6- Clinical Decision Support System (CDSS)

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- References: 436 Doctor's Slides and notes , E.H. Shortliffe and Marsden

Objectives

Not found ☹

Color index

- Doctor's notes
- Extra information and further explanation
- Important
- Main titles
- Subtitles

This slide from doctor's slides

This slide from the book

IBM

❖ On February 14, 2011, IBM Watson changed history introducing a system that rivaled a human's ability to answer questions posed in natural language with speed, accuracy and confidence

1. Watson wins!
2. Largest Jeopardy in 5 years
   - 34.5 million Jeopardy viewers
   - 1.3B+ impressions
3. Over 10,000 media stories
4. 11,000 attend watch events
5. 2.5M+ videos views (top 10 only)
6. 10,897 twitter
7. 23,647 Facebook fans

▪ **The world is getting smarter:** instrumented + interconnected + intelligent = an opportunity to think and act in new ways (economically, socially and technically).

❖ **Healthcare industry is beset with some of the complex information challenges we collectively face:**
   - Medical information is doubling every 5 years, much of which is unstructured
   - 81% of physicians report spending 5 hours or less per month reading medical journals
   - 1 in 5 diagnosis that are estimated to be inaccurate or incomplete
   - 1.5 millions errors in the way medications are prescribed, delivered and taken in the U.S every year
   - 44,000 – 98,000 of Americans who die each year from preventable medical errors in hospital alone

▪ "Medicine has become too complex (and only) about 20% of the knowledge clinicians use today is evidence-based" Steven Shapiro, Chief medical and scientific Officer, UPMC

Medical INFORMATICS

Why is Watson Technology ideal for Healthcare?

- Understands natural language questions → What condition has red eye, pain, inflammation, blurred vision, floating spots and sensitivity to light?

- Analyzes large volumes of unstructured data → Physician Notes, Medical Journals, Clinical Trials, Pathology Results, Blogs, Wikipedia

- Generates and evaluates hypothesis →

Possible Diagnosis	Confidence
Uveitis	91%
Iritis	48%
Keratitis	29%

- Presents responses with confidence →

- Supports iterative dialogue to refine results → Family History, Patient Interview, Physical Exam, Current Medications

- Learns from results over time → What actions were taken? What treatments were prescribed? What was the outcome?

IBM and WellPoint are working together to put Watson to work in healthcare

WellPoint ➕ IBM Watson ＝

Leverage medical records
TO
diagnose and identify treatment options
TO
enhance the quality of medical care delivered

Serving 1 in 9 insured

"Imagine having the ability within three seconds to look through all of that (medical) information….at the moment you're caring for that patient."

IBM smarter healthcare

- A smarter healthcare system improves visibility and collaboration across all health system participants making best use of resources to prevent and treat diseases, reduce overall healthcare costs, and keep people healthy

❖ **Components of IBM Smarter Healthcare:**

1. **Instrumented:** computer accurate, real-time information from devices & system

2. **Interconnected:** enable seamless information sharing across group

3. **Intelligent:** use advanced analytics to improve research, diagnosis and treatment

Clinical Decision Support System (CDSS)

- **Definition:** Provide clinicians or patients with computer generated clinical knowledge and patient-related information, intelligently filtered or presented at appropriate times, to enhance patient care''

❖ **Mycin**

- Gives advice to clinicians.

- Used Artificial Intelligence.

- Production Rules knowledge gathered from discussions among experts.

- **Example:** Rule 507. Comprised of conditional statement (IF-THEN).

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Clinical Decision Support System (CDSS)

❖ **Elements of CDS:**

1. **Knowledge:**
   - Provide evidence to meet physician information needs
   - Meta-analysis of Randomized Controlled trials as evidences

2. **Patient-specific Information:**
   - Medication List
   - Problem Lists
   - Lab results and other clinical data.

3. **Filtered:** Gathering and presenting pertinent data

4. **Presented at appropriate time:** Provider able and ready to act on the information.

5. **Enhance patient care:**
   - Error prevention
   - Quality improvement
   - Lab results and other clinical data.

❖ **Decision making in medicine:**
   - **Uncertainty:** what is the diagnosis? What should the intervention be? What is the latest research that gives evidence the intervention really work?
     - **Examples:** should John gets another chemotherapy? Should Mr. James undergo a third operation? Should Mrs. Blackwood be given hepatitis B vaccination as an intervention?
     - **To ensure specificity and sensitivity**

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Clinical Decision Support System (CDSS)

Condition (as determined by "Gold standard")

		Condition Positive	Condition Negative	
Test Outcome	Test Outcome Positive	True Positive	False Positive (Type I error)	Positive predictive value = Σ True Positive / Σ Test Outcome Positive
	Test Outcome Negative	False Negative (Type II error)	True Negative	Negative predictive value = Σ True Negative / Σ Test Outcome Negative
		Sensitivity = Σ True Positive / Σ Condition Positive	Specificity = Σ True Negative / Σ Condition Negative	

Patients with bowel cancer (as confirmed on endoscopy)

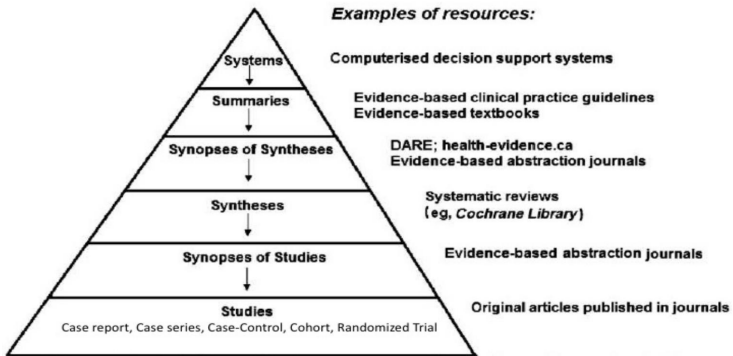|		Condition Positive	Condition Negative	
Fecal Occult Blood Screen Test Outcome	Test Outcome Positive	True Positive (TP) = 20	False Positive (FP) = 180	Positive predictive value = TP / (TP + FP) = 20 / (20 + 180) = 10%
	Test Outcome Negative	False Negative (FN) = 10	True Negative (TN) = 1820	Negative predictive value = TN / (FN + TN) = 1820 / (10 + 1820) ≈ 99.5%
		Sensitivity = TP / (TP + FN) = 20 / (20 + 10) ≈ 67%	Specificity = TN / (FP + TN) = 1820 / (180 + 1820) = 91%	

❖ **Why Clinical decision system?**

▪ **Questions**: unanswered questions, some doubts.

▪ **Information:** unmet information need, cannot process information, Lack of time, unsatisfied information need, unrecognized information need.

▪ **Inquiry:** needs time, resource Intensive (Evidence, Literature, Knowledge).

❖ Solutions are needed, so CDS can help provide ALERTS and REMINDERS
  • To avoid errors and increase patient safety –new knowledge discovery- average 17 years to take evidence into clinical practice
  • CDS embedded in EMR to improve patient safety and reduce medical errors

Clinical Decision Support System (CDSS)

Searching for evidence

Examples of resources:

Level	Examples
Systems	Computerised decision support systems
Summaries	Evidence-based clinical practice guidelines / Evidence-based textbooks
Synopses of Syntheses	DARE; health-evidence.ca / Evidence-based abstraction journals
Syntheses	Systematic reviews (eg, *Cochrane Library*)
Synopses of Studies	Evidence-based abstraction journals
Studies (Case report, Case series, Case-Control, Cohort, Randomized Trial)	Original articles published in journals

DiCenso A, Bayley L, Haynes RB. Accessing preappraised evidence: fine-tuning the 5S model into a 6S model. ACP Journal Club, 2009

❖ **CDS can help provide alerts and reminders.**

▪ **CDSS in Patient Monitoring Systems** (ex. ECG that gives out warning.).

▪ **CDSS embed in EMR and CPOE** (ex. Send reminders/warnings in test results, drug-drug interaction, dosage errors etc.).

▪ **Formulating Diagnosis.**

▪ **Formulating Treatment.**

❖ **Constructing CDSS:**

▪ Elicitation of medical knowledge
▪ Reasoning and representation
▪ Validation of system performance
▪ Integration of CDSS tools

Roles of Computer in Decision Support or Clinical Decision Support (CDS)

❖ **CDSS in Prescription**

▪ Guiding prescribing practices.

▪ Flagging adverse drug reactions.

▪ Identify duplication of therapy.

CDSS types

1. **Documentation Tool:**
   - Provide complete documentation
   - Well designed order form.
   - Required fields & Proper information.
   - Reduce error of Omission by providing selection.
   - Provide **coded data** for CDSS
2. **Relevant Data Presentation**
   - Display relevant data including costs.
   - Pertinent Data are displayed.
   - Complex Data to show overall picture
   - To highlight needed ACTIONS
3. **Order Creation Facilitators**
4. **Time-based checking & protocol/pathway support.**
5. **Reference Information and guidance**
6. **Reactive Alerts & Reminders**

CDSS types	
Sub-type	**Examples**
Documentation Tool 1. Patient Assessment Form. 2. Nursing Patient Assessment Form. 3. Clinical Encounter Patient Form 4. Departmental/multidisciplinary clinical documentation forms. 5. Data Flowsheets	1. Pre-visit questionnaires 2. Inpatient admission assessment 3. Intelligent Referral Form 4. Emergency department documentation 5. Immunization flowsheet
Relevant Data Presentation 1. Relevant data for ordering. 2. Choice list. 3. Practice status display. 4. Retrospective/aggregate reporting/filtering. 5. Environment parameter report	1. Display of relevant lab tests when ordering a medication 2. Suggest dose choice lists 3. ED tracking display. 4. Physician "report cards". 5. Recent antibiotic sensitivities
Order Creation Facilitators 1. Single order completers consequent orders. 2. Order sets. 3. Tools for complex ordering	1. Prompt Order Consequent Order Suggestions. 2. General Order Set Post Op Order Set. 3. Guided Dose Active Guidelines.
Time-based checking 1. Stepwise processing of multi-step protocol. 2. Support for managing clinical problems	1. Tools for Monitoring and supporting patient clinical pathway. 2. Computer assistant management algo.
Reference Information and guidance 1. Context-insensitive. 2. Context-sensitive	1. General Link from EMR to a reference program. 2. Direct link to a specific reference program
Reactive Alerts & Reminders Alerts to prevent potential errors	Drug Allergy Alerts Drug Interaction alert under/ Overdose Alert.

- provide clinicians or patients with computer-generated clinical knowledge and patient-related information, intelligently filtered or presented at appropriate times, to enhance patient care

يتمنى لكم فريق العمل كل التوفيق و النجاح.
في الاسفل رابط التقييم للعمل ساعدنا لتطوير العمل و ايضا التقييم يعتمد عليه في اختيار افضل فريق .