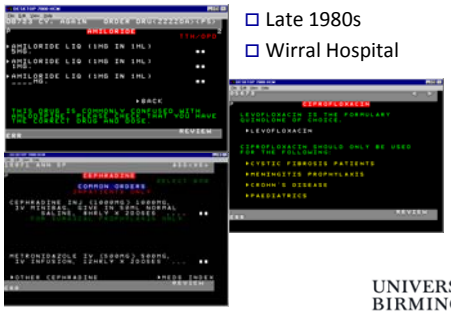
Who were the innovators? ePrescribing in UK Hospitals



- Late 1980s
- Wirral Hospital

Hughes DK, Farrar KT, Slee AL. The trials and tribulations of electronic prescribing. Hosp Presc Eur 2001; 1: 74-6

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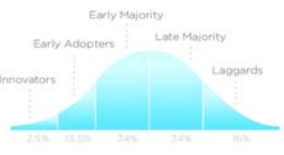
The innovation adoption lifecycle



INNOVATION ADOPTION LIFECYCLE

Bohlen, Beal & Rogers, Iowa State University, 1957

- Tracking purchase patterns of hybrid seed corn by farmers

- **innovators** – had larger farms, were more educated, more prosperous and more risk-oriented
- **early adopters** – younger, more educated, tended to be community leaders
- **early majority** – more conservative but open to new ideas, active in community and influence to neighbours
- **late majority** – older, less educated, fairly conservative and less socially active
- **laggards** – very conservative, had small farms and capital, oldest and least educated

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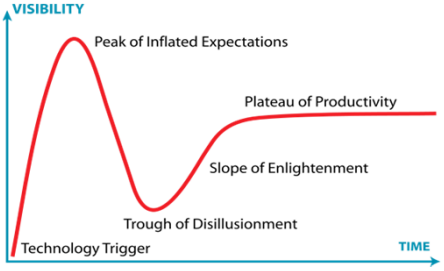
Hype or reality

Gartner Hype Cycle



http://en.wikipedia.org/wiki/File:Gartner_Hype_Cycle.svg Image attributed to Jeremykemp at en.wikipedia.

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So how diffused are our innovations…

- The pace of computerisation has been slower within hospitals
- Innovators and early adopters now give way to the early majority
- In the UK 13% fully implemented*, up to 50% putting in EPMA systems

* Ahmed Z et al. The use and functionality of electronic prescribing systems in English Acute NHS Trusts: A Cross sectional survey. PLoS One 2013; 8(11): e80378.

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THE POLICY JOURNEY

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ePrescribing – early strategies seeing out the 20th Century

IM&T strategy (1992) / Information for Health (1998)

- person-based information (NHS number)
- systems integration (reduce data duplication)
- deriving management information from operational systems
- Information security and confidentiality
- information sharing via an NHS-wide network

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Delivering 21st Century IT Support for the NHS

- Launched in 2002
- Connecting delivery of NHS Plan with capabilities of modern IT
  - Patient centred
  - Effective eCommunications
  - Learning/knowledge management
  - Time saving
  - Good quality data

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Connecting for Health - NPfIT

- National Programme for IT – largest public sector programme every attempted in the UK
- Born out of the National Strategic Document in 2002
- National Programme's aims were to:
  - bring the NHS' use of information technology into the 21st century
  - Through the introduction of
    - integrated electronic patient records systems
    - online 'choose and book' services
    - computerised referral and prescription systems
    - underpinning network infrastructure

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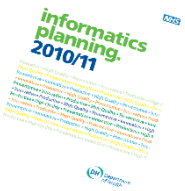
Informatics strategy – the last few years

2011: Informatics planning



- Fast, safe modern IT systems
- Case histories, schedule care, prescribe, order tests, view results
- Universally available accurate records
- Telemedicine services
- Remote monitoring

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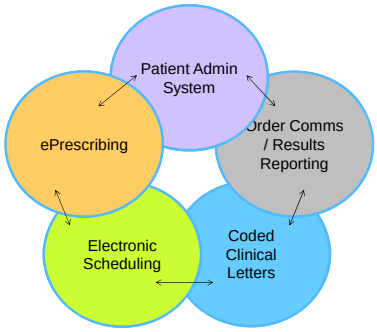

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Information Strategy – the last few years

2012: The power of information

- To give people more control over their care
- Improving access to information
- Better access to health and care records
  - Test results should be available electronically
  - booking or re-arranging appointments on line

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Current Digital Strategy 2014-15

- Promoting better integration across health and social care
- Digital solutions that support flow of information
- ePrescribing identified as an essential element of the digital care record

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THE EVIDENCE FOR SAFETY JOURNEY

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The Safety Agenda

'Defence in Depth'

- **"Prevention requires the continuous redesign and implementation of safe systems to make errors increasingly unlikely, for example, using order entry systems that provide real-time alerts if a medication order is out of range for weight or age"**

Institute of Medicine Report

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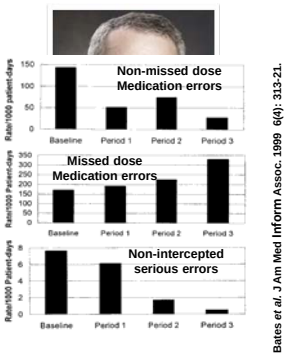
Early Evidence

- CPOE "Born in the USA"
- Home-grown implementations
- Academic Centres
- Provided clear evidence of benefits
- Error reduction even with 'simple' implementation



Bates *et al.* J Am Med Inform Assoc. 1999 6(4): 313-21.

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Pharmacological Perspective on HEPMA Implementation


Look for Opportunities to Improve Prescribing Systems, Changes That Can Make Prescribing and Medication Use Safer

Implementing well-designed computerized prescriber order entry or improved patient or laboratory monitoring has been shown to improve drug treatment, often more than the marginal impact of many new "breakthrough" drugs.[123-127] An essential "ingredient" in a successful drug regimen is an informed patient who knows why, when, and how to take a drug and is educated about adverse effects.[128]

Schiff *et al.* Principles of Conservative prescribing. Arch Int Med 2011; 171: 1433.

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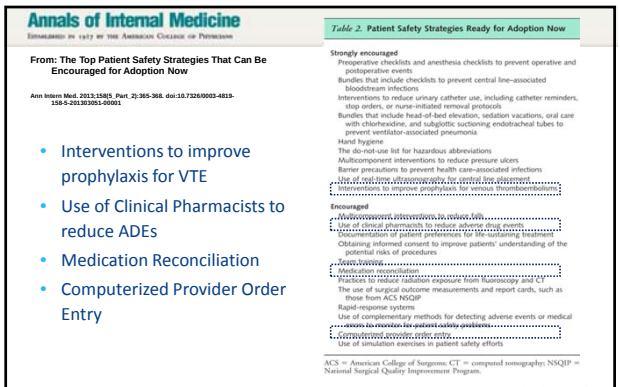
Annals of Internal Medicine

From: The Top Patient Safety Strategies That Can Be Encouraged for Adoption Now

Ann Intern Med. 2013;158(5_Part_2):365-368. doi:10.7326/0003-4819-158-5-201303051-00001

Table 2. Patient Safety Strategies Ready for Adoption Now

Strongly encouraged
- Preoperative checklists and anesthesia checklists to prevent operative and postoperative events
- Bundles that include checklists to prevent central line–associated bloodstream infections
- Interventions to reduce urinary catheter use, including catheter reminders, stop orders, or nurse-initiated removal protocols
- Bundles that include head-of-bed elevation, sedation vacations, oral care with chlorhexidine, and subglottic suctioning endotracheal tubes to prevent ventilator-associated pneumonia
- Hand hygiene
- The do-not-use list for hazardous abbreviations
- Multicomponent interventions to reduce pressure ulcers
- Barrier precautions to prevent health care–associated infections
- Use of real-time ultrasonography for central line placement
- Interventions to improve prophylaxis for venous thromboembolism

Encouraged
- Multicomponent interventions to reduce falls
- Use of clinical pharmacists to reduce adverse drug events
- Documentation of patient preferences for life-sustaining treatment
- Obtaining informed consent to improve patients' understanding of the potential risks of procedures
- Team training
- Medication reconciliation
- Practices to reduce radiation exposure from fluoroscopy and CT
- The use of surgical outcome measurements and report cards, such as those from ACS NSQIP
- Rapid-response systems
- Use of complementary methods for detecting adverse events or medical errors to monitor for patient safety problems
- Communication skills training
- Use of simulation exercises in patient safety efforts

ACS = American College of Surgeons; CT = computed tomography; NSQIP = National Surgical Quality Improvement Program.

- Interventions to improve prophylaxis for VTE
- Use of Clinical Pharmacists to reduce ADEs
- Medication Reconciliation
- Computerized Provider Order Entry

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Modern Safety Case

- Medications increased in number and complexity, demanding more knowledge and understanding from clinical staff
- Greater concern over rates of errors
- Medication errors identified as major preventable source of harm
- Processing a prescription drug order through CPOE decreases the likelihood of error on that order by **48%** (95%CI 41-55%)†

Radley *et al.* Reduction in medication errors in hospitals due to adoption of CPOE. JAMIA 2013; 20(3):470

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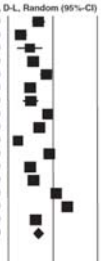
Impact of eP and CDS on Medication Errors

Study	CPOE Errors, N	CPOE Units, N	Paper Errors, N	Paper Units, N	Weight	Risk Ratio, D-L, Random (95%-CI)
Bates 1998	54	11,235*	127	12,218	6.08	0.46 (0.34-0.64)
Bates 1999	50	1,878*	242	1,704	6.12	0.19 (0.14-0.25)
Bizovi 2002	11	1,594†	54	2,326	4.81	0.30 (0.16-0.57)
Oliven 2005	220	5,033*	617	4,969	6.50	0.35 (0.30-0.41)
Shulman 2005	117	2,429†	71	1,036	6.15	0.70 (0.52-0.94)
Barron 2006	77	240,096‡	252	240,096	6.27	0.31 (0.24-0.39)
Colpaert 2006	35	1,286†	106	1,224	5.86	0.31 (0.21-0.46)
Aronsky 2007	73	2,567†	125	3,383	6.17	0.77 (0.58-1.03)
Mahoney 2007	2,319	1,390,789†	4,960	1,452,346	6.62	0.49 (0.47-0.51)
Wess 2007	57	13,105†	239	8,595	6.17	0.16 (0.12-0.21)
Franklin 2009	127	501*	135	438	6.30	0.88 (0.65-1.05)
van Doormal 2009	1,203	7,058†	3,971	7,106	6.61	0.31 (0.29-0.33)
Shawnha 2011	1,147	14,064†	3,008	13,328	6.61	0.36 (0.34-0.39)
Leung 2012	645	1,000§	550	1,000	6.56	1.17 (1.04-1.31)
Menendez 2012	1,197	11,347§	356	7,001	6.55	2.08 (1.84-2.34)
Westbrook 2012	1,029	629§	4,270	1,053	6.61	0.40 (0.38-0.43)
						Overall 0.46 (0.35-0.60)

Total Medication Errors: 8,361 (CPOE); 19,083 (Paper)
Tests for Heterogeneity: I^2 98.8%; Q statistic p < 0.0001
Overall Effect: z = -5.62, p < 0.0001



CPOE associated with half as many medication errors (RR 0.46) compared to paper

Nuckols TK *et al.* The effectiveness of CPOE at reducing pADEs and medication errors in hospital settings. Syst Revs 2014; 3: 56

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THE SOCIOTECHNICAL JOURNEY

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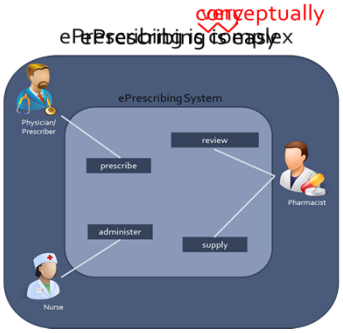

http://dutchhealthcare.wordpress.com/2011/06/22/electronic-prescribing/

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New challenges to contend with

Some noted unintended consequences associated with implementation of CPOE+CDSS

Workflow Changes	New Safety Hazards
New work demands for HCPs	System design problems
Overdependence on technology	Alert fatigue
Changes in communication patterns between staff	Workarounds to avoid perceived or actual problems with systems
Shift of data entry from admin staff to clinicians	Continued warnings mean clinicians override high-severity alerts
Workstation availability can impair clinician efficiency	Development of alternate computer or paper-based workflows
Limitation to obtain medications in an emergency	Problems relating to transitioning between different systems

Ranji SR *et al.* CPOE combined with CDS systems to improve medication safety: a narrative review. BMJ Qual Saf 2014;23:773–780

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THE DECISION SUPPORT JOURNEY

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Clinical Decision Support

- Defined as:
  - Process for enhancing health-related decisions and actions
  - Using pertinent, organised clinical knowledge and patient information to improve health delivery

- Produces basic benefits through to expert error detection

Kawamoto K, et al. Improving clinical practice using clinical decision support systems. BMJ 2005;330(7494):765.

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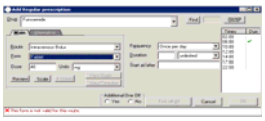
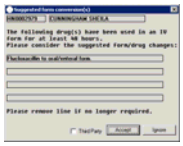
Clinical Decision Support – Constraint vs Inform

- Decision constraint
  - stops people doing daft things or leaving orders incomplete
- Information support
  - guides and helps prescribing and administration decisions





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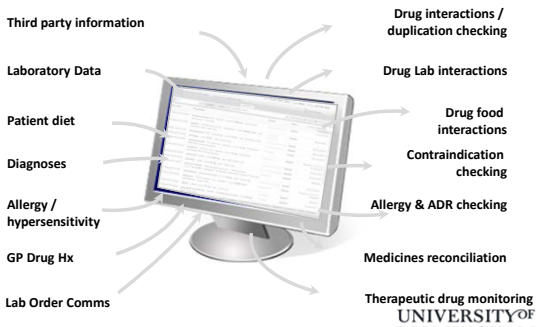
Types of Prescribing Error

Type of Error	%
Medication omitted	24
Wrong patient	16
Incorrect dose	15
Incorrect frequency	12
Incorrect timing	9
Incomplete prescription	6
Incorrect drug	4
Incorrect route	1
Incorrect formulation	3
No clear indication	3
Contraindication to medication	3
Significant drug-drug interaction	2
Incorrect duration	1
Duplication of therapy	1

Types of CDS intervention

Ross *et al.* Perceived causes of prescribing errors by junior doctors in hospital inpatients. Qual Saf Health Care 2013; 22: 97.

Desire for intelligent decision support…



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…but with fewer alerts!

"Chronic Alert Fatigue Syndrome"

Phansalkar S *et al.* DDIs that should be non-interruptive in order to reduce alert fatigue in electronic health records. JAMIA 2013; 20: 489–493

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SUCCESSFUL IMPLEMENTATION – THE END OF THE JOURNEY?

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Successful implementation may only be the start of a journey in ePrescribing

- Best use of systems
- Tweaking CDS
- Optimising systems
- Integration / Interoperability / Open APIs
- System upgrades
- Transition between systems (full EPR)

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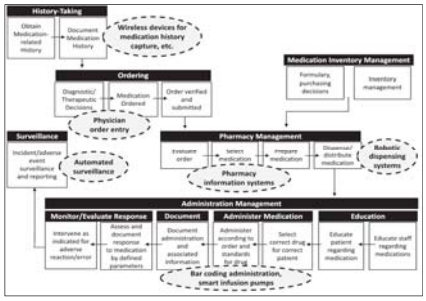
eP is only part of a larger digital medicines strategy



Technologies to reduce errors in the medication management process

Classen DC & Brown J. A sociotechnical model for pharmacy. Hosp Pharm 2013; 48(3 Suppl 2): S1-S5.

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Conclusions

- Many decades of IT implementations have already produced many valuable lessons
- Integration of policy and practice using best evidence to produce innovation in ePrescribing at scale
- A successful implementation may only be the start of the journey in ePrescribing

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QUESTIONS?

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