Clinical Data

Amr Jamal, *MD, SBFM, ABFM, MRCGP, GCMI, MBI*

Assistant Professor and Consultant
Family Physician and Clinical Informatician
Head of Medical Informatics & e-Learning Unit (MIELU)

King Saud University, College of Medicine

2013

What are clinical data?

- A datum is a single observation of a patient
- Clinical data are a collection of observations about a patient
- Each datum has four elements:
  - the patient (Amr Jamal)
  - the attribute (heart rate)
  - the value of the attribute (52 beats per minute)
  - the time of the observation (1:00 pm on 1/1/2011) or should that be 1/1/2011?

Types of clinical data

* **Narrative:** recording by clinician
* **Numerical measurements:** blood pressure, temperature
* **Coded data:** selection from a controlled terminology system
* **Textual data:** other results reported as text
* **Recorded signals:** EKG, EEG
* **Pictures:** radiographs, photographs, and other images

Use of clinical data

* Form basis of historical record
* Support communication among providers
* Anticipate future health problems
* Record standard preventive measures
* Coding and billing
* Provide a legal record
* Support clinical research

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
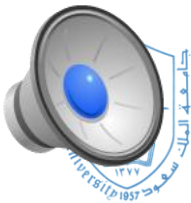
* **Circumstances of observation**

    e.g., how was heart rate taken? pulse? EKG?
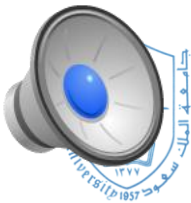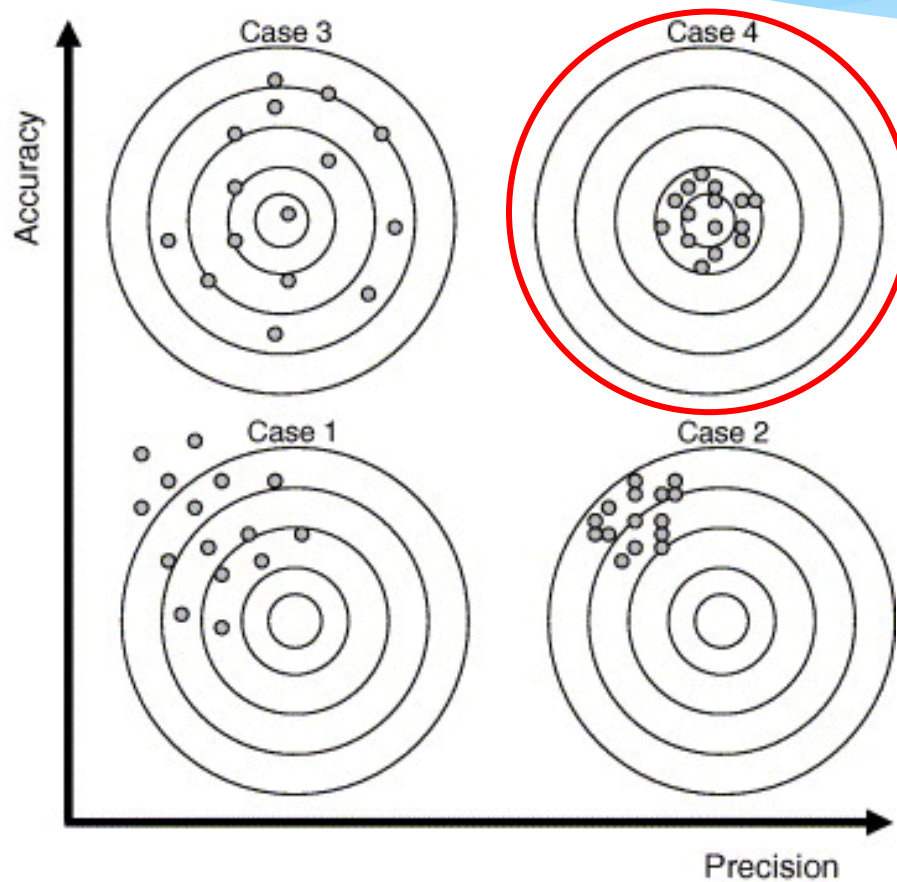
* **Uncertainty**

    how accurate is patient reporting, measurement, device?

* **Time**

    what level of specificity do we need?
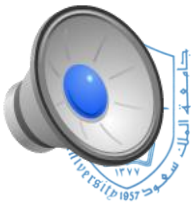
Imprecision vs. Inaccuracy

Structure of clinical data

* Medicine lacks uniform structured vocabulary and nomenclature

* Standardization and computerization of data is benefited by standard representations (Cimino, 2007)

* Counter-arguments are "freedom of expression" and "art of medicine"

* Narrative information can be expressed in many ways, can be ambiguous

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:
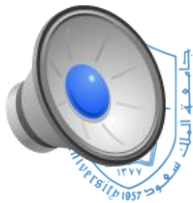
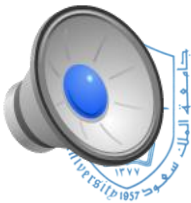| tion			
e			
ency			
time			
ty			

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 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

ORCA CPOE order screen

Menu

Add button to add an order

Med Recon

Refresh Button

Status Bar

Orders Pane

Clinical Categories

View Pane

Initiate and Sign buttons can be found in the lower right corner of the screen.

Jordan Sparks - Spander , Jason C

Select Patient   New Rx   Perio Chart   Tooth Chart

Appts
Family
Account
Treat' Plan
Chart
Images
Manage

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

Procedure List | Or Type ADA Code | OK

Or Single Click:
- Amalgam
- Composite

- Misc
- Exams/Cleanings
- **Fillings**
- Dentures

B F
M O I D
L

Entry Status
- TP
- C
- Ex Cur
- Ex Other
- Referred

☑ Today
04/20/2006

Priority
no priority

Teeth numbers (upper): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Teeth numbers: 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

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, Tembond, 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, Tembond, 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		
				br...Fuji Cem II, Fit Checker.				

All | BWs | FMXs | Panos | Photos

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)

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)
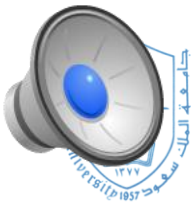
Coded vs. free-text data

* **Coded data:**
  * Documentation of discrete data from controlled vocabulary
* **Free text:**
  * Alphanumeric data that are unstructured, typically in narrative form
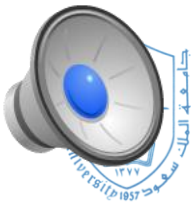
Narratives tell a story.

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

File   Edit   Default   View   Tools   Utilities   Window   Help

Exit   Save   Clear   Delete | Main Office ▼ | Barclay, Joseph   MD ▼ | Patient   History   Inbox   PAQ   Apps.   Close

Patient: John Dokes   **Age:** 47   **DOB:** 03/14/1960
Current Provider: Joseph Barclay MD   **Gender:** Male   **Current Encounter:** 06/26/2007

HOME
Demographics
Record Vital Signs
Nurse Documentation
Chart Summary
View Results

Allergies
Immunizations
Past Medical History
Family History
Social History
Health Maintenance
HPI / Problem List
Review of Systems
Physical Exam
Procedures
Assessment
Disease Management
Plan / Lab / OS / Diag
Document Library
E&M Coding

Coumadin
Adult Office Visit
Echocardiogram
Nutrition Assessment
Stress Master

Stress Nuclear

Preview   Offline

○ New patient
● Established patient
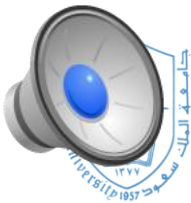
Specialty   IM
Visit Type   Office Visit

Historian   self

Referring MD | PCP Info
Alerts   Patient Service info

Reason(s) for visit   **Brief Visit**
cough   F/U ☐
headache   F/U ☐
                                       F/U ☐
                                       F/U ☐
                                       F/U ☐
                                       F/U ☐

Chronic Problem List   **Add new problem**

Chronic Problem	Code

Add to today's assessments ?

Vitals   Vital Signs Outside Normal Range   **Add New Vital Signs   Expand Vital Signs**

Date / Time	Temp F	Temp C	BP	Pulse	Rhythm	Respiration	Ht In	Ht Cm	Wt Lb	Wt Kg	Conte
06/26/2007 12:00 PM	96.4		130/90	80	regular	16	71.0		216.00		dress

Medications ☐ **No Medications**   **Comment**   **Allergies** ☑ **No Known Allergies**   **Comment**

Medication	Dose	Sig Codes	Start Date	Stop Date		Ingredient/Allergen	Brand Name
SIMVASTATIN	10MG	1T PO OD	/ /	/ /			

Health Monitor: Set Health Maintenance Protocols   Set Disease Management Protocols   **Tobacco User:** ● yes ○ quit

	Due:		Due:		Due:		Due:
Physical Exam	/ /	Tetanus	/ /	Eye Exam	/ /	ALT/AST	/ /
Lipid Panel	06/26/2007	PSA Test	/ /	Foot Exam	/ /	CPK	/ /
Colonoscopy	/ /			HgbA1C	/ /	Urinalysis	06/26/2007
Sigmoidoscopy	/ /			BMP Fasting	/ /	Urine Micro	/ /
FOBT x3	/ /			EKG	06/26/2007	TSH	/ /
Influenza Vac	/ /			Stress Test	/ /	PFT	/ /
Pneumo Vac	/ /			Echocardiogram	06/26/2007	Chest X-ray	/ /

New   Lock

📁 06/26/2007 12:00 PM
   📄 Master Im
   📄 Master Im Vitals
   ℞ Medication
   📄 Adult Office Visit
   📄 Disease Mngt

Custom ▼   ...

Ready   06/26/2007

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

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]

Fluids / Feeds
160 ml/kg/day
TPN 10% Fat 3g
14x2 EBM 24cal (134)

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.

Jaundice
09/03 SBr 135 Biliblanket
ceased 08/03

Other
01/03 Mod PDA
POSSIBLE NEC

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

Treatments
Pentavite, Folic Acid
Longline,

Added to Worksheet 01/03
This is freetext

Orders on Worksheet 01/03
Freetext orders

(double click on text to delete)

Test Results
09/03 Na 136
09/03 Hb 135
09/03 Plat 265
02/03 HUS IVH II
01/04 Eyes ROP I

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 Delete Episod

Opened 01 Apr 12:27

Add Twin

local form

Issues with coded data

* "pick from a list" allows wrong selection
* Compliance concerns
* Over documentation for care
* cloning
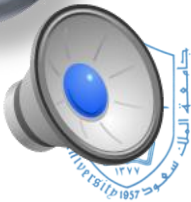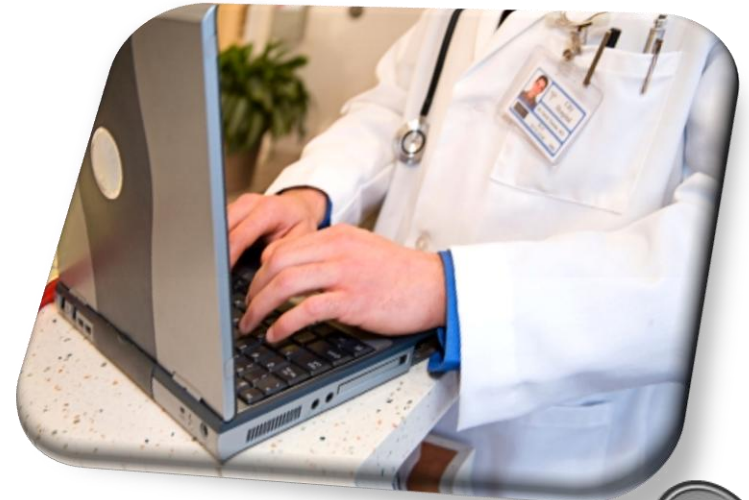
Coded clinical data enables EHR advanced functionality

* Alerts
* CDS
* Best documentation practices
* Multi-media reporting
* Multiple output formats
* Data mining

Questions for Discussion

* Will work flow disruptions and time inefficiencies preclude most providers from accepting the need for coded data entry?

* Since it is not practical to code every single data in the EHR, in what bases we can select what data to code?

In summary,

* Types of clinical data
* Types of clinical data documents
* Use of clinical data
* Access to clinical data
* Data entry
* Coded vs. free-form data
* Speech recognition