

# CDSS – Part II

## Clinical Decision Support

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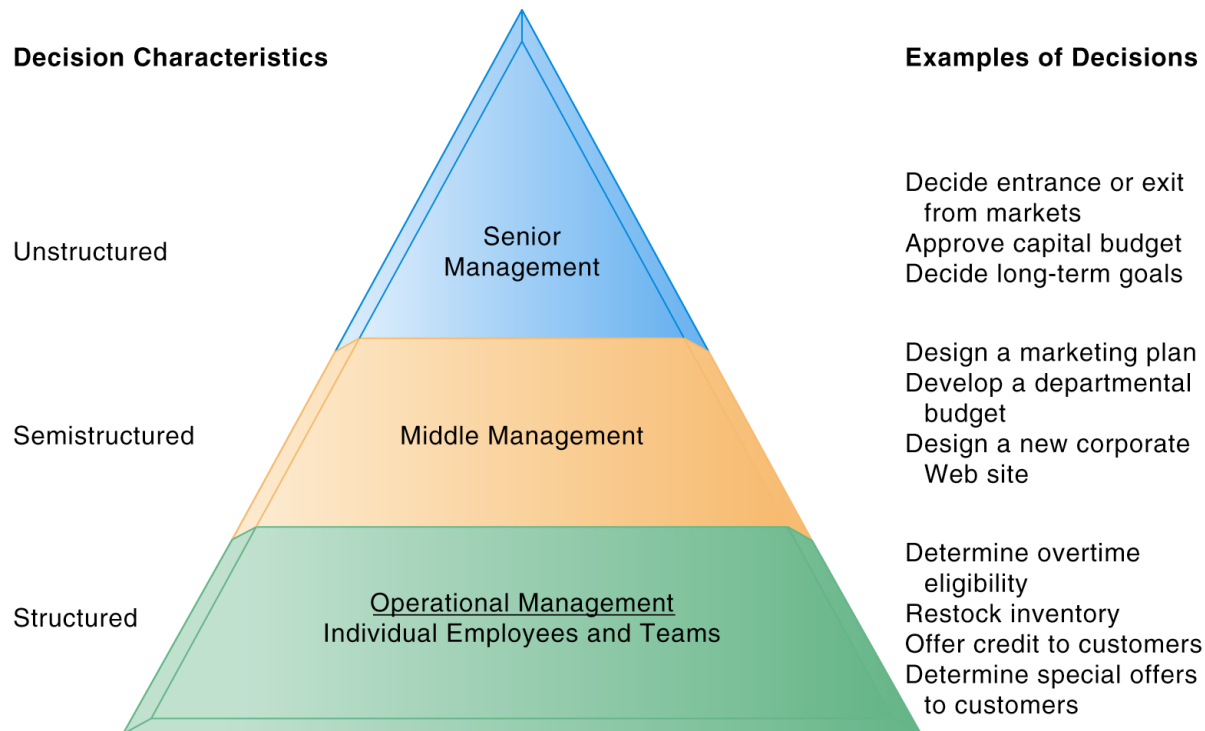
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# Decision Making and Information Systems [1]

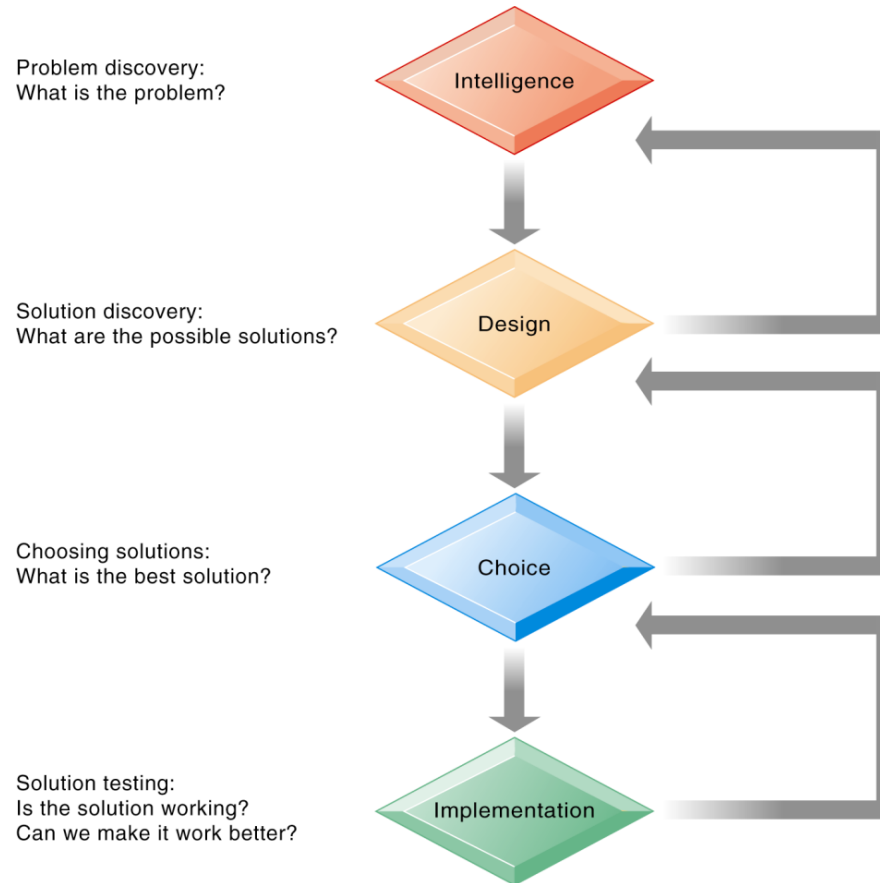
## Information Requirements of Key Decision-Making Groups in a Firm



Senior managers, middle managers, operational managers, and employees have different types of decisions and information requirements.

# Decision Making and Information Systems [1]

## Stages in Decision Making



The decision-making process is broken down into four stages.

**Figure 12-2**

- **Components of DSS**

- **Database**

- Used for query and analysis
    - Current or historical data from number of applications or groups
    - May be small database or large data warehouse

- **User interface**

- Often a Web interface

- **Software system**

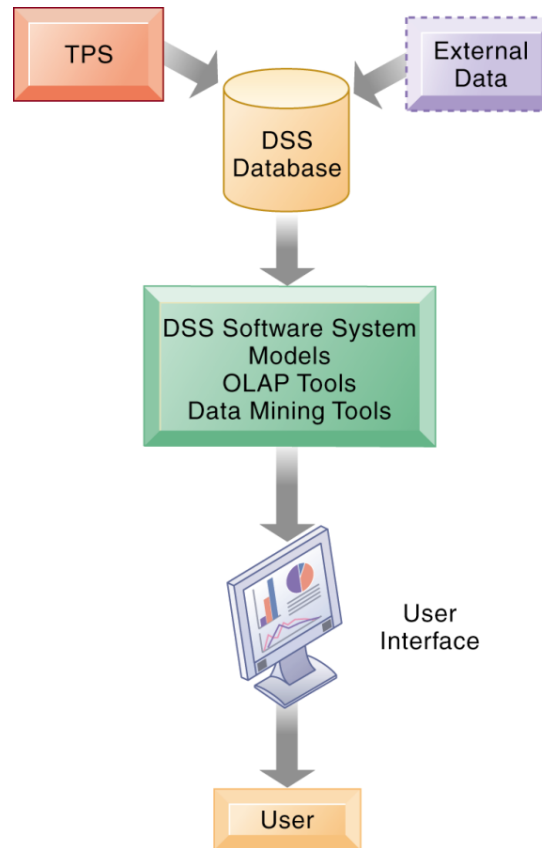
- With models, data mining, other analytical tools

# Management Information Systems

## Chapter 12 Enhancing Decision Making

### Systems for Decision Support

#### Overview of a Decision-Support System



The main components of the DSS are the DSS database, the user interface, and the DSS software system. The DSS database may be a small database residing on a PC or a large data warehouse.

**Figure 12-3**

# Star Trek & Diagnostic Device



# Futuristic ....

- \* In *Star Trek*- point diagnostic device to patients and device determine
  - \* What is the problem ?
  - \* How serious damage is?
- \* In *Star Trek*- Diagnostic device is the “Clinical Decision Support”
- \* Societal Concerns
  - \* Can computers replace doctors in making decisions?
  - \* What kinds of decisions can computers make?
  - \* How good will computers be?
  - \* What will the effects be on the practice of medicine, on medical education and on relationship among colleagues or between physicians and patients?

# 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” [2]*



# Elements of CDS [2]

- \* Knowledge

- \* Provide evidence to meet physician information needs
- \* Meta-analysis of Randomized Controlled trials as evidences

- \* Patient-specific Information

- \* Medication List
- \* Problem Lists
- \* Lab results and other clinical data

# Elements of CDS [2]

- \* Filtered

- \* Gathering and presenting pertinent data

- \* Presented at appropriate time

- \* Provider able and ready to act on the information

- \* Enhance Patient Care

- \* Error prevention
  - \* Quality improvement
  - \* Lab results and other clinical data

# Clinical Decision Support System (CDSS) [3]

- \* CDSS in Patient Monitoring Systems
  - \* Example: ECG that gives out warning
- \* CDSS embed in Electronic Medical Record (EMR) and Computerized Patient Order Entry (CPOE)
  - \* Example: Send reminders/warnings in test results, drug-drug interaction, dosage errors etc.
- \* Formulating Diagnosis
- \* Formulating Treatment

# Decision Making in Medicine [4]

- \* Uncertainty

- \* What is the diagnosis?
- \* What should the intervention be?
- \* What is the latest research that gives evidence the intervention really works?

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



# Why CDS?[2]

## 1. Questions

- \* Unanswered Questions
- \* Some doubts

## 2. Information

- \* Unmet information need
- \* Cannot process information
- \* Lack of time
- \* Unsatisfied information need
- \* Unrecognized information need

# Why CDS? [2]

- \* Inquiry & Information
  - \* Needs time
  - \* Resource Intensive (Evidence, Literature, Knowledge)

Solutions are needed.... 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 error



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

## CDSS in Prescription [5]

- \* Guiding prescribing practices
- \* Flagging adverse drug reactions
- \* Identify duplication of therapy

## CDSS in Osteoporosis Screening [6]

- \* For discussion later....

# Characterizing CDSS[2]

- \* System Function
- \* Mode of Giving Advice
- \* Style of Communication
- \* Underlying Decision Making Process



# MYCIN [3]

- \* Gives ADVICE to clinicians
- \* Used Artificial Intelligence
- \* Production Rules– knowledge gathered from discussions among experts

Example:

Rule 507

Comprised of conditional statement (IF-THEN)

# HELP [3]

- \* Developed at LDS Hospital , Salt Lake City
- \* Generate ALERTS –abnormalities in patient record
  - \* Medical record monitoring program
  - \* Used MLM (Medical logic Module)- a decision rule

Examples of functionalities

1. Alerts & Warnings for drug action
2. Interpretation of Lab tests
3. Calculation for likelihood disease

Output– communicated to the appropriate people in HIS workstation or written reports

# Evidence Based Medicine & CDSS [2]

“... use of current best evidence in making decisions .....”[2, pg. 194]

Ideally:

- \* EBM that uses Randomized Controlled Trial studies
- \* High quality literature

Weaker forms:

- \* Expert opinion

Interventions– are not based on FORMAL studies – found in BMJ

BMJ – one of the leading source of EBM studies

<http://www.bmj.com/research>



# Types of CDSS [2]

- \* See handouts

## 1) Documentation Tools

- \* Well-designed order form
- \* Required fields & Proper information
- \* Computerized Flow sheets ,Disease maintenance form, Quality Tracking tools
- \* Patient Self Assessment form, Health risk appraisals

## 2) Relevant Data Presentation

- \* Display relevant data –including costs
- \* Feedback Audit, Report card

# Types of CDSS [2]

## 3) Order Creation Facilitators

- \* Trigger consequent order
- \* Order sets : General Order set (Admission) , Condition-specific Order Set (Heart Attack), Post-Op Order Set
- \* Complex Ordering- Guided Dose, Active guidelines

## 4) Protocol and Pathway Support

- \* Disease Management- procedures over a period of time
- \* Computerized Pathway- track progress
- \* Computerized Protocols– follow procedures on proper sequence

# Types of CDSS [2]

## 5) Reference Information

- Drug, Disease, Lab references
- “Infobuttons” – linked to references/standards

## 6) Reactive Alerts and Reminders

- \* Data entry level
- \* Immediate notification for errors and hazards
- \* Lack of an order- reminder
- \* Contradictions to a procedure

# Constructing DSS[2]

- \* Elicitation of Medical Knowledge
- \* Reasoning and Representation
- \* Validation of System Performance
- \* Integration of DSS Tools

# References

- [1] Laudon & Laudon (2012). *Management Information Systems: Managing the Digital Firm*, 12<sup>th</sup> edition, Pearson Education.
- [2] Carter, J.H. (2008) . *Electronic Health Records*, 2<sup>nd</sup> edition, American College of Medicine.
- [3] Jaspers , M.N.W, Smeulers, M., Vermuelen, H., Peute, L.W. (200x). Effects of clinical decision-support systems on practitioner performance and patient outcomes: a synthesis of high-quality systematic review findings. *Journal of American Medical Informatics Association*, No 18, pp. 327-334.



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- [4] Shortliffe, E.H., Cimino, J.J. (2006). *Biomedical informatics: computer applications in health care and biomedicine*, 3<sup>rd</sup> Edition, Springer.
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