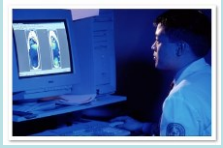

Clinical data clinical care

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Data and Knowledge

- Data, information and knowledge are often used interchangeably, however, they are not the same

- Data, in itself is not knowledge, nor is information. Data *is without a meaningful relation to anything else"* (Bellinger, 2004).

Data?

- **Data:** *"data are numbers, words or images that have yet to be organized or analyzed to answer a specific question"* (Audit Commission, 2007).
- What makes numbers, words and images all data? rawness. No exact meaning or context.
- **Information:** Information is the result of *processing, manipulating and/or organizing data* or combinations of data *to answer question.*
- *"Knowledge is the full utilization of information and data, with the potential of people's skills, competencies,…..* (Grey, 2009*7)

Knowledge

- Knowledge *Involves interpreting information received, adding relevance and context to clarify the insights the information contains"* (Audit Commission, 2007)
- Knowledge: is the understanding and **interpretation** of information and its **settings** within a **meaningful** context
- There are numerous theories existence regarding not only the creation of knowledge, but also the different types of knowledge that exist.
- Cook and Brown (1999) define four types of knowledge: individual/explicit; individual/tacit; group/explicit; group/tacit.

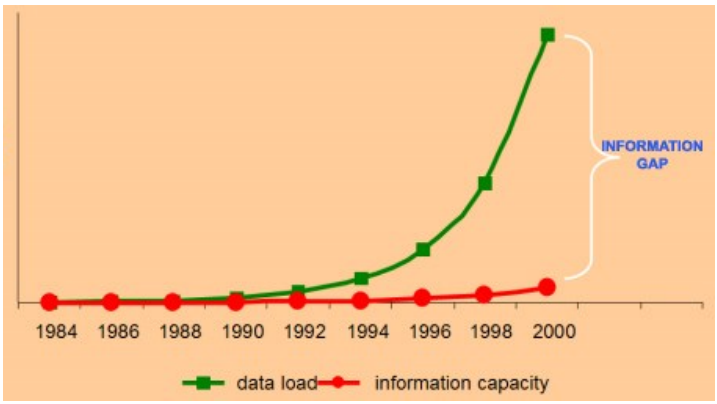
Environment public health KM

	Data	Information	Knowledge
Asthma	Number of hospital visits due to asthma	Asthma case data organized by geographic location, population, etc.	Understanding of the times and places to alert asthma patients due to risks posed by air quality
Air Quality	Ambient air quality monitoring data	Air quality measurements organized by geographic location and time.	

Why Knowledge in Health care

Flood of Information

- Huge gap in data acquisition and information → knowledge capacity



Date:

Personal History:

Name:
Age:
Nationality: ❑ **Saudi** ❑ **Other:**
Sex: ❑ **male** ❑ **female**
Occupation:
Marital Status: ❑ **Single** ❑ **married** ❑ **Other:**
Residence:

Admission Date:
Admission type: ❑ **Emergency** ❑ **Elective**
Ward / Bed:

The Complaint:

laint(s)	1.	2.	3.
ion			

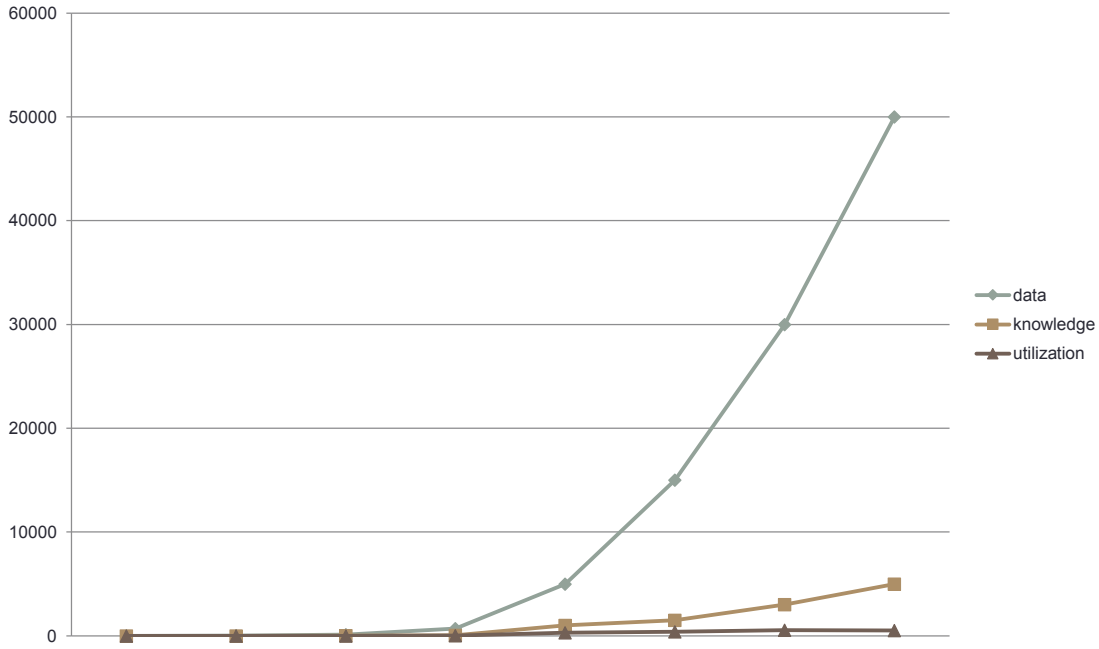
History of Presenting Illness:

tion			
e			
ency			
time			
ty			

We need better access to clinical data

- Missing clinical information during primary care visits (Smith, 2005)
  - Information reported missing in 13.6% of clinical visits
    - Available but outside system in 52% of instances
    - Estimated to adversely effect patients 44% of time
    - Unsuccessful searching for it took >5 minutes 35% of time
- Physicians have two unmet information needs for every three patients (Gorman, 1995; Ely, 1999)
- Secondary use of clinical data (Safran, 2007)

Data – knowledge - utilization



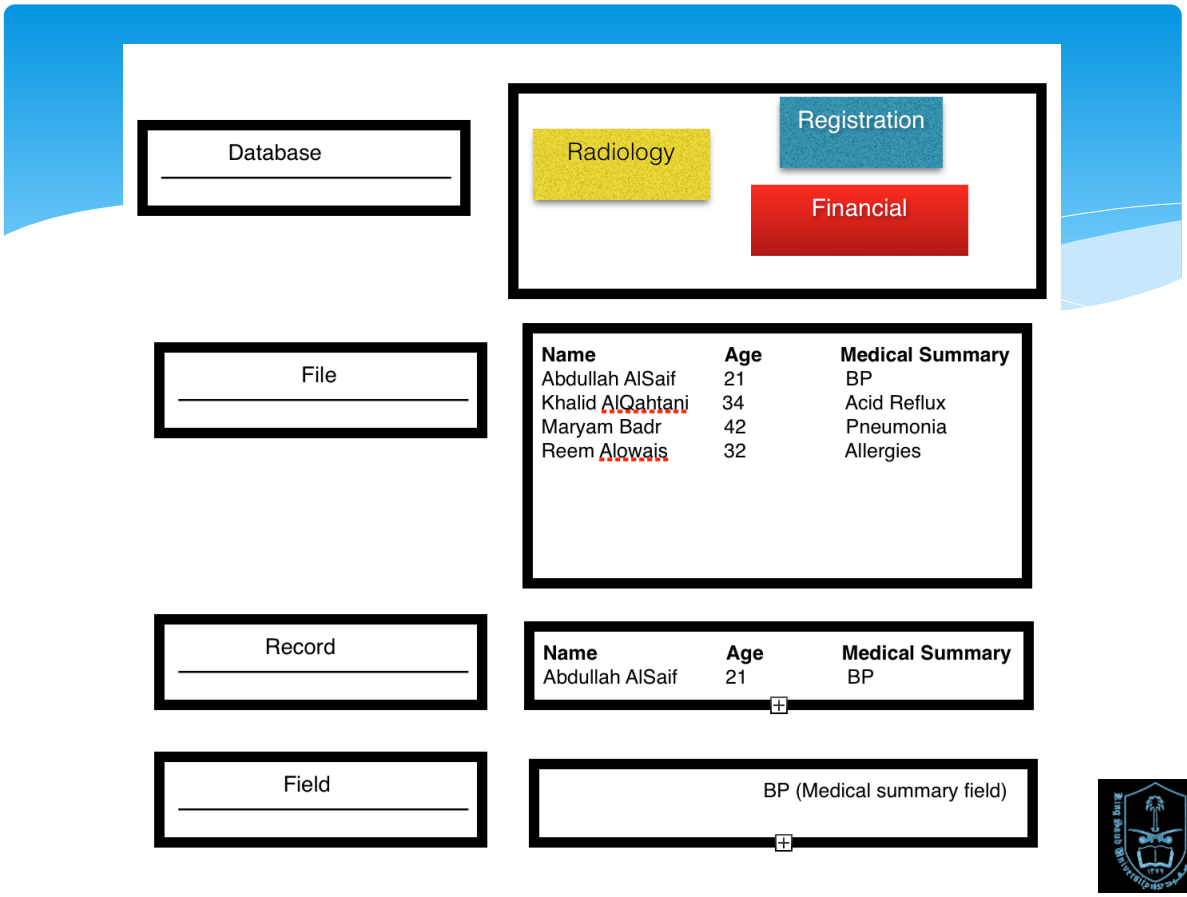
- Institute of Medicine (IOM) estimated that around 98,000 patients die each year as a consequence of preventable errors. Likewise, a study of two UK hospitals found that 11% of admitted patients experienced adverse events of which 48% of these events were most likely preventable if the **right knowledge was applied**.

- The **under-utilization** of healthcare data- information knowledge contributes to improper clinical decisions, medical errors, under-utilization of resources and raise in healthcare delivery costs

Data management

File Organization concepts

- Database: A set of related files
- File: Collection of records of same type
- Record: A set of related field
- Field: Words and numbers


Database
Radiology
Registration
Financial
File
Name Age Medical Summary
Abdullah AlSaif 21 BP
Khalid AlQahtani 34 Acid Reflux
Maryam Badr 42 Pneumonia
Reem Alowais 32 Allergies
Record
Name Age Medical Summary
Abdullah AlSaif 21 BP
Field
BP (Medical summary field)

Relational DBMS

- Relational model links records to tables
- Allows efficiencies
  - One-time information (e.g., demographics) stored only once
  - Complex queries easier to construct and carry out
- Most query capabilities are based on **Structured Query Language (SQL)**-special language in relational database

Use of clinical data

- Form basis of historical record
- Support communication among providers
- Anticipate future health problems
- Record standard preventive measures
- Identify deviations from expected trends example being a growth chart
- Coding and billing
- Provide a legal record
- Support clinical research

Types of clinical data

- Narrative: recording by clinician, e.g. maternity history
- Numerical measurements: blood pressure, temperature
- Coded data:
  selection from a controlled terminology system example being the term MI that may mean myocardial infarction or mitral insufficiency
- Textual data: other results reported as text
- Recorded signals: EKG, EEG
- Pictures: radiographs, photographs, and other images

Clinical data

- A datum is a single observation of a patient
- Clinical data are a collection of observations about a patient
- Each datum has five elements:
  - the patient (Name)
  - the attribute (heart rate)
  - the value of the attribute (52 beats per minute)
  - the time of the observation (1:00 pm on 1/1/2015)
  - the method by which the attribute was obtained (heart monitor)

Types of clinical data documents

- History and physical examination:
  - by a clinician
- Progress notes
  - update of progress by primary, consulting, and ancillary providers
- Reports
  - by specialists, ancillary providers

- Typical paper chart maintains all patient notes in chronological order, sometimes separated into different components

Assessment of a stable patient

- Chief complaint
- History of the present illness
- Past medical history
- Social history
- Family history
- Review of systems
- Physical examination
- Investigations –lab, x-ray, other
- Assessment plan

Some complications of data

- Circumstances of observation
  e.g., how was heart rate taken? pulse? EKG?
- Uncertainty
  how accurate is patient reporting, meas urement, device?
- Time
  what level of specificity do we need?

Some complications of data

- Duplication
- e.g., multiple records in different departments
- Outdated
  e.g. missing values
- Incorrectly formatted
  does not follow standards

Structure of clinical data

- Medicine lacks uniform structured vocabulary and nomenclature as does Physics and Chemistry
- Standardization and computerization of data is benefited by standard representations (Cimino, 2007)
- Counter-arguments are "freedom of expression" and "art of medicine"
- Narrative information when expressed in many ways can be ambiguous

Structured or menu-driven data entry

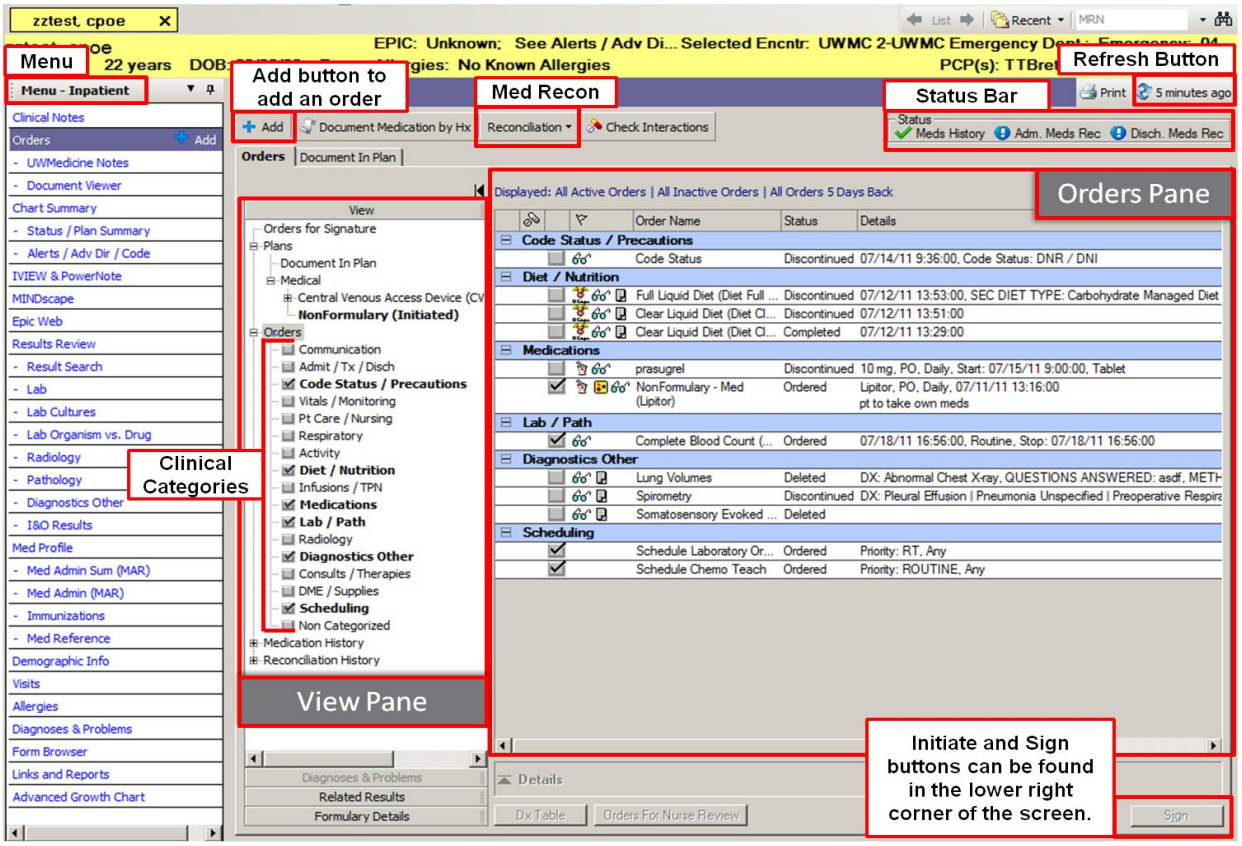
- Many attempts from old (Greenes, 1970; Cimino, 1987; Bell, 1994) to new (Oceania; OpenSDE – Los, 2005)
- Can be done via mouse or pen, with typing
- Benefits
  - Data codified for easier retrieval and analysis
  - Reduces ambiguity if language used consistently
- Drawbacks
  - In general, more time-consuming
  - Requires exhaustive vocabulary
  - Requires dedication to use by clinicians
- Alternative: Processing free text with natural language processing and tagging text (in XML) (Johnson, 2008)

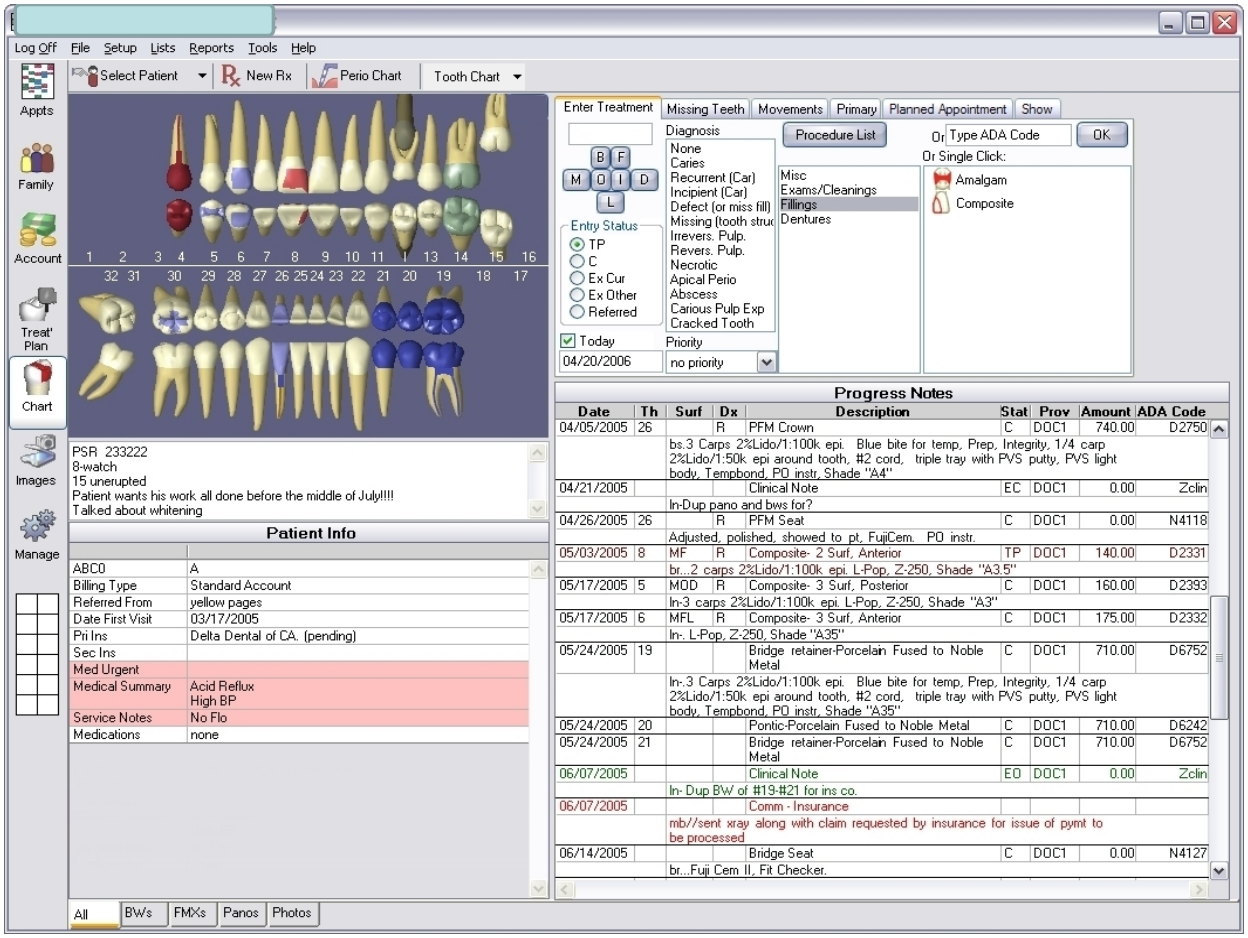
Data entry

General categories of data entry:

- Free-form entry by historical methods:
  - writing
  - dictation
  - typing
- Structured (menu-driven) data entry by mouse or pen
- Speech recognition for either of above

CPOE order screen




Log Off
File
Setup
Lists
Reports
Tools
Help
Select Patient
New Rx
Perio Chart
Tooth Chart
Appts
Family
Account
Treat' Plan
Chart
Images
Manage
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17
PSR 233222
8-watch
15 unerupted
Patient wants his work all done before the middle of July!!!!
Talked about whitening
Patient Info
ABC0 A
Billing Type Standard Account
Referred From yellow pages
Date First Visit 03/17/2005
Pri Ins Delta Dental of CA. (pending)
Sec Ins
Med Urgent
Medical Summary Acid Reflux
High BP
Service Notes No Flo
Medications none
All
BWs
FMXs
Panos
Photos
Enter Treatment
Missing Teeth
Movements
Primary
Planned Appointment
Show
Diagnosis
None
Caries
Recurrent (Car)
Incipient (Car)
Defect (or miss fill)
Missing (tooth struc
Irrevers. Pulp.
Revers. Pulp.
Necrotic
Apical Perio
Abscess
Carious Pulp Exp
Cracked Tooth
B F M O I D L
Entry Status
TP
C
Ex Cur
Ex Other
Referred
Today
04/20/2006
Priority
no priority
Procedure List
Or Type ADA Code
OK
Or Single Click:
Misc
Exams/Cleanings
Fillings
Dentures
Amalgam
Composite
Progress Notes
Date Th Surf Dx Description Stat Prov Amount ADA Code
04/05/2005 26 R PFM Crown C DOC1 740.00 D2750
bs.3 Carps 2%Lido/1:100k epi. Blue bite for temp, Prep, Integrity, 1/4 carp 2%Lido/1:50k epi around tooth, #2 cord, triple tray with PVS putty, PVS light body, Tempbond, PO instr, Shade "A4"
04/21/2005 Clinical Note EC DOC1 0.00 Zclin
In-Dup pano and bws for?
04/26/2005 26 R PFM Seat C DOC1 0.00 N4118
Adjusted, polished, showed to pt, FujiCem. PO instr.
05/03/2005 8 MF R Composite- 2 Surf, Anterior TP DOC1 140.00 D2331
br...2 carps 2%Lido/1:100k epi. L-Pop, Z-250, Shade "A3.5"
05/17/2005 5 MOD R Composite- 3 Surf, Posterior C DOC1 160.00 D2393
In-3 carps 2%Lido/1:100k epi. L-Pop, Z-250, Shade "A3"
05/17/2005 6 MFL R Composite- 3 Surf, Anterior C DOC1 175.00 D2332
In-. L-Pop, Z-250, Shade "A35"
05/24/2005 19 Bridge retainer-Porcelain Fused to Noble Metal C DOC1 710.00 D6752
In-.3 Carps 2%Lido/1:100k epi. Blue bite for temp, Prep, Integrity, 1/4 carp 2%Lido/1:50k epi around tooth, #2 cord, triple tray with PVS putty, PVS light body, Tempbond, PO instr, Shade "A35"
05/24/2005 20 Pontic-Porcelain Fused to Noble Metal C DOC1 710.00 D6242
05/24/2005 21 Bridge retainer-Porcelain Fused to Noble Metal C DOC1 710.00 D6752
06/07/2005 Clinical Note EO DOC1 0.00 Zclin
In- Dup BW of #19-#21 for ins co.
06/07/2005 Comm - Insurance
mb//sent xray along with claim requested by insurance for issue of pymt to be processed
06/14/2005 Bridge Seat C DOC1 0.00 N4127
br...Fuji Cem II, Fit Checker.

Data entry

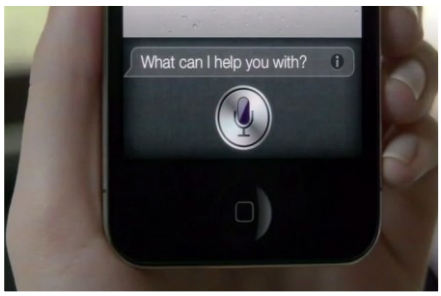
- Coded vs free text
- Coded data:
- Documentation of discrete data from controlled vocabulary
- Free text:
- Alphanumeric data that are unstructured, typically in narrative form

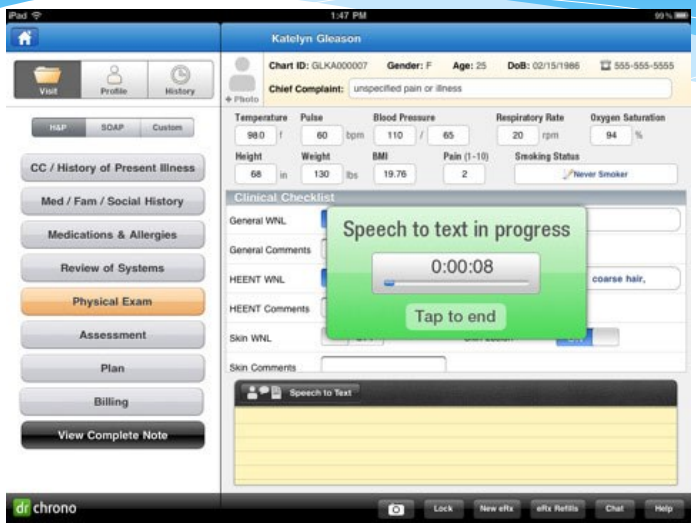
Narratives

- A narrative tells a story
- See the patient through a description
- Complicated events are even easier to describe in text
- Undifferentiated problems
- Interpretation.
- “only a human can prioritize and determine what the chief complaint really is”

Speech recognition for data entry

- Most common use is for narration
  - e.g., computer dictation of clinical notes
- An advantage is instant availability of dictated content
- Continuous speech recognition now is commercial reality
  - Speaker-dependent systems require user training
  - Speaker-independent are systems less accurate
- Many established systems on the market that operate on:
  - front-end (used by clinician) or
  - back-end (process dictations) (Brown, 2008)




iPad
1:47 PM
Katelyn Gleason
Visit
Profile
History
Chart ID: GLKA000007
Gender: F
Age: 25
DoB: 02/15/1986
555-555-5555
Chief Complaint:
unspecified pain or illness
Photo
H&P
SOAP
Custom
Temperature
Pulse
Blood Pressure
Respiratory Rate
Oxygen Saturation
98.0
60
bpm
110
65
20
rpm
94
%
Height
Weight
BMI
Pain (1-10)
Smoking Status
68
in
130
lbs
19.76
2
Never Smoker
CC / History of Present Illness
Med / Fam / Social History
Medications & Allergies
Review of Systems
Physical Exam
Assessment
Plan
Billing
View Complete Note
Clinical Checklist
General WNL
General Comments
HEENT WNL
HEENT Comments
Skin WNL
Skin Comments
Speech to text in progress
0:00:08
Tap to end
coarse hair,
Speech to Text
dr chrono
Lock
New eRx
eRx Refills
Chat
Help

Coded vs. free-text data [1]

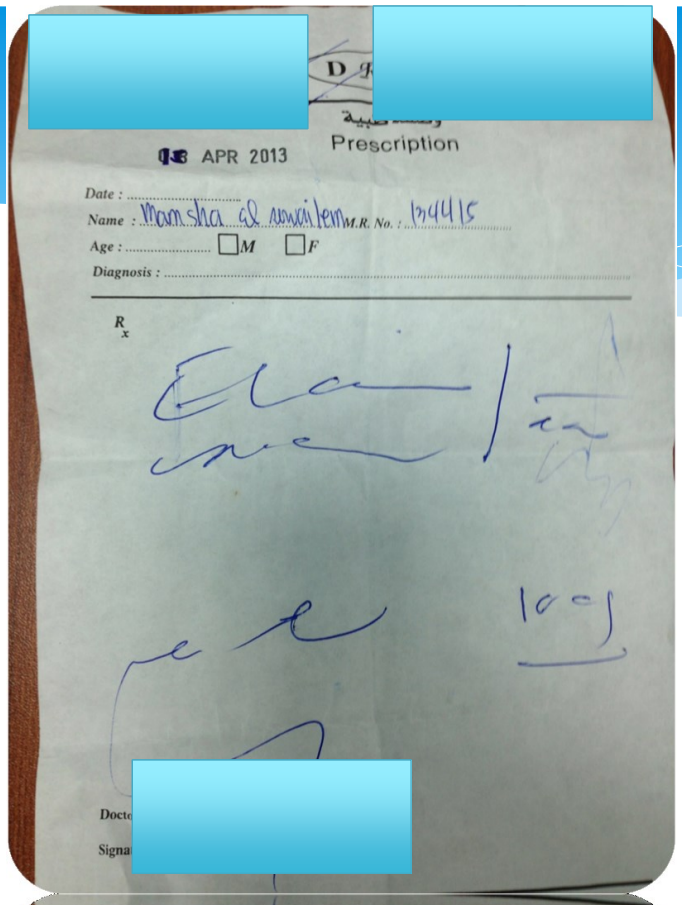
- **Coded data:**
  - Documentation of discrete data from controlled vocabulary
- **Free text:**
  - Alphanumeric data that are unstructured, typically in narrative form

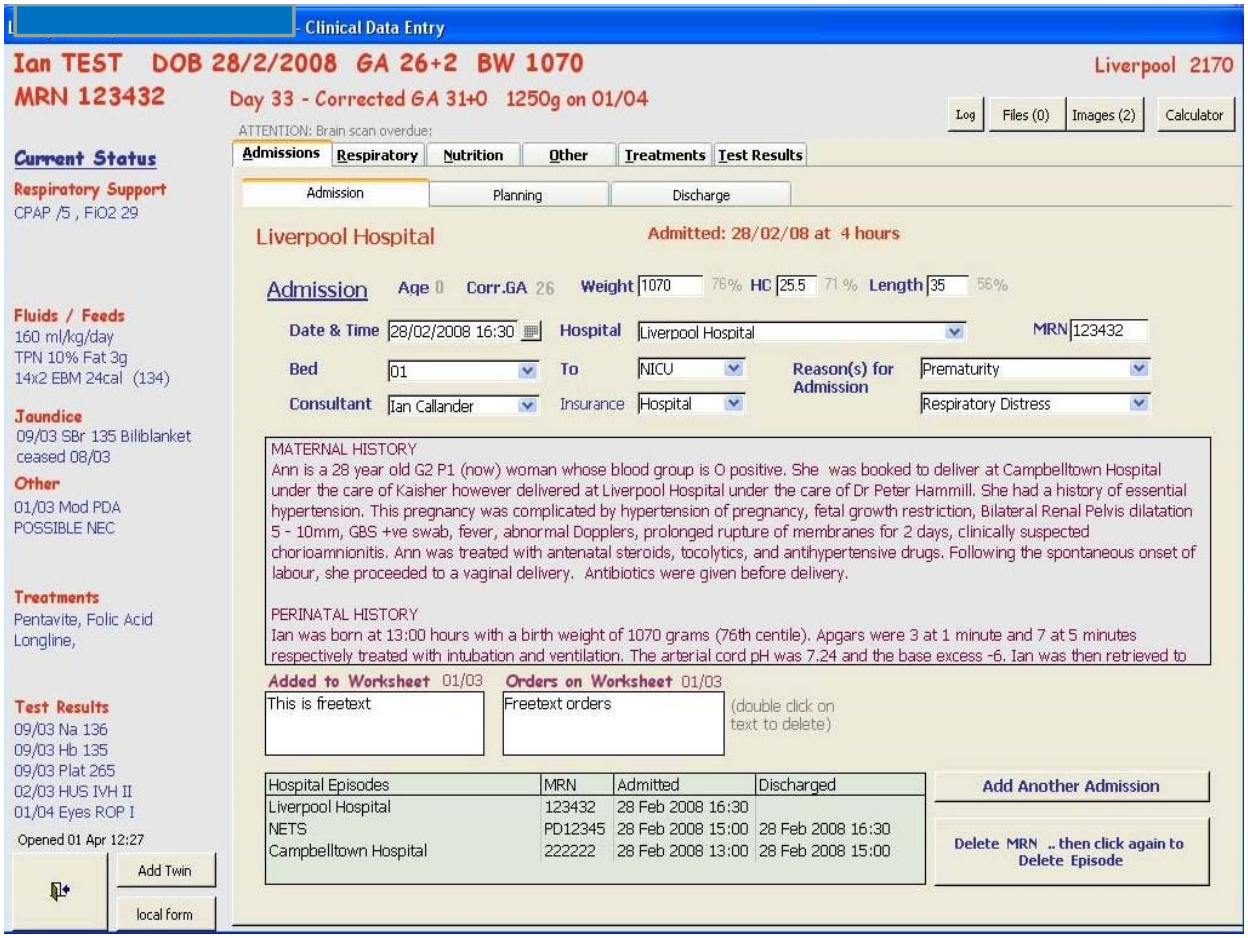
Coded Data

- Alerts
- Clinical Decision Support
- Best documentation practices
- Multi-media reporting
- Multiple output formats
- Data mining

Isses with coded data

- “pick from a list” allows wrong selection
- compliance concerns
- over documentation for care
- Cloning and limitation


13 APR 2013
Prescription
Date :
Name :
M.R. No. :
Age :
M
F
Diagnosis :
R
x


Clinical Data Entry
Ian TEST DOB 28/2/2008 GA 26+2 BW 1070
Liverpool 2170
MRN 123432
Day 33 - Corrected GA 31+0 1250g on 01/04
Log
Files (0)
Images (2)
Calculator
ATTENTION: Brain scan overdue:
Admissions
Respiratory
Nutrition
Other
Treatments
Test Results
Admission
Planning
Discharge
Current Status
Respiratory Support
CPAP /5 , FiO2 29
Fluids / Feeds
160 ml/kg/day
TPN 10% Fat 3g
14x2 EBM 24cal (134)
Jaundice
09/03 SBr 135 Biliblanket ceased 08/03
Other
01/03 Mod PDA
POSSIBLE NEC
Treatments
Pentavite, Folic Acid
Longline,
Test Results
09/03 Na 136
09/03 Hb 135
09/03 Plat 265
02/03 HUS IVH II
01/04 Eyes ROP I
Opened 01 Apr 12:27
Add Twin
local form
Liverpool Hospital
Admitted: 28/02/08 at 4 hours
Admission
Age 0
Corr.GA 26
Weight 1070 76%
HC 25.5 71 %
Length 35 56%
Date & Time 28/02/2008 16:30
Hospital Liverpool Hospital
MRN 123432
Bed 01
To NICU
Reason(s) for Admission Prematurity
Consultant Ian Callander
Insurance Hospital
Respiratory Distress
MATERNAL HISTORY
Ann is a 28 year old G2 P1 (now) woman whose blood group is O positive. She was booked to deliver at Campbelltown Hospital under the care of Kaisher however delivered at Liverpool Hospital under the care of Dr Peter Hammill. She had a history of essential hypertension. This pregnancy was complicated by hypertension of pregnancy, fetal growth restriction, Bilateral Renal Pelvis dilatation 5 - 10mm, GBS +ve swab, fever, abnormal Dopplers, prolonged rupture of membranes for 2 days, clinically suspected chorioamnionitis. Ann was treated with antenatal steroids, tocolytics, and antihypertensive drugs. Following the spontaneous onset of labour, she proceeded to a vaginal delivery. Antibiotics were given before delivery.
PERINATAL HISTORY
Ian was born at 13:00 hours with a birth weight of 1070 grams (76th centile). Apgars were 3 at 1 minute and 7 at 5 minutes respectively treated with intubation and ventilation. The arterial cord pH was 7.24 and the base excess -6. Ian was then retrieved to
Added to Worksheet 01/03
This is freetext
Orders on Worksheet 01/03
Freetext orders
(double click on text to delete)
Hospital Episodes
MRN
Admitted
Discharged
Liverpool Hospital 123432 28 Feb 2008 16:30
NETS PD12345 28 Feb 2008 15:00 28 Feb 2008 16:30
Campbelltown Hospital 222222 28 Feb 2008 13:00 28 Feb 2008 15:00
Add Another Admission
Delete MRN .. then click again to Delete Episode

Acknowledgement

- Some materials, slides and notes are **adapted with permission** from colleagues including Dr Nasriah Zakria, Dr Amr Jamar, KSU, and Professor Hersh, Oregon Health and Science University (OHSU), Oregon, USA

Best wishes

Questions?

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