

Computers in healthcare – not just for geeks anymore!



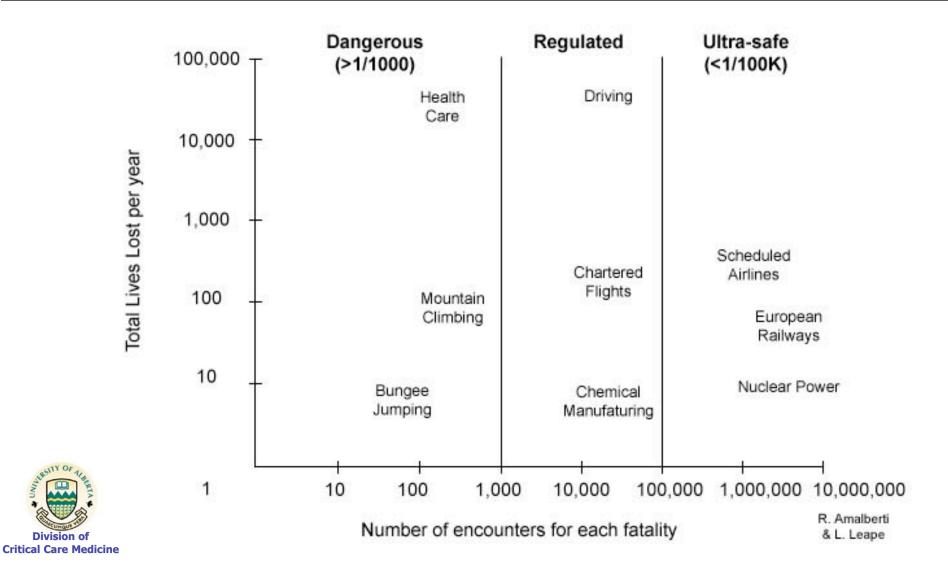


Clinical Information Systems

- Error in healthcare
- Information technology in healthcare
- Patient portal
- Departmental clinical information systems



How Hazardous is Healthcare?



To Err Is Human

Building a Safer Health System

Linda T. Kohn, Janet M. Corrigan, and Molla S. Donaldson, Editors

Committee on Quality of Health Care in America

INSTITUTE OF MEDICINE





IOM Report-patient safety in the USA

- Major findings
 - Adverse events are a major problem
 - 7% of hospitalized patients in the United States suffer a significant medication error.
 - 44,000-98,000 people die each year in the United States from errors in care.
 - The economic impact of these errors is approximately \$50 billion annually.
 - Health care workers not to blame
 - Safety and harm are products of systems



Error in Medicine

Leape L.JAMA, 272:1851,1994.

- The hospital's ICU was functioning at a 99% level of proficiency. However, a 1% failure rate is not tolerated in other high-risk industries.
- Even a ten-fold improvement (99.9% proficiency rating) would equate to
 - 2 unsafe landings at O'Hare airport everyday,
 - 16,000 pieces of lost mail every hour and
 - 32,000 bank checks directed from the wrong bank account every hour.



Error in the ICU

- 6 bed ICU
- Average of 178 activities per patient per day and 1.7 errors per patient per day (1%).
- A severe or potentially life-threatening error occurred on average twice a day

Donchin Y, Gopher D, Olin M, Badihi Y, Biesky M, Sprung CL, Pizov R, Cotev S. A look into the nature and causes of human errors in the intensive care unit. *Crit Care Med*, 23:294,1995.



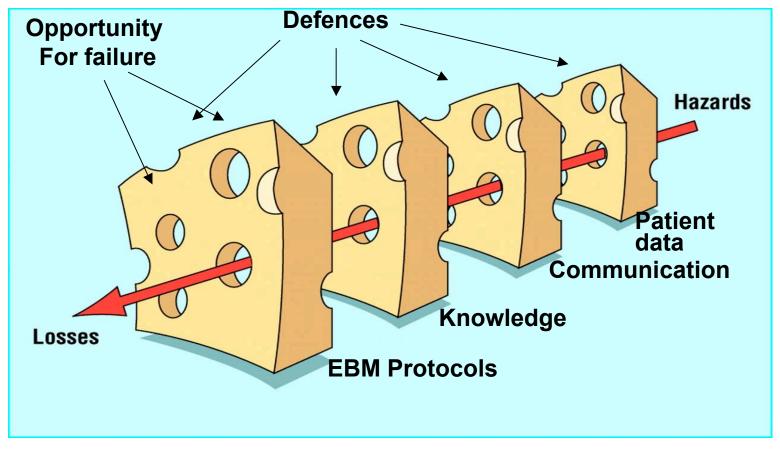
Error in the ICU

- 18% of patients suffered an error that led to physical disability or death.
- The likelihood of experiencing an adverse event increased about 6% for each day of hospital stay and increased further if the patient spent time in an intensive care unit.
- The effect on length of stay was dramatic at 8.8 days for patients without adverse events and 23.8 days for those with adverse events."

Andrews LB, Stocking C, Krizek T, Gottlieb L, Krizek C, Vargish T, Siegler M. An alternative strategy for studying adverse events in medical care. *Lancet*, 349:309, 1997.



The Swiss Cheese Model





The Swiss cheese model of how defenses, barriers, and safeguards may be penetrated by an accident trajectory.

Reason J. BMJ 2000

Reasons for Healthcare Error

- Lack of clinical patient information
 - Failure of physician handover
 - Unavailability of previous clinical records
 - Unavailability of previous investigations
- Failure to be aware of critical clinical information
- Variability in clinical practice
- Prescribing error
- Transcription error
- Dispensing error
- Lack of clinical knowledge

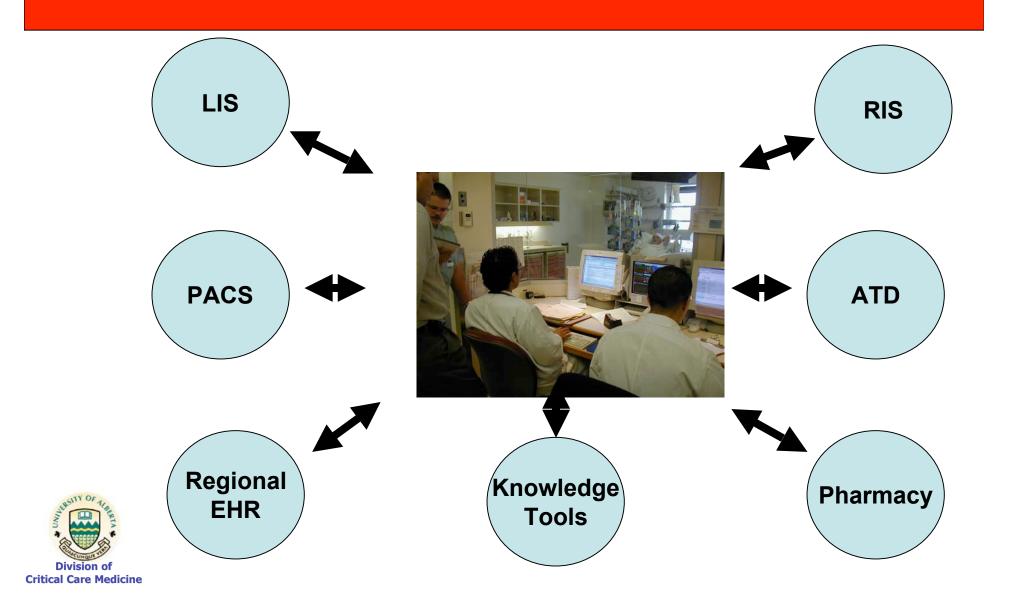


Clinical Information Systems

- Admission/Transfer/Discharge system
- Laboratory information system
- Radiology information system
- Pharmacy information system
- Picture Archival and Communication System
- Departmental clinical systems
 - Critical care information system
 - E.D. clinical information system
 - O.R. clinical information system
 - Anesthesia clinical information system
 - Cardiology clinical information system
 - Etc.
- Clinical Portal



Clinical Information Systems

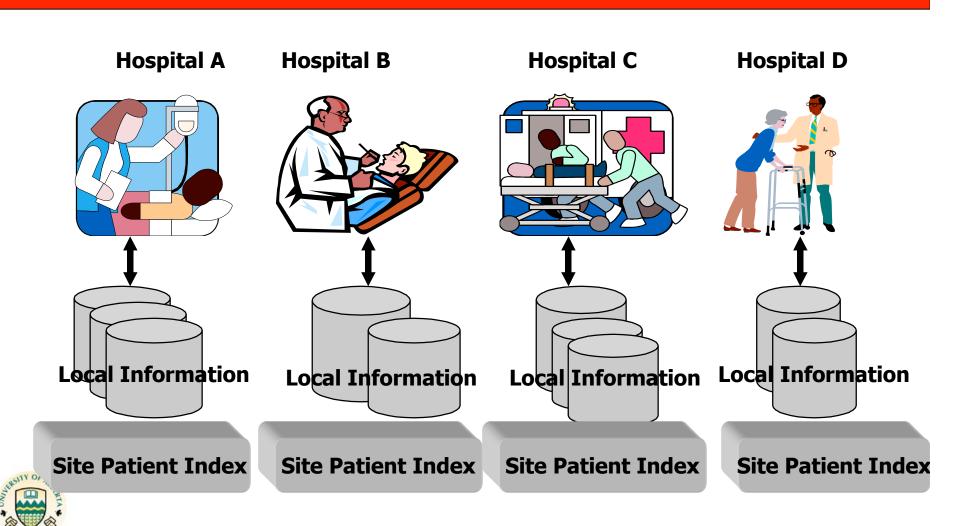


Value of CIS in patient safety

- Comprehensive, accurate, timely, secure access to patient information
- Facilitating more rapid response to clinical deterioration
- Computerized Physician Order Entry
- Clinical decision support
- Knowledge tools
- Smart alerts
- Error reporting tools
- Remote intensivist management



Hospital Information Systems



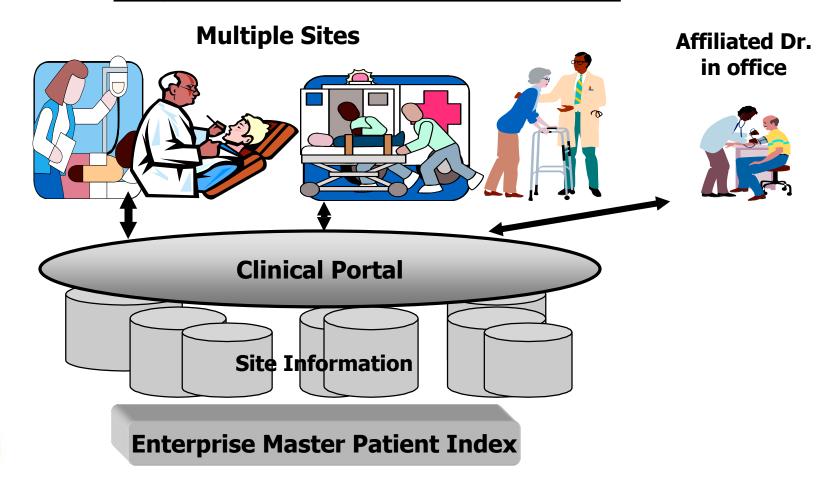
Division of Critical Care Medicine



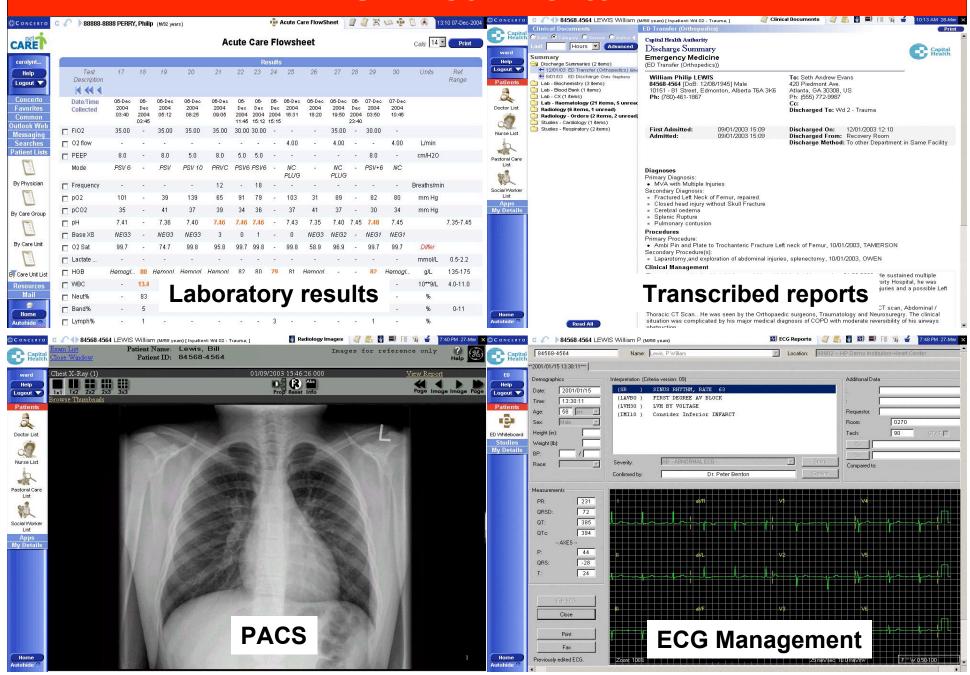
Division of Critical Care Medicine

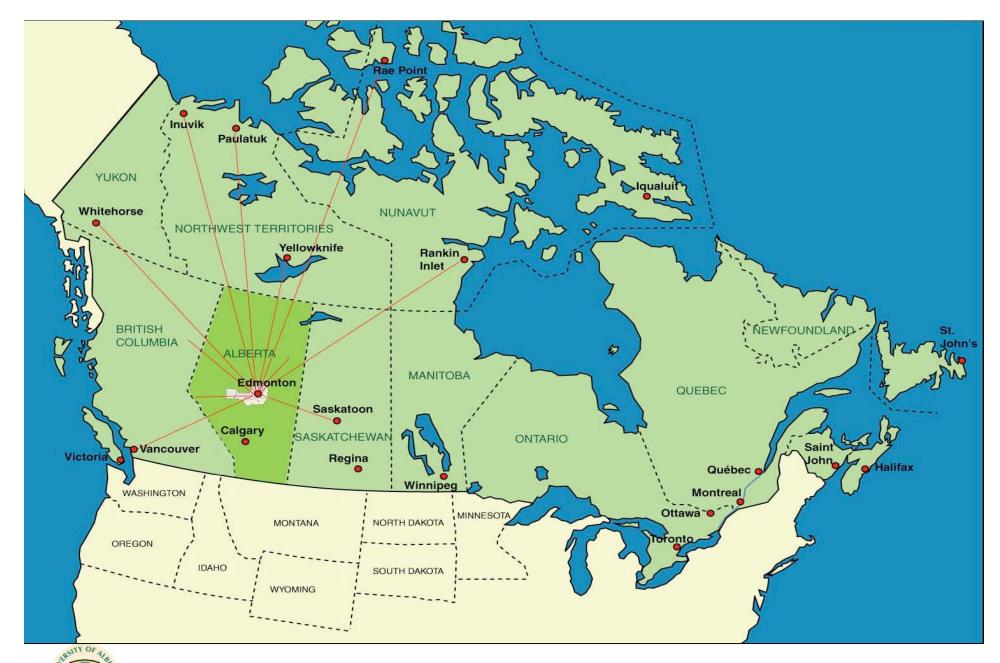
Clinical Portal

Regional electronic health record









Regional Health Information Network

Division of Critical Care Medicine

Illegible handwriting

500 - 600 W. ATH STREE	T ODESSA, TEXAS	PITAL PA. 333-7111
FOR VE	aguer Roman	
	Warren Baran	DATE 6/23/95
NO REFILLS		4 120-
PRODUCT SE	Humarkin N SR Raw	
	D.E.A. #	
720037- Yr Sh		0488 270

Jurors blamed this illegible prescription for the death of a Texas man. Although it allegedly calls for Isordil, the pharmacist filled it as Plendil. The jury's \$450,000 judgment, finding both the cardiologist and pharmacist negligent, is believed to be critical Care Mediathe first of its kind to focus solely on bad handwriting.



Computer Physician Order Entry • ICC Physician Stoffing • Evidence-Based Hospital Referral





Division of Critical Care Medicine

Leapfrog initiatives

Safety Initiative	Potential benefit with full implementation (USA/yr)	
Computerized Physician Order Entry (CPOE)	522,000 serious medication errors avoided (55% reduction)	
Evidence based hospital referral		
5 High risk procedures CABG, AAA, angioplasty, espohagectomy, carotids endratrectomy	2,581 lives saved	
High risk deliveries	1,863 lives saved	
Intensivist physician staffing	53,850 lives saved	

CPOE - Decision support

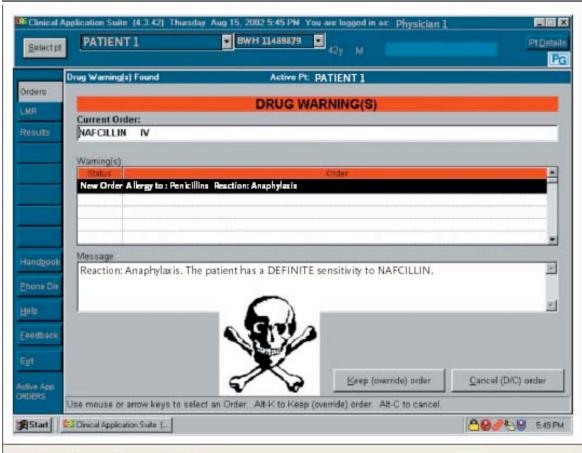




Figure 4. Warning Displayed for a Drug Allergy.

When warnings are displayed in current systems, even important messages are often overridden, most likely because too many unimportant warnings are displayed. Principles of design that take into account human factors suggest that it is important to make warnings that are more serious look different from those that are less serious, 43 as in this case, in which the screen displays a skull and cross bones to warn that the patient has previously had an aphylaxis. Whether or not such a design would result in increased attention to important warnings has not been tested.

Computerized Physician Order Entry

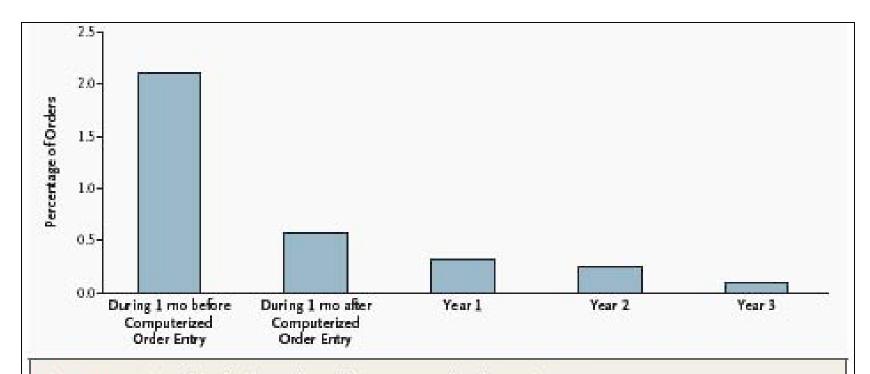
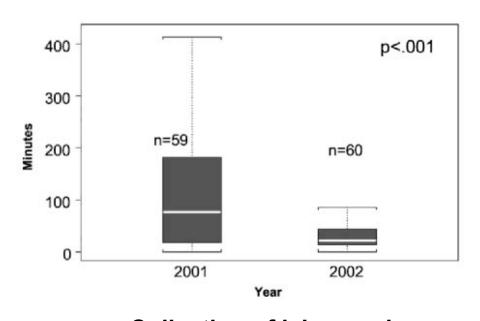


Figure 2. Percentage of Medication Orders with Doses Exceeding the Maximum.

Data are the percentage of orders for doses exceeding the medication-specific recommended maximal dose according to year, after the implementation of a computerized system for order entry by physicians. ²³ The application suggested a default dose and displayed only potentially appropriate options, but it did not check for overly high doses. Even so, the percentage of orders exceeding the recommended safe maximum fell by more than 80 percent over a three-year period.



Effect of CPOE on investigations



400 p<.001

300 n=26

100 2001

2001

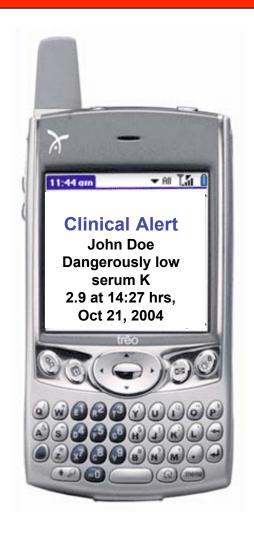
2002

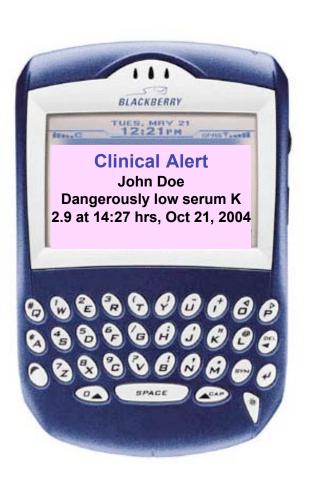
Year

Collection of lab samples

Performance of imaging studies

Improving communication and access to information-clinical alerts







Critical Care Clinical Information Systems

- Real time interface with
 - Physiological monitor
 - Ventilator
 - Infusion pumps
 - Laboratory information system
 - PACS
- Online patient charting
- Smart alerts



Impact of CCIS on nursing activity

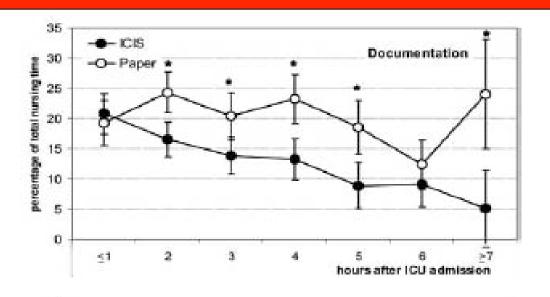
Bosman et al. Int Care Med. 2003;29:83-90.

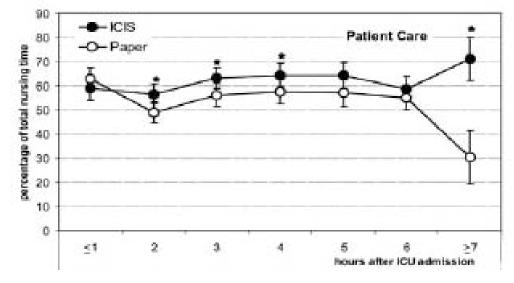
	CCIS	Paper	Time difference
Patient care	293	264	+29%
Documentation	69	98	-29%
Unit-related	16	21	-5%
personal	102	97	+5%
Total	480	480	



Impact of CCIS implementation

Bosman et al. Int Care Med. 2003;29:83-90.







CCIS and quality improvement

Quality benefits of an intensive care clinical information system

David J. Fraenkel, BM, BS, FRACP; Melleesa Cowie, BN, GDip-HIS; Peter Daley, BN, BappSc

Crit Care Med 2003;31:120-125



ICU Nursing perceptions of CCIS Fraenkel et al. Crit Care Med 2003;31:120-125

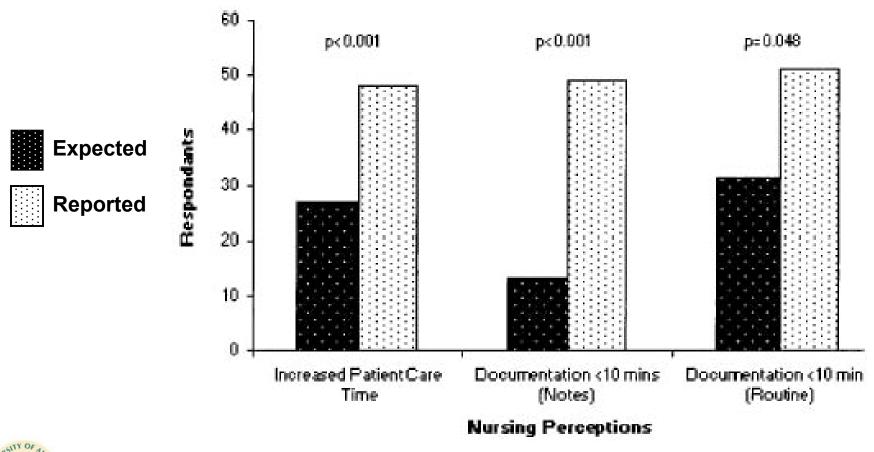
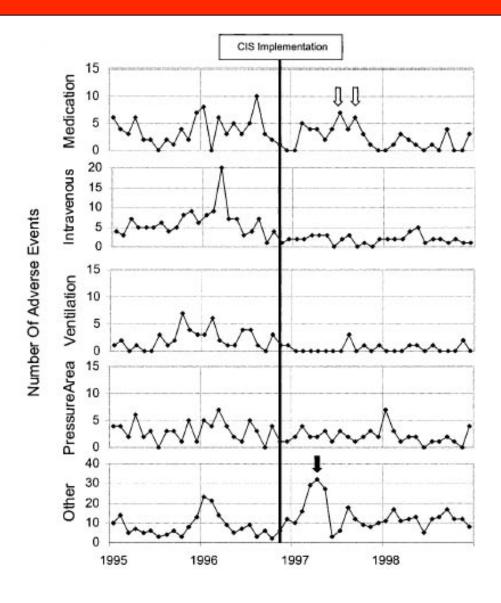




Figure 2. Results of the survey of nursing perceptions of the clinical information system utility preand postimplementation. Shown are numbers of respondents with particular responses.

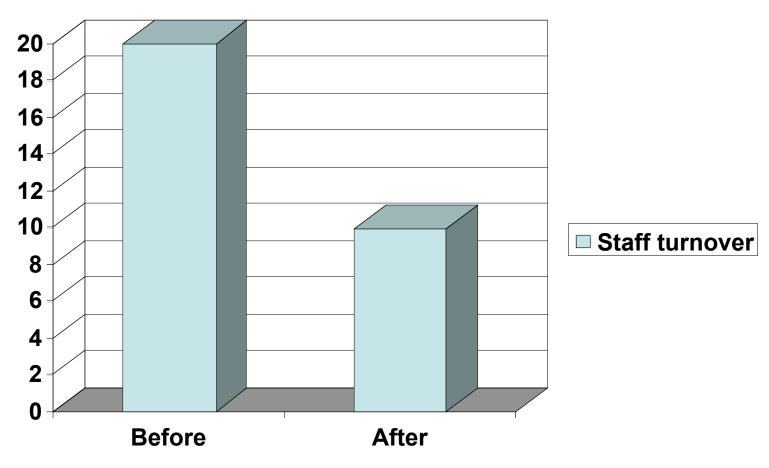
Impact of CCIS implementation on adverse events



Fraenkel et al. Crit Care Med 2003;31:120-125



Impact of CCIS on RN retention





Fraenkel et al. Crit Care Med 2003;31:120-125

CCIS in PICU

BMC Medical Informatics and Decision Making



Research article

Computerized clinical documentation system in the pediatric intensive care unit

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BMC Medical Informatics and Decision Making 2001, 1:3



Received: 10 July 2001 Accepted: 17 September 2001

CCIS in PICU

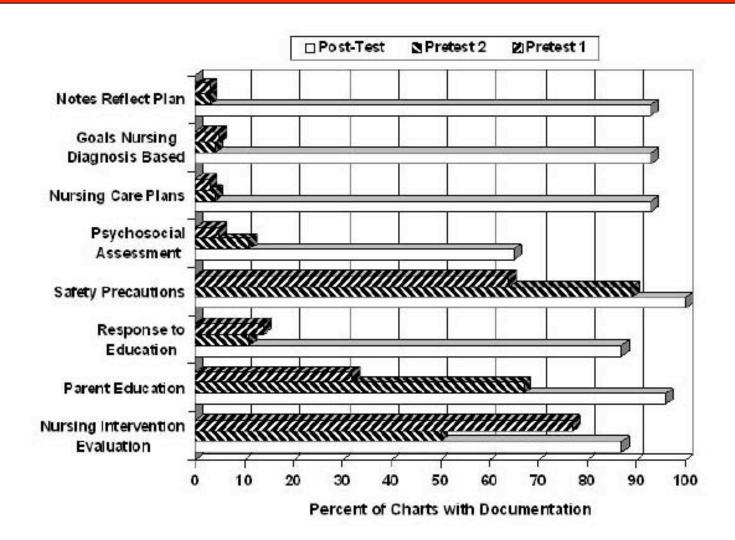
Menke et al BMC Medical Informatics and Decision Making 2001;1:3

- No change in RN documentation time
- Documentation
 - more legible
 - more accurate
 - more complete
- Decrease in time and cost for audits
- Decrease in cost for printing forms



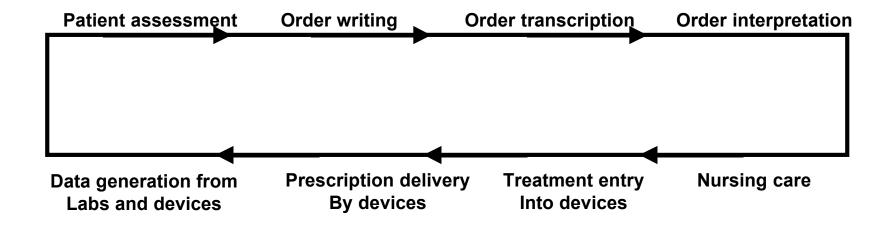
CCIS in PICU

Menke et al BMC Medical Informatics and Decision Making 2001;1:3





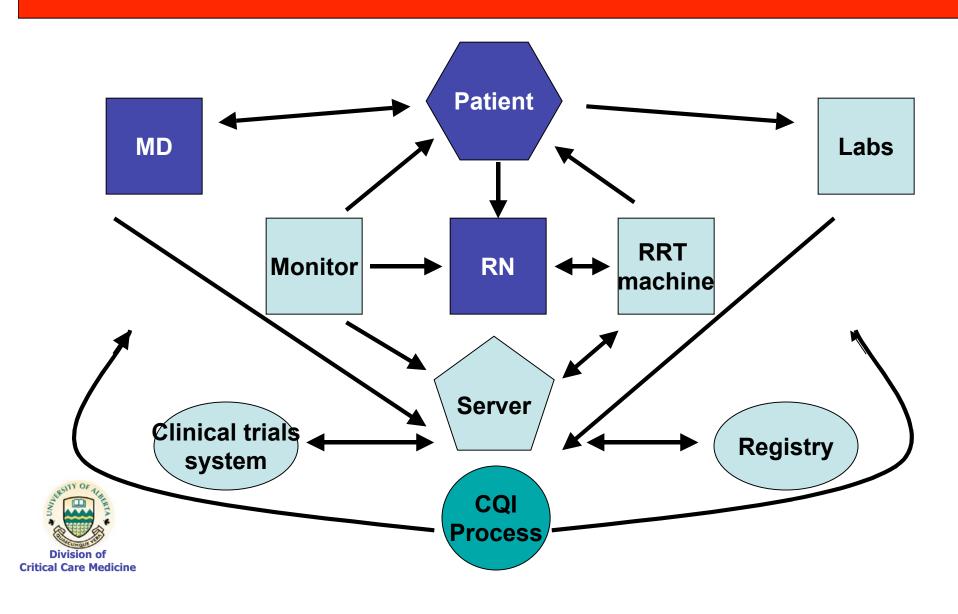
CCIS in RRT





CIS for Acute RRT

Savage B et al curr opin crit care 2002;8:544-548



CCCIS Benefits

- RNs spend 15%-25% less time charting
- More time for direct patient care
- Improved RN job satisfaction and retention
- Legibility
- Computerized order entry
- Elimination of transcription error
- Integration of care plans
- Improved compliance with EBM standards
- Smart alerts
- Administrative report generation
- Quality improvement projects
- Research





Knowledge tools

- Online resources
 - Links to existing CPGs
 - Links to journals
 - Links to professional organizations
 - Links to commercial sites
 - Up to Date
 - Zynx.com
 - Epocrates
- Tablet PC based resources
- Handheld resources
 - Epocrates
 - Merck manual
 - PEPID



Issues with CIS

- Security
- Reliability
- Vendor survival
- User interface
- User vendor selection
- User customization
- Interface/integration with other hospital systems
- Opportunity to re-engineer care processes
- Speed
- Speed
- Speed
- Speed



CCIS Implementation

- Selection & implementation of CIS requires user group champion and ownership with guidance from IT and professional resources.
- Select CCIS already successfully implemented elsewhere on a similar scale you require
- Select CCIS that will interface with other hospital clinical and departmental CIS
- Ensure vendor has existing drivers for bedside equipment
- Ensure appropriate charting for <u>ALL</u> members of multidisciplinary ICU team

Critical Care Medicine

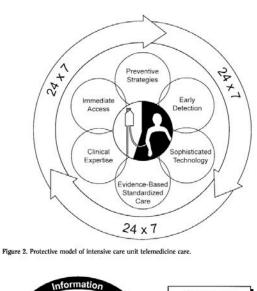
- Use CCIS implementation as an opportunity to completely redesign workflow
- Need more study of impact of clinical information systems.

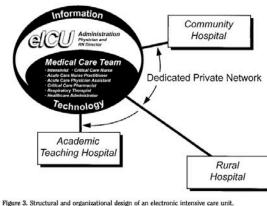
Intensivist staffing

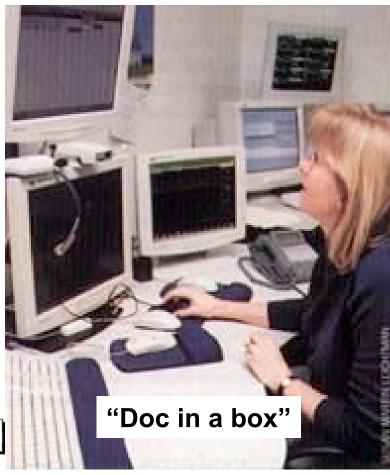
- Intensivists improve care in ICUs
- Shortage of intensivists in USA
- Small ICUs do not attract intensivists
- Remote intensivist management now available –eICU/VisICU



The elCU: remote intensivist management



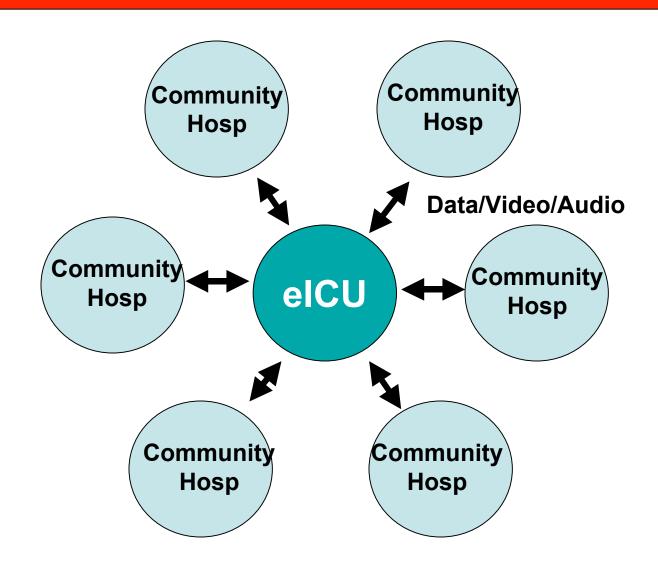






Celi LA et al. Crit Care Med 2001; 29(Suppl.):N183-N189

VisICU





Why do we need protocols, checklists, clinical information systems etc.?





Critical Care Medicine

"Every process is perfectly designed to achieve the results it gets"

-Donald Berwick IHI

"We cannot ask our doctors and nurses to work any harder. If we want safer, higher-quality care, we will need to have redesigned systems of care".

-Institute of Medicine-Crossing the Quality Chasm, 2001



