

# Universal Medical Record



# Medical Record

- What is a medical record
  - Sources of information
  - Uses
  - How is it maintained
  - What are its component parts



# Medical Record

- What is used for
  - By whom
  - How accessed
  - When accessed



# Purposes of a MR

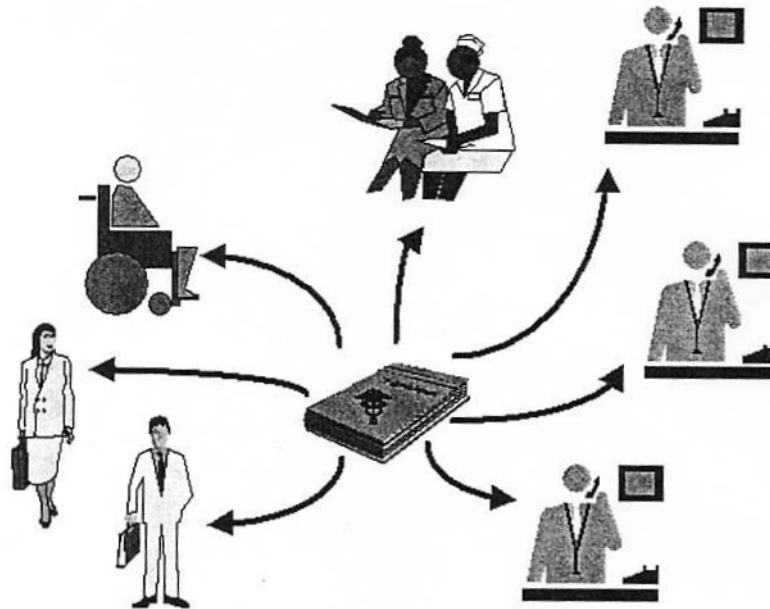
- Record information from the patient
- Record caregivers findings and (planned) treatments
- Communicate information to other (subsequent careivers)
- Coordinate the activities of caregivers
- Serve as a formal (legal/financial) record
- Provide data for studies and research





FIGURE 1.1. Inputs to the medical record. The traditional paper medical record is created by a variety of organizational processes that capture varying types of information (notes regarding direct encounters between health professionals and patients, laboratory or radiologic results, reports of telephone calls or prescriptions, and data obtained directly from patients). The record thus becomes a merged collection of such data, generally organized in chronological order.





**FIGURE 1.2.** Outputs from the medical record. Once information is collected in the traditional paper medical record, it may be provided to a wide variety of potential users of the chart. These users include health professionals and the patients themselves but also a wide variety of “secondary users” (represented here by the individuals in business suits) who have valid reasons for accessing the record but who are not involved with direct patient care. Numerous providers are typically involved in a patient’s care, so the chart also serves as a means for communicating among them. The mechanisms for displaying, analyzing, and sharing information from such records results from a set of processes that often vary substantially across several patient-care settings and institutions.



# Clinical users

- Want computer support to be “zipless”
- Computers should help with noxious tasks but shouldn't infringe on other activities
- Want intuitive interfaces requiring no training like telephone or ATM
- Need critical mass of functionality to use a workstation



# Definitions

- Patient record
  - Repository of information about a single patient
  - Generated by health care professionals
  - Information from direct interaction with a patient





# Definitions

- [Internet resource](#)
- Computer-based patient record
  - Electronic patient record
  - Resides in a system designed to support users
  - Access to complete, accurate and legible data
  - Alerts, reminders, decision support
  - Links to medical knowledge



# Definitions

- Primary patient record
  - Maintained by health care professionals
- Secondary patient record
  - Derived from primary record
  - Used to aid non-clinical workers for supporting evaluating, advancing patient care
    - Support = money
    - Evaluation = quality control, audits
    - Advancement = research



# Data

- Most people have many medical records
- Some medical centers have up to 4 million records
- Record must be stored by law for 25 years
- Storage formats
  - Paper
  - Microfiche
  - Disks, computer cards, tapes



# Data

- Average weight of a record 1.5 lbs
- 35-50% of clinician's time is spent documenting in the record



# Data

- The cost of information handling is 25% of total hospital operating cost
- Professionals spend up to 35% of their time in information handling



# Strength of the paper record

- Familiarity to users
- Portability
- No downtime (?)
- Flexibility in recording data
- Paper records can be browsed through for patterns that aren't explicitly available



# Weakness of the paper record

- Content
- Format
- Access, availability and retrieval
- Linkages and integration



# Content

- Data
  - Missing
    - Never acquired, not recorded, lost
  - Illegible
    - Handwriting appalling, worse when hurried, not standardized, ? Intended to obscure
  - Inaccurate, incomplete
    - Anesthesia record



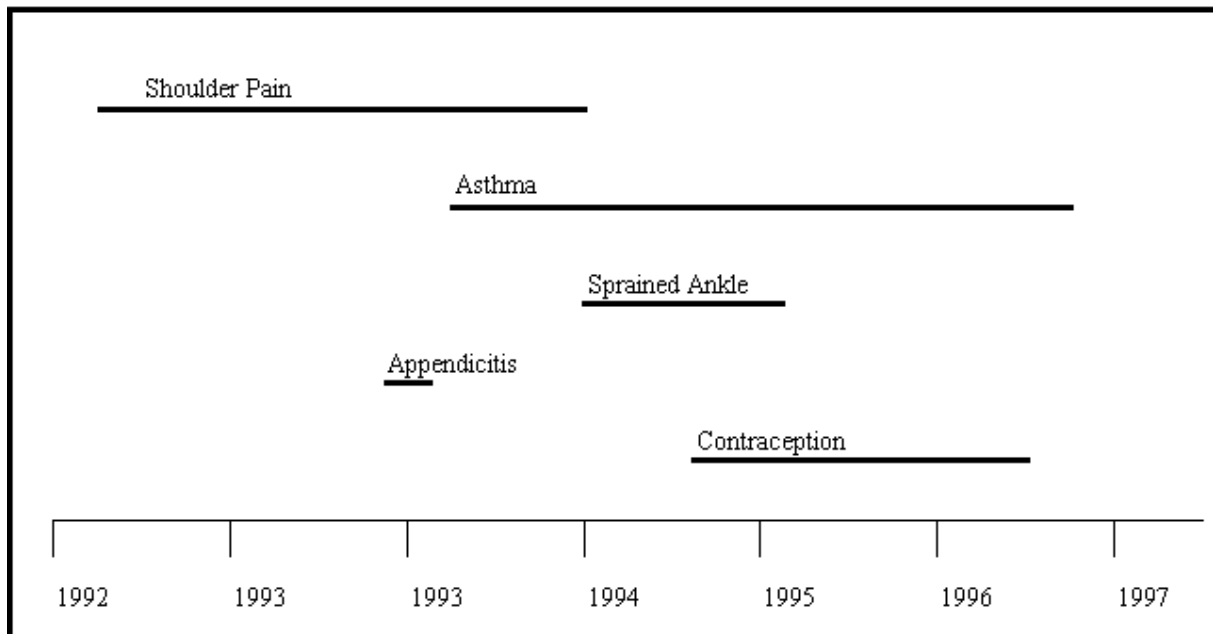


# Format

- Data fragmented and not designed for dealing with multiple problems over time
- Usually organized chronologically NOT problematically
  - POMR: Lawrence Weed



# POMR



# Access, Availability and Retrieval

- Records unavailable 10-30% of the time
- Record movement
- Simultaneous use impossible
  - ICU example

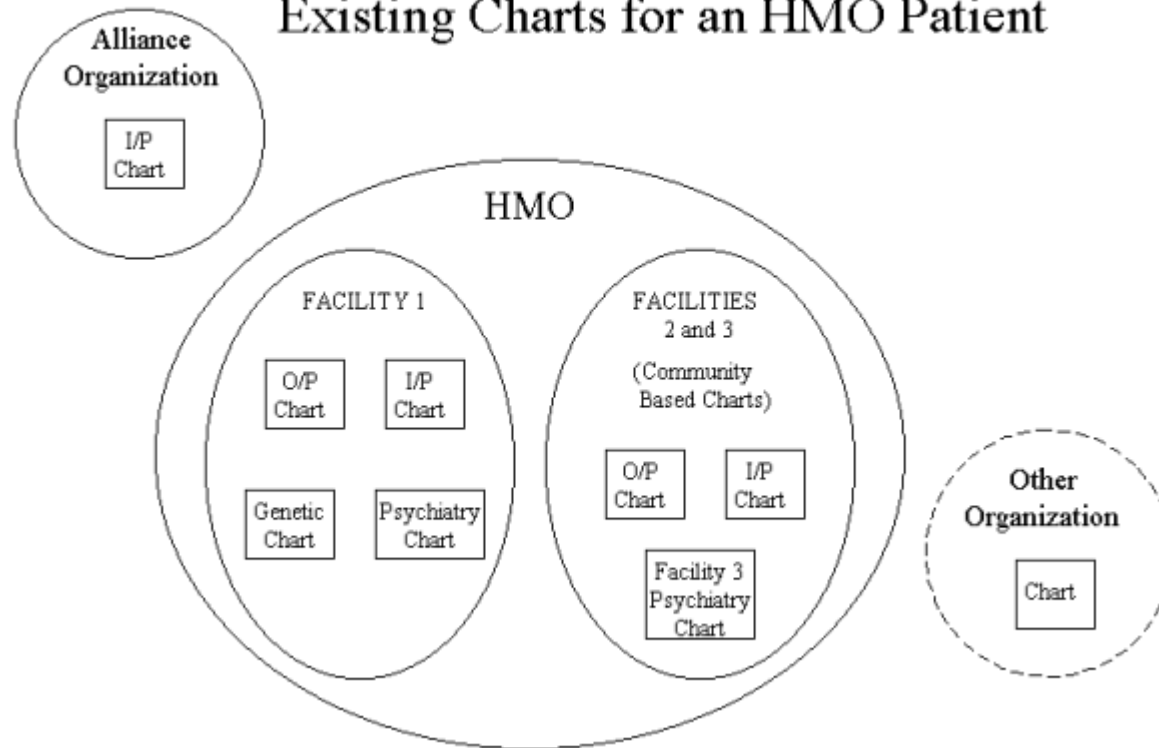


# Linkages and integration

- Discontinuity
  - Outpatient to inpatient
  - Interfaces to clinical data, other records, administrative info non-existent



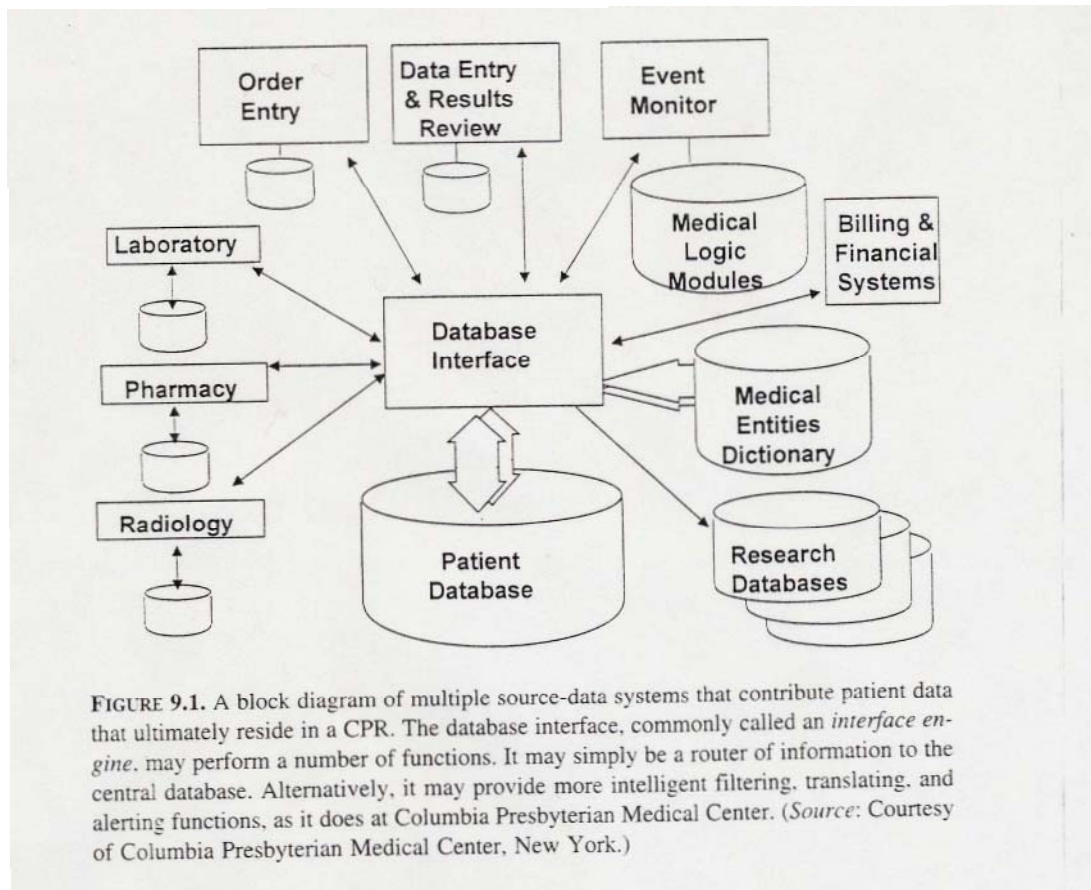
Figure 4.8: An Example of the Existing Charts for an HMO Patient



# Terminology

- CPR – computerized patient record
- EPR – electronic patient record
- UMR – universal medical record





# Disease coding formats

- Specification of disease
- Specification of procedures





Respiratory disease w/ major chest operating room procedure, no major complication or comorbidity	75
Respiratory disease w/ major chest operating room procedure, minor complication or comorbidity	76
Respiratory disease w/ other respiratory system operating procedure, no complication or comorbidity	77
Respiratory infection w/ minor complication, age greater than 17	79
Respiratory infection w/ no minor complication, age greater than 17	80
Simple Pneumonia w/ minor complication, age greater than 17	89
Simple Pneumonia w/ no minor complication, age greater than 17	90
Respiratory disease w/ ventilator support	475
Respiratory disease w/ major chest operating room procedure and major complication or comorbidity	538
Respiratory disease, other respiratory system operating procedure and major complication	539
Respiratory infection w/ major complication or comorbidity	540
Respiratory infection w/ secondary diagnosis of bronchopulmonary dysplasia	631
Respiratory infection w/ secondary diagnosis of cystic fibrosis	740
Respiratory infection w/ minor complication, age not greater than 17	770
Respiratory infection w/ no minor complication, age not greater than 17	771
Simple Pneumonia w/ minor complication, age not greater than 17	772
Simple Pneumonia w/ no minor complication, age not greater than 17	773
Respiratory infection w/ primary diagnosis of tuberculosis	798

**FIGURE 6.6.** Diagnosis-related group codes assigned to cases of bacterial pneumonia depending on co-occurring conditions or procedures (mycobacterial disease is not shown here except as a co-occurring condition). “Simple Pneumonia” codes are used when the primary bacterial pneumonia corresponds to ICD-9 code 481, 482.2, 482.3, or 482.9 (refer to Figs. 6.4 and 6.5) and when there are only minor or no complications. The remaining ICD-9 bacterial pneumonias (482.0, 482.1, 482.2, 482.4, 482.8, 484, and various other codes such as 003.22; refer to Fig. 6.4) are coded as “Respiratory Disease” or “Respiratory Infection.” Cases in which pneumonia is a secondary diagnosis may also be assigned other codes (such as 798), depending on the primary condition.



Respiratory Disorder  
 Infection of the Lower Respiratory Tract and Mediastinum  
 Acute Lower Respiratory Tract Infection  
 Pneumonia  
 Bacterial Pneumonia  
 Actinomycotic Pneumonia  
 Haemophilus Influenzae Pneumonia  
 Legionella pneumonia  
 Pneumococcal Pneumonia  
 Pneumonic Plague  
 Primary Pneumonic Plague  
 Secondary Pneumonic Plague  
 Pneumonic plague, unspecified  
 Salmonella Pneumonia  
 Typhoid Pneumonia  
 Staphylococcal Pneumonia  
 Meningococcal Pneumonia  
 Pneumonia due to Klebsiella pneumoniae  
 Pseudomonal pneumonia  
 Escherichia coli pneumonia  
 Proteus pneumonia  
 Tularemia pneumonia  
 Pertussis pneumonia  
 Anthrax pneumonia  
 Nocardial pneumonia  
 Toxoplasma pneumonia  
 Streptococcal pneumonia  
 Group B streptococcal pneumonia  
 Secondary bacterial pneumonia \*  
 Other bacterial pneumonia \*  
 Pneumonia due to other specified bacteria \*  
 Pneumonia due to bacteria NOS \*  
 Bacterial pneumonia NOS \*  
 Pneumonia due to other aerobic gram-negative bacteria \*  
 Pneumonia in bacterial disease classified elsewhere \*

**FIGURE 6.8.** Bacterial pneumonias in the Read Clinical Codes. A user can code additional infections by using Bacterial Pneumonia with one of the prescribed modifiers (Bacteria). Some of these terms also appear in other hierarchy locations; for example, Meningococcal Pneumonia also appears under Meningococcal Infection (which is under Bacterial Disease). The asterisk (\*) denotes optional terms that are included for use in classification by epidemiologists or coders but would not be included in a clinical record. (NOS = not otherwise specified.)



DE-10000	Bacterial infectious disease, NOS	(L-10000)
DE-10100	Bacterial pneumonia, NOS	(T-28000)(M-40000)(L-10000)
DE-11205	Pneumonia in anthrax	(T-28000)(M-40000)
DE-13212	Pneumonia in pertussis	(T-28000)(M-40000)
DE-13430	Pneumonic plague, NOS	(T-28000)(L-1E401)(DE-01750)
DE-13431	Primary pneumonic plague	(T-28000)(L-1E401)(DE-01750)
DE-13432	Secondary pneumonic plague	(T-28000)(L-1E401)(DE-01750)
DE-13510	Pneumococcal pneumonia	(T-28000)(M-40000)(L-25116)
DE-13934	Salmonella pneumonia	(T-28000)(L-17100)
DE-14120	Staphylococcal pneumonia	(T-28000)(L-24800)
DE-14213	Pneumonia due to Streptococcus	(T-28000)(M-40000)(L-25100)
DE-14817	Tuberculous pneumonia	(T-28000)(M-40000)(L-21801)
DE-15104	Pneumonia in typhoid fever	(T-28000)(M-40000)
DE-15613	Haemophilus influenzae pneumonia	(T-28000)(L-1F701)
DE-15710	Legionella pneumonia, NOS	(L-20401)
DE-15716	Pittsburg pneumonia	(L-20402)
DE-15810	Mycoplasma pneumonia	(T-28000)(L-22018)
DE-19110	Bacterial infection due to	(L-16001)
	Klebsiella pneumoniae	
DE-19111	Pneumonia due to	(T-28000)(M-40000)(L-16001)
	Klebsiella pneumoniae	
DE-19134	Achromobacter pneumonia	
DE-19151	Pneumonia due to Pseudomonas	(T-28000)(M-40000)(L-23400)
DE-19162	Pneumonia due to Proteus mirabilis	(T-28000)(M-40000)(L-16802)
DE-19204	Pneumonia due to E. coli	(T-28000)(M-40000)(L-15602)
DE-21611	Ornithosis with pneumonia	(T-28000)(M-40000)(L-2A902)
DE-21704	Pneumonia in Q fever	(T-28000)(M-40000)
DE-3632A	AIDS with bacterial pneumonia	(T-28000)(L-34800)(L-10000)
DE-3632B	AIDS with pneumococcal pneumonia	(T-28000)(L-34800)(L-25100)
DE-36333	AIDS with pneumonia, NOS	(T-28000)(M-40000)(L-34800)
D2-50100	Bronchopneumonia, NOS	(T-26000)(M-40000)
D2-50104	Peribronchial pneumonia	(T-26090)(M-40000)
D2-50110	Hemorrhagic bronchopneumonia	(T-26000)(M-40790)
D2-50120	Terminal bronchopneumonia	(T-26000)(M-40000)
D2-50130	Pleurobronchopneumonia	(T-26000)(M-40000)
D2-50130	Pleurpneumonia	(T-26000)(M-40000)
D2-50140	Pneumonia, NOS	(T-28000)(M-40000)
D2-50142	Catarrhal pneumonia	(T-28000)(M-40000)
D2-50150	Unresolved pneumonia	(T-28000)(M-40000)
D2-50152	Unresolved lobar pneumonia	(T-28770)(M-40000)
D2-50154	Organized pneumonia	
D2-50160	Granulomatous pneumonia, NOS	(T-28000)(M-44000)
D2-50300	Aspiration pneumonia, NOS	(T-28000)(M-40000)(G-C001) (F-29200)
D2-61020	Gangrenous pneumonia	(T-28000)(M-40700)
D8-72532	Infective pneumonia acquired prenatally, NOS	

FIGURE 6.7. SNOMED International codes for pneumonia. The first set of terms are those from the Disease axis, which are included under the Bacterial Infectious Disease hierarchy (excluding several veterinary diseases). NOS-not otherwise specified. The codes shown on the right are the SNOMED codes that, when taken together, are the equivalent of the pre-coordinated bacterial pneumonia terms. For example, "Pneumococcal pneumonia" (DE-13510) is the precoordination of the terms "Lung, NOS" (T-28000), "Inflammation, NOS" (M-40000), and "Streptococcus pneumoniae" (L-25116). The second set of terms shows some of the other pneumonia terms in SNOMED that could be coupled with specific Living Organism terms to allow postcoordinated coding of concepts not coded explicitly in SNOMED.



003 Other Salmonella Infections  
003.0 Salmonella Gastroenteritis  
003.1 Salmonella Septicemia  
003.2 Localized Salmonella Infections  
003.20 Localized Salmonella Infection, Unspecified  
003.21 Salmonella Meningitis  
003.22 Salmonella Pneumonia  
003.23 Salmonella Arthritis  
003.24 Salmonella Osteomyelitis  
003.29 Other Localized Salmonella Infection  
003.8 Other specified salmonella infections  
003.9 Salmonella infection, unspecified

**FIGURE 6.5.** Example of fifth-digit codes in the Clinical Modifications of ICD-9 (ICD-9-CM). The four-digit codes are identical to those in ICD-9; the five-digit codes were introduced in ICD-9-CM. Note that Salmonella Pneumonia has been added as a child in the 003 section; it is not included under 482 (Other Bacterial Pneumonia) or 484 (Pneumonia in Infectious Disease Classified Elsewhere).



# Medical Record

- Data formats
  - Traditional
  - Digital
  - Storage implications



SAMPLE, PATIENT  
05-APR-96 317-630-7400  
1001 TENTH ST  
INDIANAPOLIS 46202

THU AM 2 Dr: MEGREMIS, JIM G  
Wishard Memorial Hospital  
1001 W Tenth Street  
Indianapolis IN 46202

1 CLINIC VISIT, 2 CLINIC CONSULT, 3 CONSULTATION, 4 ASA EVALUATION, 5 LAB ONLY, 6 RX REFILL, 7 NO CHARGE, 8 MC CLINIC VISIT

---- Diagnoses List ----

- 1 umbilical hernia
- 2 thrush
- 3 seborrheo nos /CRADLE CAP
- 4 cough

- 5 throat pain
- 6 well child
- 7 otitis media
- 8 SICKLE TRAIT
- 9
- 10

--- Observations List ---

- 1 HEIGHT PDS \_\_\_\_\_ INCH
- 2 WEIGHT PDS \_\_\_\_\_ LBS
- 3 TEMP \_\_\_\_\_ DEG F
- 4 TEMP RECTAL \_\_\_\_\_ DEG F
- 5 TEMP AXILLARY \_\_\_\_\_ DEG F
- 6 RR \_\_\_\_\_ /MIN
- 7 PULSE \_\_\_\_\_ /MIN
- 8 HEAD CIRCUMF \_\_\_\_\_ CM
- 9 HEAD CIRC WILE \_\_\_\_\_ %
- 10 WT WILE \_\_\_\_\_ %
- 11 HEIGHT WILE \_\_\_\_\_ %
- 12 SYS BP SITTING \_\_\_\_\_ MM HG
- 13 DIAS BP SITTING \_\_\_\_\_ MM HG
- 14 TIME COUNSELING \_\_\_\_\_ MIN
- 15 TOTAL TIME c PAT \_\_\_\_\_ MIN
- 16\*IVH GRADE \_\_\_\_\_

Notes:

Age: \_\_\_\_\_  
Informant: \_\_\_\_\_  
Feedings: \_\_\_\_\_  
Elimination: \_\_\_\_\_  
Sleep: \_\_\_\_\_  
Concerns: \_\_\_\_\_

PHYSICAL EXAM:

Normal: \_\_\_\_\_ Significant Findings: \_\_\_\_\_  
Head \_\_\_\_\_  
Skin \_\_\_\_\_  
Eyes/Vision \_\_\_\_\_  
Ears/Hearing \_\_\_\_\_  
Nose/Throat \_\_\_\_\_  
Teeth/Gums \_\_\_\_\_  
Nodes \_\_\_\_\_  
Chest/Lungs \_\_\_\_\_  
Heart \_\_\_\_\_  
Pulses \_\_\_\_\_  
Abdomen \_\_\_\_\_  
Ext Genitalia \_\_\_\_\_  
Hip Abduct \_\_\_\_\_  
Back \_\_\_\_\_  
Extremities \_\_\_\_\_  
Neurc \_\_\_\_\_

DEVELOPMENT:

Feeds self, crawls \_\_\_\_\_  
Listens and imitates sound \_\_\_\_\_  
Sits without support \_\_\_\_\_  
Gets to sitting position \_\_\_\_\_  
Feeds self crackers \_\_\_\_\_  
Pulls up \_\_\_\_\_  
Vision observed \_\_\_\_\_

SAFETY:

Poison control number \_\_\_\_\_  
Syrup of Ipecac \_\_\_\_\_  
Car restraints \_\_\_\_\_  
Safe toys \_\_\_\_\_  
Prevent burns/water heater 125 \_\_\_\_\_  
Prevent choking \_\_\_\_\_

SOCIAL ASSESSMENT DONE: \_\_\_\_\_

NUTRITIONAL ASSESSMENT:

MIC: Certified/Letter A \_\_\_\_\_  
Recert Due: \_\_\_\_\_  
Risk Codes: \_\_\_\_/\_\_\_\_/\_\_\_\_

PARENTING:

Temper tantrums/limits \_\_\_\_\_  
Stranger anxiety, separation anxiety \_\_\_\_\_  
Sleep \_\_\_\_\_  
Reading to child \_\_\_\_\_  
Praise/affection \_\_\_\_\_  
Teeth care \_\_\_\_\_

NUTRITION/FEEDINGS:

Encourage cup \_\_\_\_\_  
Vit/min supp if indicated \_\_\_\_\_

IMPRESSIONS:

PLANS:

ORDERS

- \* Consider DPT immunization or record previous dates if available.
- \* Consider OPV immunization or record previous dates if available.
- \* Consider HEMOPHILUS B VACCINE or record previous dates if available.

Staff: \_\_\_\_\_ Signature: \_\_\_\_\_

30-JAN-97 Encounter Date	Provider ID	Return _____ wks months	Return Provider	Next Appt Date	PEDIATRICS Service Area
SAMPLE, PATIENT		#0999999-6	30-JAN-97 09:15 AM		
ENCOUNTER FORM			Printed: 28-Jan-97 Page: 3 OPB-8		



<b>ID:</b> age, race, gender, risk factor, protocol status		
<b>Subjective:</b>		
<b>Medications:</b> as directed, tolerating all meds		
<b>Constitutional:</b> doing well, <u>fever</u> , <u>chills</u> , sweats, night sweats, <u>fatigue</u> , <u>weight gain</u> weight loss, anorexia, headaches		
<b>Altered Consciousness:</b> confusion, anxiety, depression, memory loss		
<b>Visual:</b> blurred vision -left eye, blurred vision -right eye		
<b>ENT:</b> sore throat		
<b>Cardiovascular:</b> chest pain, cyanosis, palpitations		
<b>Pulmonary:</b> dyspnea on exertion, <u>dyspnea</u> , <u>cough</u> sputum, hemoptysis		
<b>Gastrointestinal:</b> diarrhea, hematochezia, dysphagia, abdominal pain, vomiting, change in abdominal girth		
<b>GU:</b> dysuria, flank pain, <u>urethral discharge</u> , <u>vaginal discharge</u> , contraception use		
<b>Neuro-Muscular:</b> pain, numbness, weakness		
<b>Musculoskeletal:</b> swelling, erythema, warmth		
<b>Skin:</b> rash, moles & pigmented lesions, other skin lesion, swollen lymph nodes		
Moderate cough for the last 2 days. The cough is not improving. The cough is brought on by smoking and night time.		
S2		
O1	<b>Past History</b>	<b>Onset</b>
O2		< 1 day 1 day <u>2 days</u> 3-5 days
O3		1-4 weeks 1-6 months > 6 months
O4		
O5	<b>Type</b>	<b>Relieved By</b>
A	productive non-productive	
P		<u>smoking</u> <u>night time</u> season change
N		
	<b>Laterality</b>	<b>Location</b>
	<b>Severity</b>	<b>Trend</b>
	mild <u>moderate</u> severe	unchanging -improving -worsening
	<b>Quality</b>	
	<b>Values (OK)</b>	<b>Note:</b>

FIGURE 2.12. The user interface for PEN-Ivory, a prototype system for the entry of progress notes. The left side of the screen represents the encounter form on which the names of medical findings are listed. The right side represents the attributes palette, used to augment findings with specific modifiers (in this case, modifiers refer to "cough," the current entry, which is circled in bold on the encounter form. Users circle, line out, and scratch out words to interact with the system. A text translation of the selected finding and its attributes is displayed at the top right. The page tabs located between the encounter form and the attributes palette are used to move among the pages of the encounter form. (Example screen courtesy of Alex Poon. See also Poon A.D., Fagan L.M., Shortliffe E.H. [1996]. The PEN-Ivory project: Exploring user-interface design for the collection of items from large controlled vocabularies of medicine. *Journal of the American Medical Informatics Association*.)



SEEGER, MARTY S NORTHWESTERN (12-CLIDEM) 3:53 pm

Medical Record # Patient Name (Last,First,M) Birthdate Age Sex Patient Type Primary Provider Primary Center

483823 CORMICK,MADELINE K 18/23/56 38 F FFS CURMAN,MICHAEL MAIN EPIC

**Results**

P	Status	Yield	Patient	Test	Provider	Results
+	Pending	06/28	Parini,Roberto L	STREP - RAPID SCREEN	Seeger,Marty S	Final result
+	Pending	06/01	Danvers,James	HEMATOCRIT	Seeger,Marty S	Final result
+	Pending	06/26	Able,Sarah	URINALYSIS	Seeger,Marty S	Final result
	Pending	18/18	Cormick, Madeline K	PAP SMEAR	Seeger,Marty S	Final result
	Pending	07/13	Pfeiler,Simon	UPPER GI SERIES	Seeger,Marty S	Preliminary result

Quick Browser  
 Auto Done  
 Auto Display  
 List View  
 ↑ ↓  
 ↓ ↑

Options  
 [D]Done  
 [D]Display  
 [P]Print  
 [F]Forward  
 [S]Send  
 [D]Dial  
 [Q]Quick Note  
 [F]Flowcharts  
 [L]Letter  
 [T]Telephone Enc  
 [R]Review  
 [C]Close

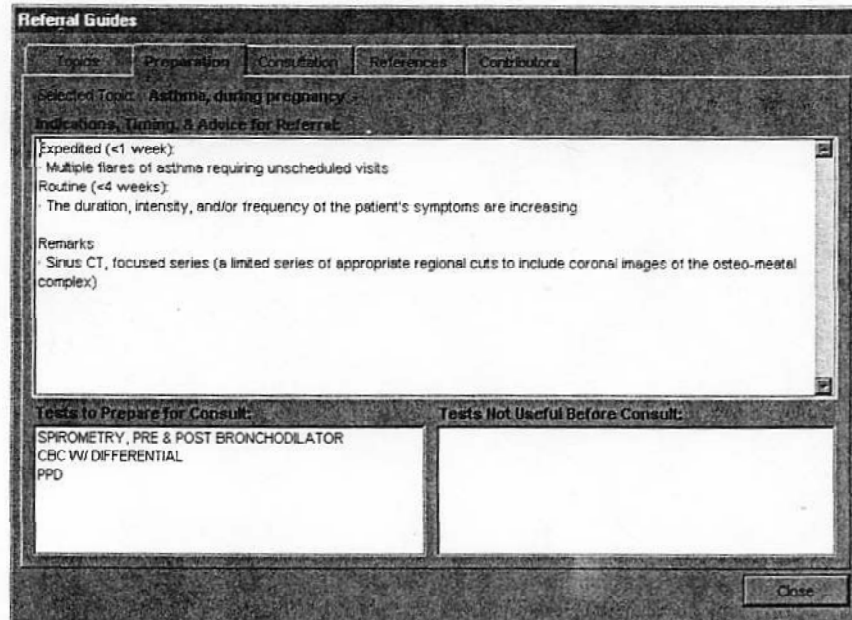
Resulted: 10/17/95 Normal Final result  
 Collected: 10/10/95 Priority: Routine  
 Lab: DANE COUNTY CYTOLOGY  
 MD: Gigi Strick, M.D.  
 Result Impression:  
 Adequate sample. No abnormal cells.  
 Normal Pap smear.  
 Provider Status: Open  
 CC Provider list: TANG, PAUL  
 SEEGER, MARTY S

Status of other order(s) for this encounter:  
 URINALYSIS [81005] Order #: 12985  
 No Result, Ordered  
 MAMMOGRAM, BOTH BREASTS [76091] Order #: 12987  
 No Result, Ordered  
 CONSULT, SURGERY [5002] Order #: 12988  
 No Result, Ordered  
 CBC [85001] Order #: 12989

FIGURE 9.12 Prompt notification of laboratory test results. When a messaging system is integrated with the CPR system, test results can be directed to the provider's in-basket as soon as they are available. By clicking on the Review button at the lower right corner, the clinician can retrieve the patient's CPR instantly and with it any relevant information that she reviewed before acting on the most recent result or message. Telephone messages and other patient-related information can be handled in the same manner. (Source: Courtesy of Epic Systems, Madison, WI.)







**FIGURE 9.9.** A CPR linked to knowledge resources so that context-specific information can be displayed at the time of clinical decision-making. For a clinician deciding whether to refer a pregnant patient with asthma to a specialist, a referral guide can provide information that may support decision-making. The guide also may support improved workflow by ensuring that relevant tests and procedures are completed before referral and that unnecessary tests and procedures are avoided. (Source: Courtesy of MedicalLogic, Hillsboro, OR.)



ENT WWW STORE LOH REPORT - Netscape

File Edit View Go Communicator Help

Back Forward Reload Home Search Guide Print Society Stop

Help Logout Cancel OK Result Data Entry User: TEST-4 TEST,USER ID  
#0005555-8 BLEVINS,LONNIE G Time: 20-AUG-97 09:16 AM Test(s): ROUTINE URINALYSIS

You may enter or modify result values.

Data Is Verified

Requesting MD 401-0

Data Set Interpreter Macdonald,Clement

Specimen Source urine

Set Comment Possible contamination

Test	Result	Comment	Normals & Units
1. COLOR-UA	pale yel		
2. TURBID URN	#1 clay		
3. GLUCOSE-UA	>/=1000 mg/dl		
4. BILIRUBIN-UA	small		
5. KETONES-UA	trace		
6. SP GRAV-UA	1.005		1.005 - 1.03
7. HGB-UA	moderate		
8. PH-UA	6.2		5 - 8
9. PROTEIN-UA	trace	very, very small amount	
10. UROBILINOGEN-UA	.7		2 - 1 EU/DL SEMI
11. NITRITE-UA	negative		
12. WBC ESTERASE-UA	trace		

Field Controls

Del 7 8 9

Orig 4 5 6

Same 1 2 3

Help 0 1 2

Next

Prev

TURBID URN

clear

clear

cloudy

Pick one:

Dictation Controls

Rec Play Stop

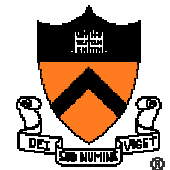
Document Done

FIGURE 9.3. Web resources. (a) Web-browser display of ECG results, measurements, and diagnostic impressions. When the user clicks on the icon, the computer displays the full ECG tracing. (Source: Courtesy of Regenstrief Institute, Indianapolis, IN). (b) A general data-gathering Web page. The form and content are driven by a set term (in this case *urinalysis*). Digital voice input is allowed on any text field (using dictation controls displayed on the right). The system compresses speech to 270 bytes per second using VOXWARE's algorithm. (Source: Courtesy of Regenstrief Institute, Indianapolis, IN.)



# Outpatient documents

Document	Description
History and Physical	The patient's initial medical examination and evaluation data. This document includes the following: chief complaint (CC), history of present illness (HPI), past medical history (PMH), family history (FH), social history (SH) and marital history, review of systems (ROS), physical exam (PE), assessment, diagnosis (Dx), impression, rule out (R/O), plan, prognosis (Px).
Progress notes	Documentation for a follow-up visit. The physician's objective findings concerning improvement or aggravation of the condition, any change in treatment or medication, and the patient's own report about the condition.
Physician's orders	A record of a physician's medical orders.
X-rays, other diagnostic images, EKGs, etc.	
Diagnostic findings	Diagnostic and laboratory data--for example, hematology, pathology, radiology, and X-ray test results and transcriptions.
Correspondence / E-mail	Letters and E-mail conveying clinical information on the patient.
Phone messages	Phone messages conveying clinical information on the patient.
Consent forms	A patient's or patient's guardian's consent for treatment, special procedures or to release information.
Consultation reports	An opinion about the patient's condition by a practitioner other than the primary care physician.



Document	Description
Face sheet	Information identifying the patient, including name, admission date, address and birth date, emergency contact and closest relative, allergies, admitting diagnosis and attending physician.
Medical history and physical examination	The patient's initial medical examination and assessment data completed by the physician.
Initial nursing assessment form	Initial assessment.
Physician's orders	A record of a physician's medical orders.
Problem or nursing diagnosis list	List of nursing diagnoses.
Nursing plan of care	Plans for patient care.
Graphic sheet	A type of flow sheet showing graphic recording of the patient's temperature, pulse rate, blood pressure, and possibly daily weight.
Other flow sheets	Abbreviated progress notes, recording dates, times, changes in the patient's condition.
Medication administration record (MAR)	A recording of each medication the patient receives, including name, dosage, route, site, and date and time of administration.
Physician's progress notes	Physician's observations, notes on the patient's progress, and treatment data.
Nurses' progress notes	Patient care information, interventions, and patient's responses.
Consultation sheets	Reports of evaluations made by physicians and others called in for opinions and treatment recommendations.
Health care team records	Notes from other departments, including physical therapy and respiratory therapy.
X-rays, other diagnostic images, EKGs, etc.	
Diagnostic findings	Diagnostic and laboratory data--for example, hematology, pathology, radiology, and X-ray test results and transcriptions.
Consent forms	A patient's or patient's guardian's consent for treatment, special procedures or to release information.
Incident report	Information about a reportable event.
Advance directives	A legal, written document that specifies patient preferences regarding future health care or specifies another person to make medical decisions in the event that the patient is unable to do so.
Discharge plan and summary	A brief review of the patient's hospital stay and plans for care after discharge.



**Figure 4.6 – Possible Emergency Department Clinical Documents**

<b>Document</b>	<b>Description</b>
Triage documentation	This document, which may be a part of another document such as the Nursing flow sheet, records information which determines how to triage the patient. Information may include mode of arrival, acuity, chief complaint, medications, allergies, nursing actions at triage.
Medical history and physical examination	The patient's initial medical examination and evaluation data. This document includes the following: chief complaint (CC), history of present illness (HPI), past medical history (PMH), family history (FH), social history (SH) and marital history, review of systems (ROS), physical exam (PE), assessment, diagnosis (Dx), impression, rule out (R/O), plan, prognosis (Px).
Progress notes	The physician's objective findings about improvement or stabilization of the condition.
Nursing flow sheet	Abbreviated progress notes, recording times, treatments, medications and diagnostic tests given, changes in the patient's condition, including vital signs.
Physician's orders	A record of a physician's medical orders.
X-rays, other diagnostic images, EKGs, etc.	
Diagnostic findings	Diagnostic and laboratory data--for example, hematology, pathology, radiology, and X-ray test results and transcriptions.
Emergency Room discharge instruction sheet	Lists discharge instructions for diet, treatments, medications, activities and follow-up visits.
Follow-up after discharge	Documentation of calls to patients following discharge from the ED.



A natural and seemingly straightforward way of organizing documents making up the patient chart is to categorize source documents and other patient clinical information as to whether they apply to an

- inpatient stay, including hospice, SNF, subacute care facility, etc.
- outpatient visit
- emergency department (ED) visit
- surgery
- phone call consult that takes the place of an outpatient visit
- e-mail consult [1]
- observation visit
- home health care visit.



The following are assumed attributes of a universal patient record:

1. To allow communication between differing healthcare institutions, the universal patient record must have a commonality of information.
2. However, to support the different needs of healthcare organizations, the universal patient medical record must also allow for a diversity of formats for medical record documentation.
3. The universal patient record must use agreed-upon healthcare industry data standards.
4. The universal patient record may be stored anywhere and retrievable from anywhere and thus requires a common secure network shared by healthcare organizations.
5. The universal patient record must be able to employ security measures to control the visibility and availability of information. Authorized parties can request permission to copy source documents, and the owner or creator of a source document can grant permission to an authorized party to copy the document, perhaps with certain categories of permissions granted by policy.
6. The universal patient record must be able to accommodate information in any language that care is given in.



**Figure 5.7—Twenty-five Documentation Problems, Errors and Suggestions**

Number	Description	Eliminated by Automation of the Patient Chart?
1	Illegible notation	Yes
2	Failure to identify the patient being treated	Yes
3	Failure to identify the date (and time) of treatment	Yes
4	Use of multiple or inconsistent documentation formats by providers in a facility	Yes
5	Failure to use an indelible instrument to record treatment entry	Yes
6	Pen runs out of ink midway through a treatment entry	Yes
7	Provider editing chart removing the originally entered data	Yes
8	Not signing treatment entries	Yes
9	Not properly correcting errors in treatment entries	Yes
10	Unauthorized abbreviations	Yes
11	Improper spelling, grammar, and use of extraneous verbiage not affecting patient care	Yes
12	Physician orders: ambiguous orders, treating patients without written orders	Largely
13	Untimely documentation of patient care	No
14	Identifying the filing of an incident report in the patient record--it should not be mentioned	No





15	Delineating patient care rendered and clinical information supplied by another caregiver	No
16	Blaming or disparaging another provider in the patient treatment record	No
17	Expressing personal feelings about a patient in the treatment record	No
18	Especially the 'O', 'A' and 'P' parts of the SOAP note must be written in objective, unambiguous and where possible quantifiable terms. Providers should avoid ambiguous conclusions such as "appears within normal limits".	Potentially
19	Not documenting with specificity	Potentially
20	Recording hearsay as fact	No
21	Special caution is not exercised when countersigning another provider's evaluation or treatment	No
22	Failure to document a patient's informed consent to treatment	Yes
23	Failure to thoroughly document discharge, home care, and follow-up instructions issued to patients and/or family members or significant others	To some extent
24	Failure to carefully document a patient's noncompliance with treatment orders	No
25	Failure to carefully document a patient's or family member or significant other's possible contributory negligence	No



Figure 6.2: CPR Repository and Source Document Repository

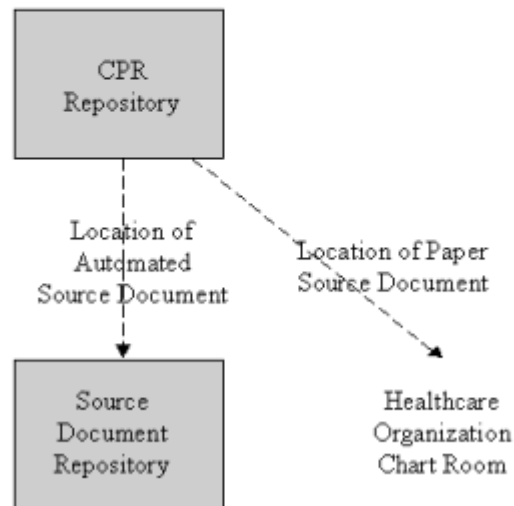


Figure 6.4: Functioning of the Repositories

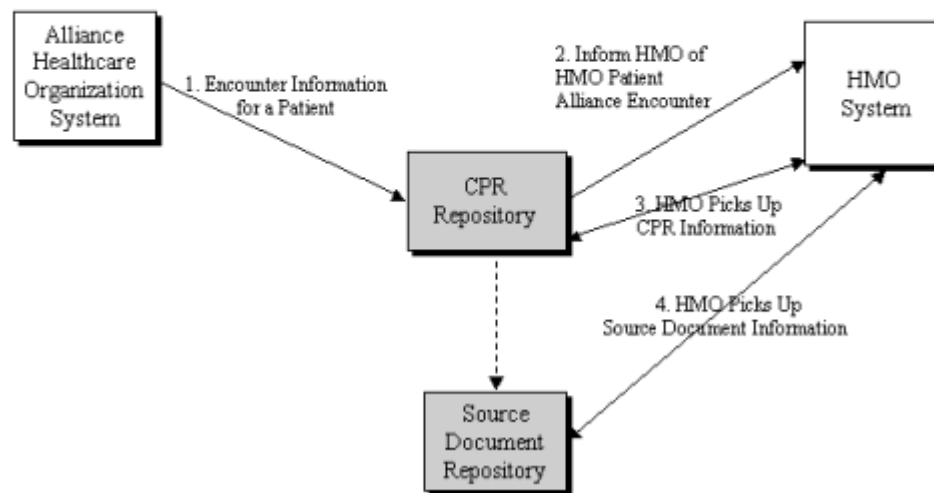
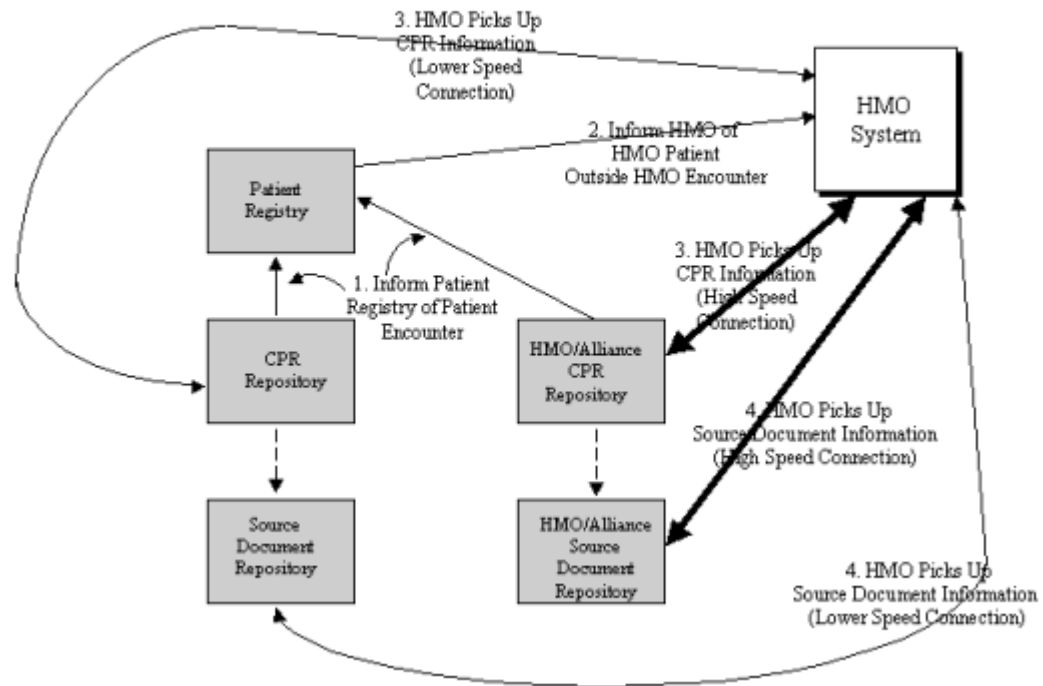
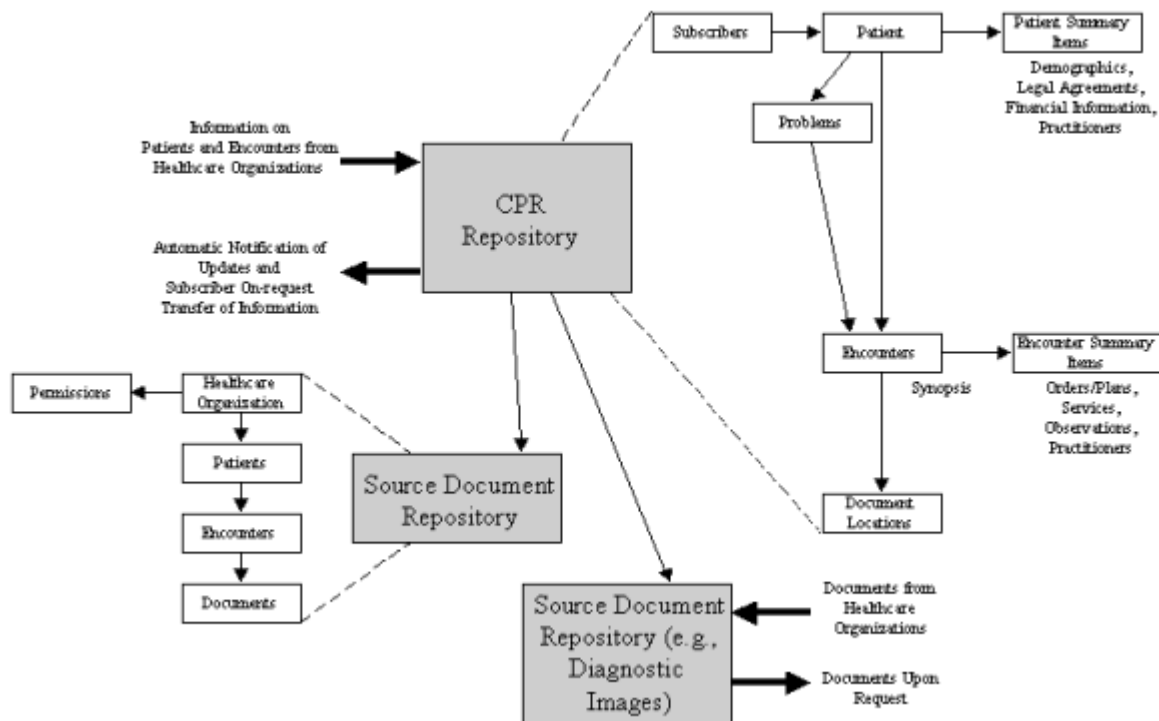


Figure 6.5: Later Repositories and Registry





**Figure 13.6: CPR Repository**

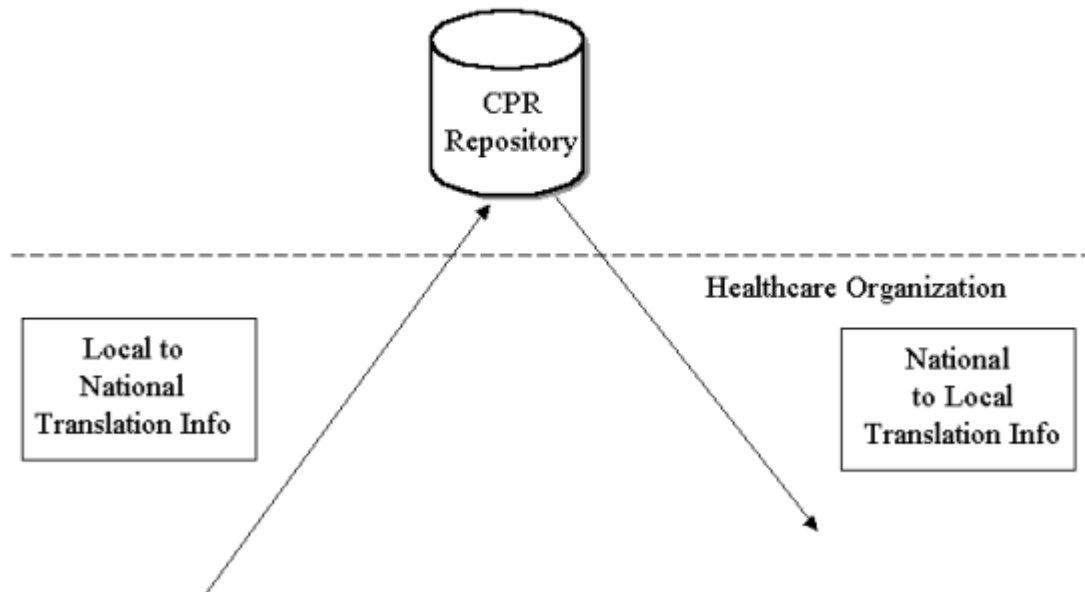
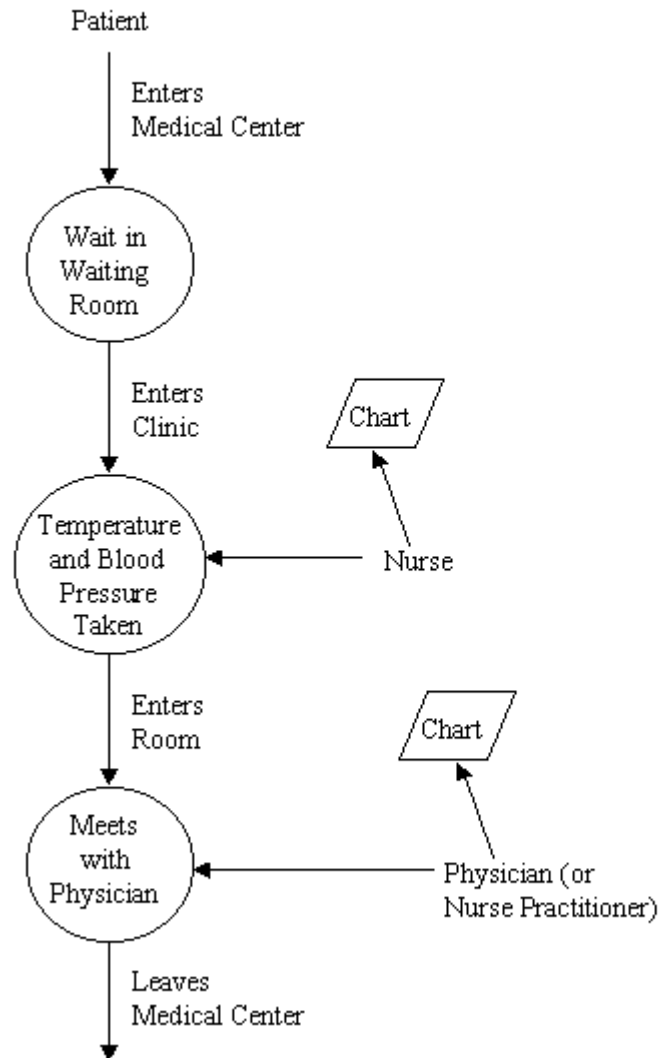
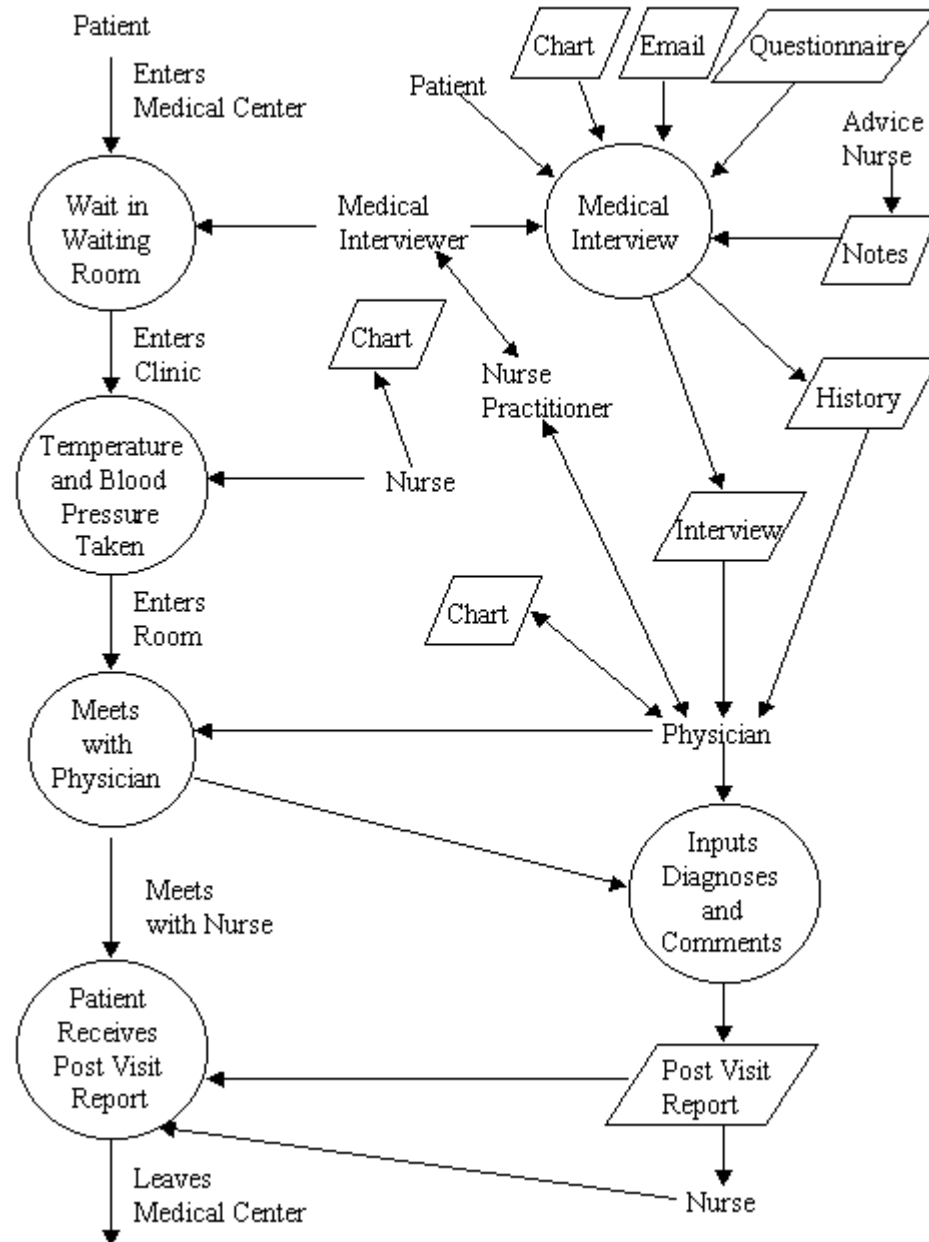


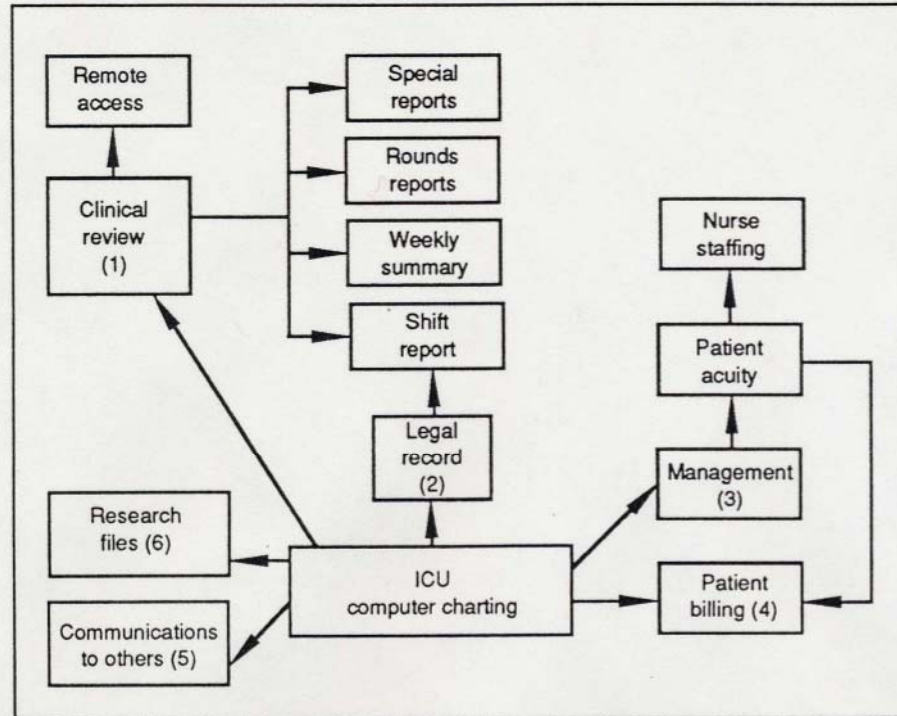
Figure 8.3-1: Traditional Outpatient Paradigm



# Post Visit Report







**FIGURE 13.19.** Block diagram showing the six major areas in which healthcare professionals interact with computer-based ICU charting to make patient care more effective and efficient. See text for explanations of functions. (Source: Reprinted with permission from Gardner R.M., Sittig D.F, Budd, M.C. [1989]. Computers in the intensive care unit: match or mismatch? In Shoemaker W.C., et al. (Eds.), *Textbook of Critical Care* (2nd ed. (p. 249). Philadelphia: W.B. Saunders.



**Figure 7.16--New Conceptual View**

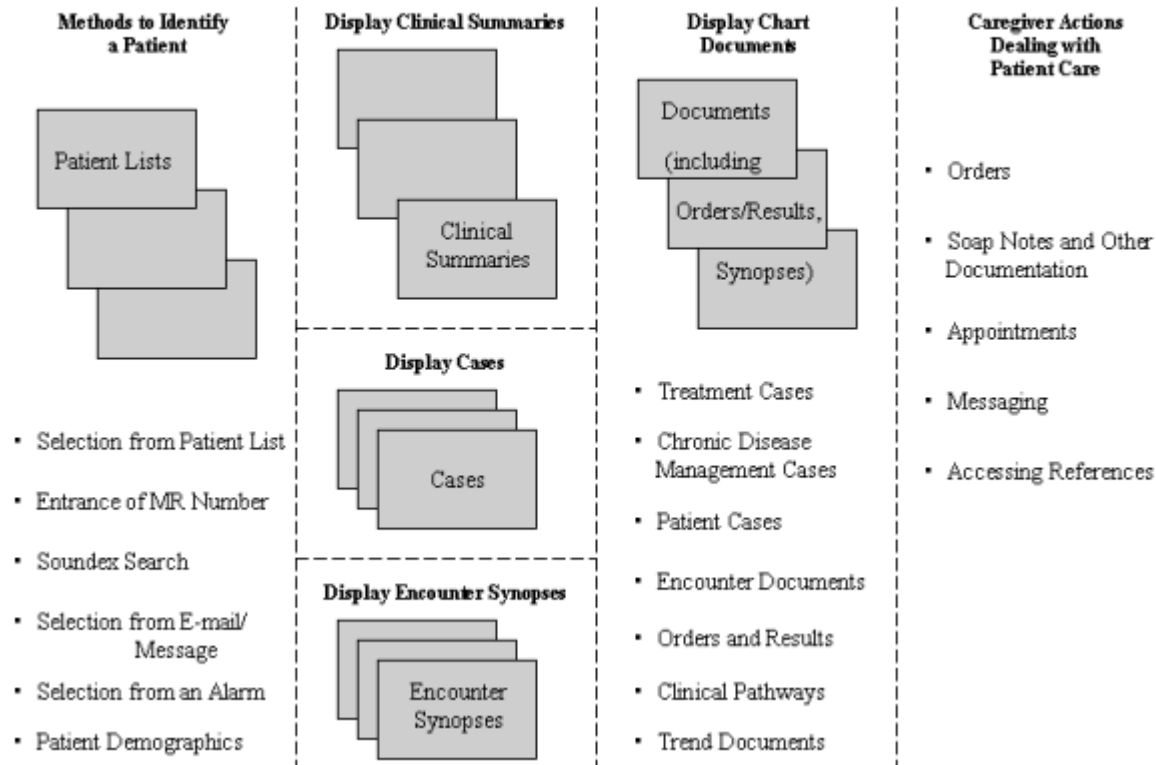
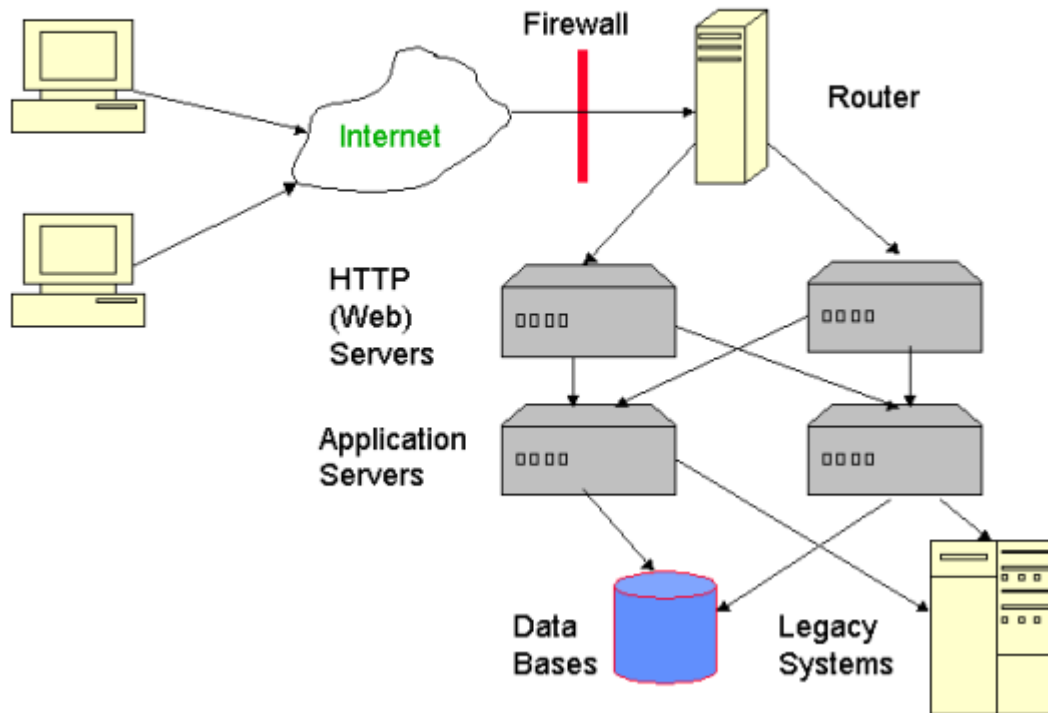


Figure 12.22: An N-Tier System

System Users



```

<?xml version="1.0" encoding="UTF-8"?>
<patientreferral >

  <Header>
    <TransmissionFrom>... TRANSMISSION-FROM Information ...</TransmissionFrom>
    <TransmissionTo>... TRANSMISSION-TO Information ...</TransmissionTo>
    <DateIssued>2001-01-10</DateIssued>
  </Header>

  <Patient>
    <IdList>
      <Id type="universal">
        <IdMnemonic>0912873456</IdMnemonic>
        <AssigningAuthority>U. S. Assignment Authority</AssigningAuthority>
      </Id>
      <Id>
        <IdMnemonic>38933845</IdMnemonic>
        <AssigningAuthority>Lytton HMO</AssigningAuthority>
      </Id>
    </IdList>
    <PersonName>Jane Louise Doe</PersonName>
    <Sex Sex.HL70001="F" >Female</Sex>
    <BirthDate>1960-02-29</BirthDate>
  </Patient>

  <DiseaseList>
    <Disease>
      <DiseaseString>Lump or mass in breast</DiseaseString>
      <DiseaseCode>611.72</DiseaseCode>
      <DiseaseCodeSystem>ICD-9</DiseaseCodeSystem>
    </Disease>
  </DiseaseList>

  <ReferralPurpose>Evaluation of mammogram.</ReferralPurpose>

  <OtherDocumentList>
    <OtherDocument>Mammogram</OtherDocument>
  </OtherDocumentList>

</patientreferral>

```



Figure 13.55--Inheritance

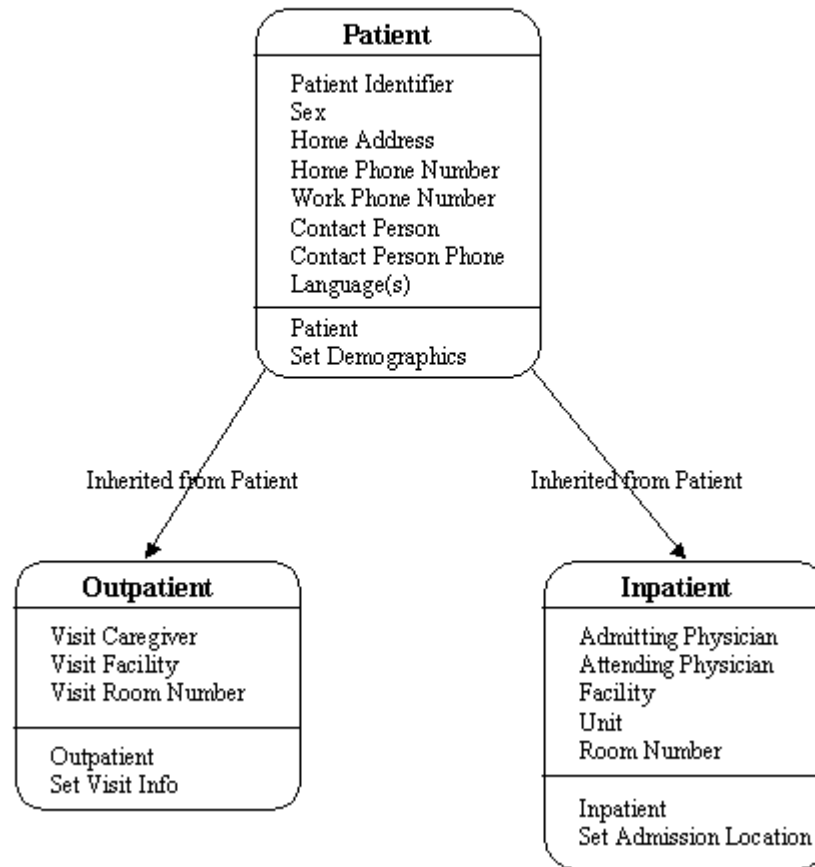


Figure 12.21: Proposed Internet Interconnections  
with an Automated Patient Medical Record

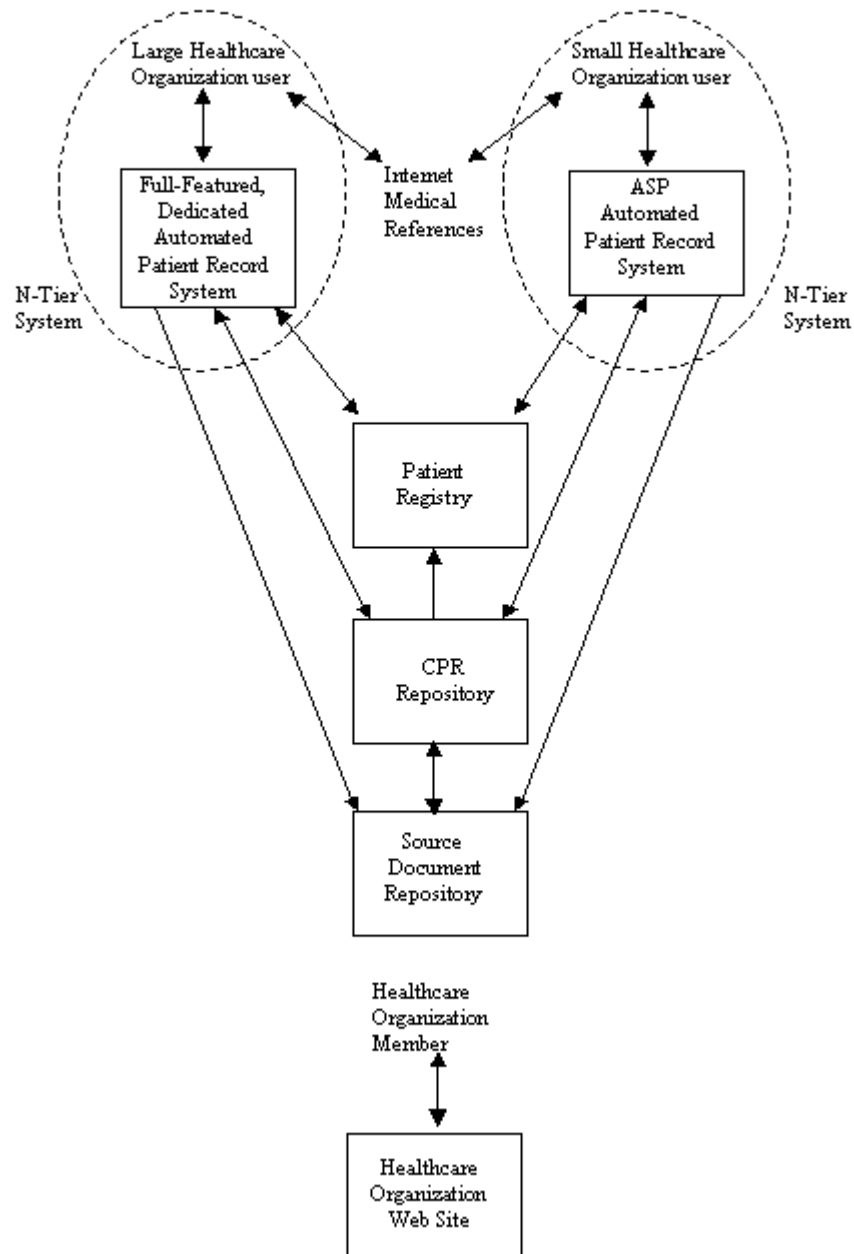
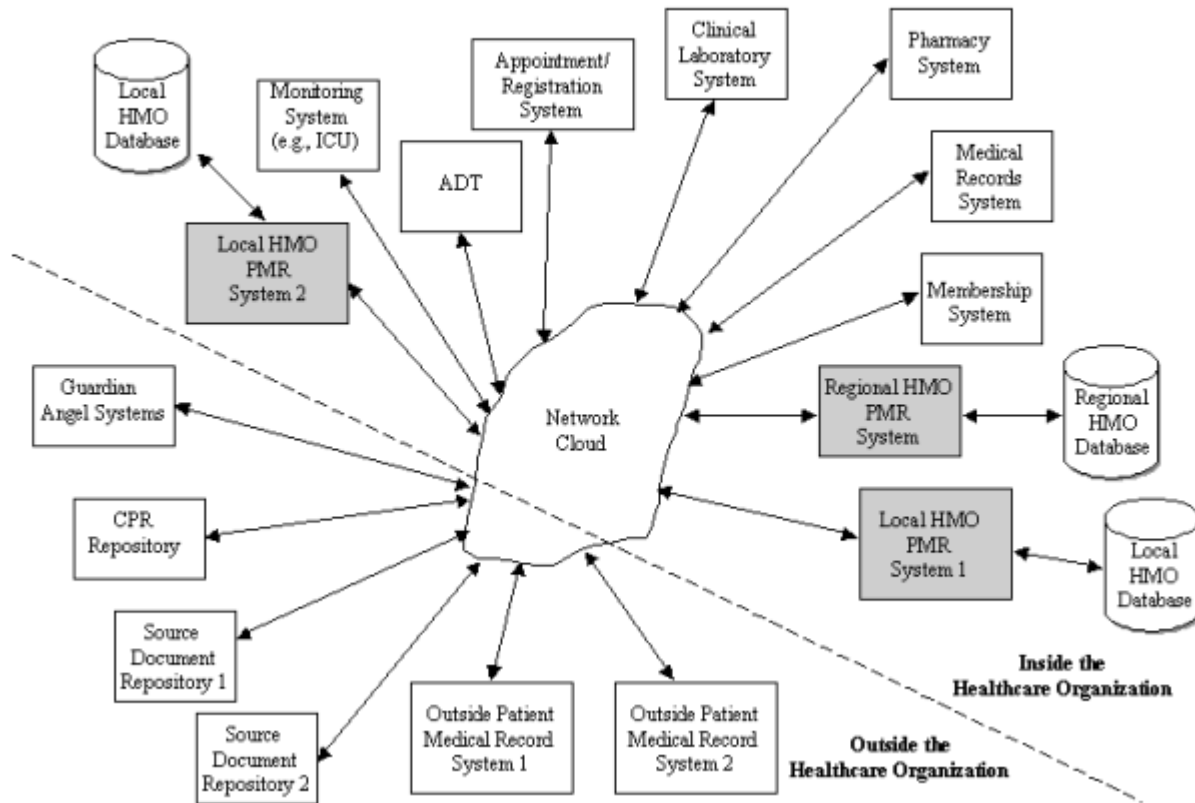


Figure 13.2: Possible System Architecture



**Figure 12.2--Character-Based Menu Screen**

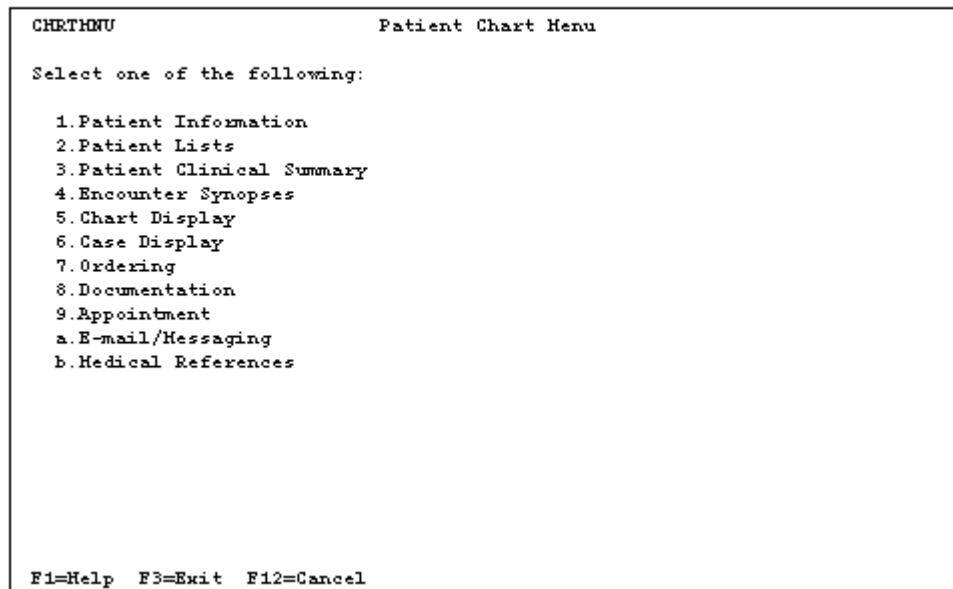




Figure 12.3--Character-Based Patient Information Screen

```
PATINFO                                Patient Information

Type Information.  Then Enter.

Patient Id ..... : 6347730211
Patient Name.... : Cindy S Brady
  First.....    : Cindy_____
  Middle.....   : S_____
  Last.....     : Brady_____
  Suffix.....   : _____
Birth Date/Age  : 01 / 01 / 1991 : 7:02
Sex.....       : F : Female
Day Phone..... : ( 415 ) 333 - 3333 EXT 1000
Eve Phone..... : ( 808 ) 359 - 6817 EXT ____
Mail Address.. : 2222 Miami Ave_____
City.....     : Palm Springs_____
State.....    : CA  Zip 97956 - 0120

Contact Name... : Sarah Rogers_____
Relationship.. : Mother_____
Day Phone..... : ( 415 ) 333 - 3333 Ext ____
Eve Phone..... : ( 808 ) 359 - 6817 Ext ____

Enter  F1=Help  F3=Exit  F7=Bkwd  F8=Fwd  F12=Cancel
```

Page 1 of 2  
More: +

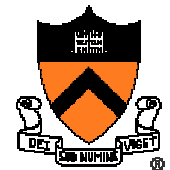


Figure 12.7--Patient Lists

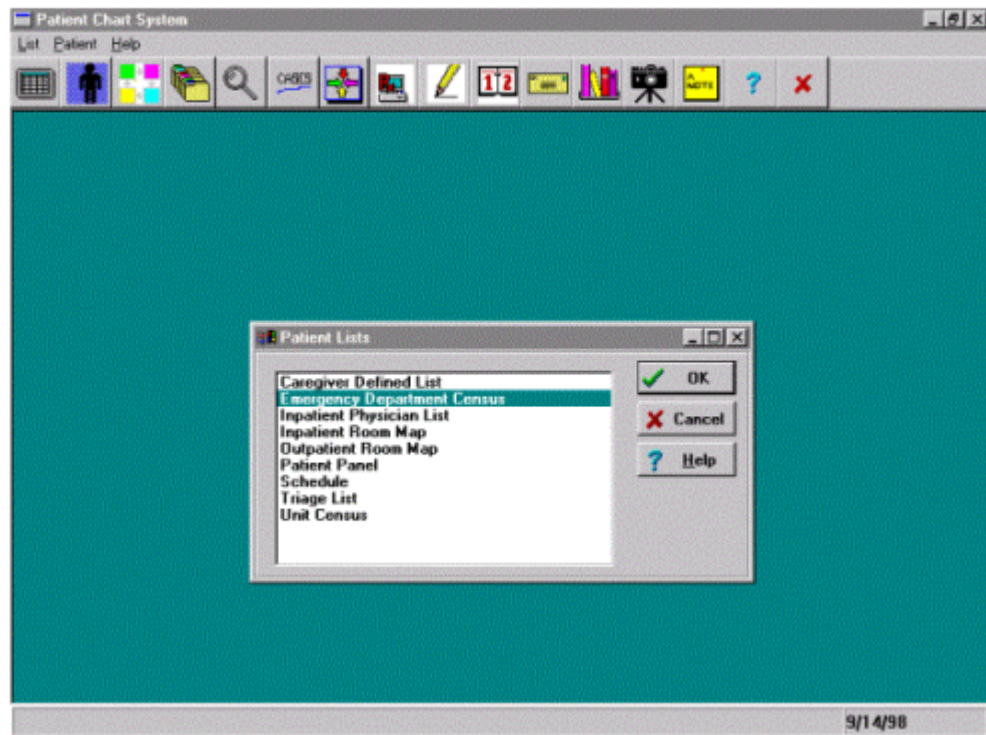


Figure 12.8--Patient Lists

Patient Chart System

List Patient Help

Schedule, John Jones MD

Date: 9/14/1998 Caregiver:

Time	Type	Patient Id	Pat
0000	[DH]		
0800	Routine	5678901234	Jane
0830	Urgent	3254027570	John
0945	Urgent	2092409855	Kerr
0900	Urgent	2450826388	Lam
0915	Routine	5008299064	Kath
0945	Urgent	3462030203	Phili
1000	[Meeting]		
1100	Urgent	4587092862	Suz
1115	Urgent	9549090236	Sally
1130	Routine	6548320806	Star
1200	Routine	5380306266	Kare
1230	[Lunch]		
1330	Urgent	3550026487	Harold Grayson
1345	Urgent	6083969889	Jonathan Grossman
1400	[Meeting]		
1800	[DH]		

Inpatient Physician List, John Jones MD

Date: 01/21/1997 Physician: J.A. Jones MD

Facility	Status	Patient Id	Patient Name	Unit	Sex	Age	Diagnosis
ALA	Attending	2381206036	Stan Peters	NW1	M	69	Upper GI Bleeding
ALA	Attending	9034987053	Sally R Terry	NW2	F	54	Breast Cancer
ALA	Consulting	3458043230	John L Lewis	RSP1M		47	COPD

9/14/98, 14:15



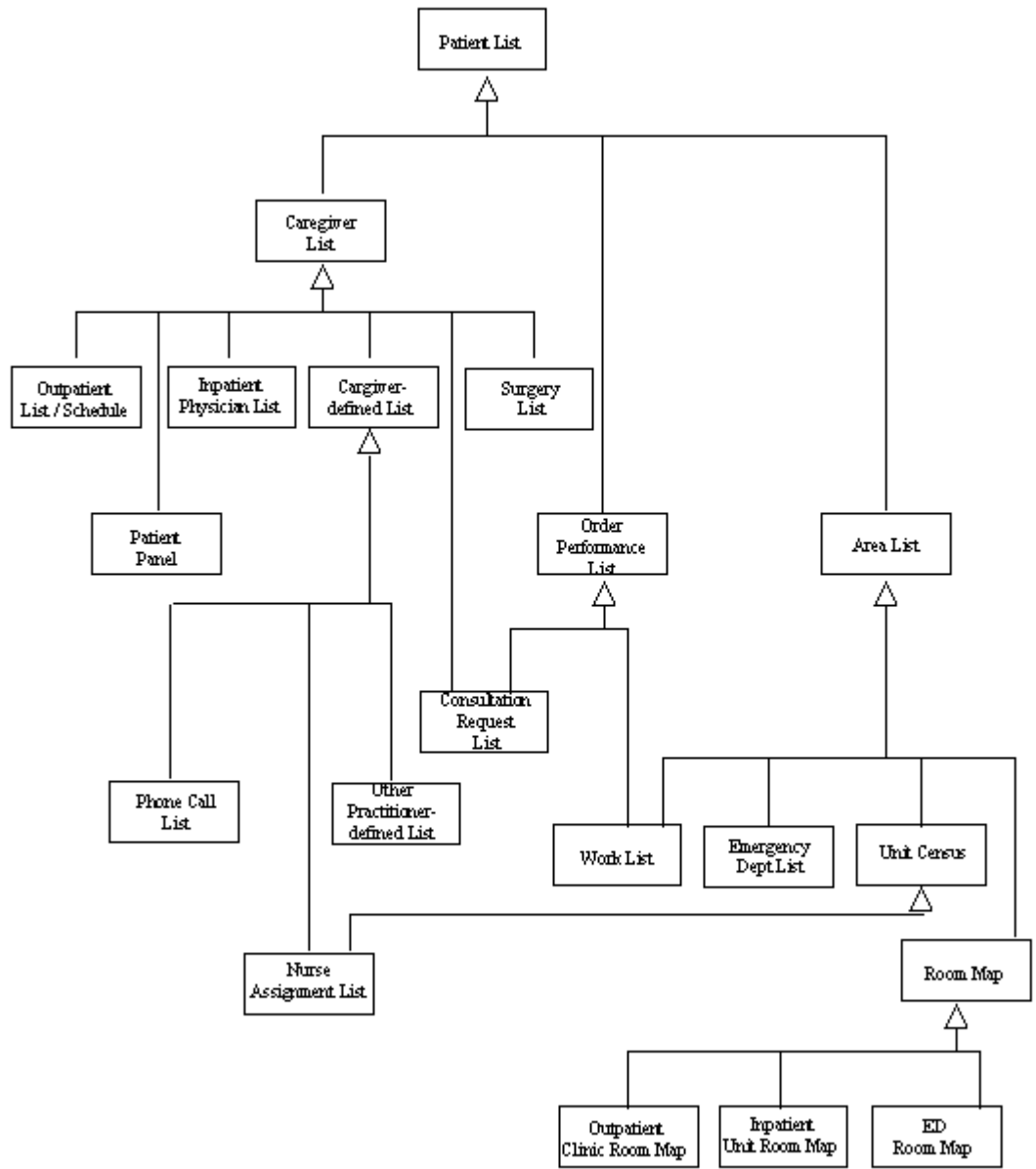


Figure 7.12: Examples of Problem/Condition/Concern List Relationships

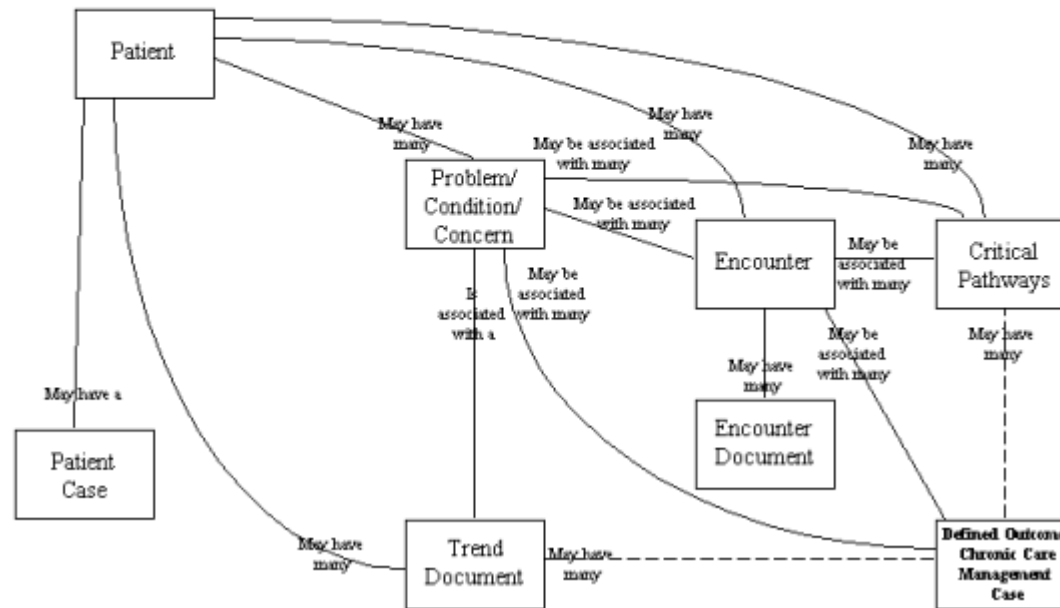


Figure 12.14--Clinical Summary List

**Clinical Summaries**

Patient Identifier: 6419486149  OK

Patient Name: Julie K Andrews  Cancel

Diagnosis/ Chief Complaint: Upper GI Bleeding  Help

Clinical Summaries:

- Inpatient Clinical Summary**
- Overall Clinical Summary

Figure 12.15--Overall Clinical Summary

**Clinical Summary**

Julie K Andrews, 42 YEAR OLD FEMALE Diagnosis/ Chief Complaint: Upper GI Bleeding

**Significant Health Problems**  
Asthma, 05/93 (Chronic)

**Caregivers**

Name	Type
Fran Eddy	Case Manager
J Schwartz MD	MED Personal C
K L Allison, RN	MED Nurse Pract

**Allergies**  
Penicillin 12/96

**Immunizations**  
Tetanus 04/94

**Encounters**

Date	LOS	Diagnosis
9/14/98		Upper GI Bleeding
9/10/98		Prob Gastric Ulcer
7/9/98		Cystoscopy Non
6/11/98		Cystitis
3/27/98		Cystitis
9/22/97	5	Appendicitis
9/22/97		Appendicitis

**Current Medications**  
Tagament 300mg qid

**Orders**

Date	Type	Comments
9/14/98	Med	Omeprazole 20mg S
9/14/98	Lab	hCG
9/14/98	Rad	Fluoroscopy

**Cases**  
**Referrals**  
Clinical Pathways  
Trend Documents

Cancel



Figure 12.11--Patient Demographics

**Patient Demographics**

<b>Patient Name</b>	Jeffrey C Kurkdand Jr	<b>Patient Id:</b>	6419486149
<b>Encounter</b>		<b>Chief Complaint</b>	
<b>Mailing Address</b>		<b>Language Preference</b>	
<b>Address</b>	599 Elm Street	<b>Language</b>	German
<b>City</b>	Quincy	<b>Interpreter?</b>	<input checked="" type="checkbox"/> Yes
<b>State</b>	CA	<b>Zip</b>	94677-00
<b>Telephone Numbers</b>		<b>Contact Person</b>	
<b>Day Phone</b>	(211) 555-5738 ext. 8400	<b>Name</b>	Susan Kurkdand
<b>Eve Phone</b>	(211) 555-8766	<b>Relationship</b>	Wife
<b>Day Phone</b>		<b>Day Phone</b>	(203) 555-4555
<b>Eve Phone</b>		<b>Eve Phone</b>	(203) 555-6794
<b>Birth Date</b>			
<b>Date</b>	02/28/1954	<b>Age:</b>	43:11



Figure 12.54--H & P from Triage Document

**ED Assessment Worksheet**

Bruce L. Stern, 58 YEAR OLD MALE

Chief Complaint:

Arrival Time:  Priority:  Room Number:

Allergies:

Assigned Caregivers:

Vital Signs:

Time	P	BP	R	T(F)
10:08 am	72	138/79	17	98.5

History of Problem

69 yo male seen 4 days ago with epigastric pain and treated with tagamet for presumed peptic ulcer disease. Today vomited bright red blood times 2 and is dizzy. Has epigastric burning pain non-radiating relieved by antacids and food. Patient is a 2 pack per day smoker for 35 years. Denies ingestion of medications such as steroids or NSAIDs.

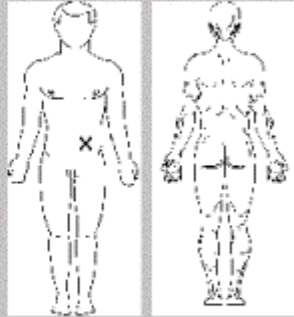





Figure 7.8--History and Physical Using Templates and Pick Lists

**History and Physical**

Bruce L. Stern, 58 YEAR OLD MALE      Chief Complaint: Abdominal Pain

Vital Signs: BP: 138/79 P: 72 T: 98.5(F) R: 18

**Section**

- S:
- O:
- A:
- P:
- Dx
- Rx
- Lab
- Xray
- Proc
- Order

**Section Notes:**

[age] yo male c/o  pain x . Pain is (nature), lasting   
Pain is relieved with [factors]; worsened with [factors].  
Radiation . [Denies] previous occurrence. [Denies]  
nausea, vomiting. States stools . [Denies] melena,  
hematochezia. [Denies] use of NSAIDs.

**Drug Allergies:**

None

**Significant History:**

Appendectomy 9/79

**Active Problems:**

Prostatitis

**Current Medications:**

Tagamet

Complete    Sign    Send    Cancel    Help



Figure 12.17--Patient Chart/Vital Signs

The screenshot shows a software window titled "Patient Chart" with a menu bar containing "Main", "Vital Signs", "SOAP Note", "Medications", and "Lab Tests".

**Visit Synopsis:**  
9/10/98 OUTPATIENT VISIT    Diagnosis: Probable Gastric Ulcer [ICD9 533.9]  
Epigastric burning pain, treated with Tagament, for presumed peptic ulcer disease. {J A Jones MD, 9/10/98 1420}

**Vital Signs:**  
Blood Pressure: 152/80  
Pulse : 72  
Temperature : 98.8 (F)  
Respiration : 18  
{K L Keeley Medical Assistant, 9/10/98 1410}

**Document List:**  
- 9/14/98  
+9/10/98  
  Probable Gastric Ulce  
  Dr. John Jones MD  
  SFO MED  
+ Vital Signs  
- SOAP Note  
- Medications  
- Lab Tests  
- 7/9/98  
- 6/11/98  
- 3/27/98  
- 9/22/97  
- 9/22/97  
- 9/21/97  
- 6/4/96

Julie K Andrews, 42 YEAR OLD FEMALE

Buttons: OK, Cancel, Help



Figure 12.55--Medication Administration Record (MAR)

**Medication Administration Record (MAR)**

Stan S Westbrook, 63 YEAR OLD MALE      Diagnosis: CHF

**Assignments**

Unit	Nurse
Night	Pat Little, RN
Day	D. Gail, RN
Even	Ellen Aldridge, RN
Other	Carol Wilson, RN

**Allergies**  
Penicillin 12/96

Start	Stop	Medication	Scheduled Times
9/14/98 0800		Procan SR 500 mg tab-SR 500 mg q6h	0800 1200 1800 2400
9/14/98 0800		Digoxin (Lanoxin) 0.125 mg tab odd days	0800
9/14/98 0900		Furosemide (Lasix) 40 mg tab 1 tab qd po	0900

Actual Date: 9/14/98      Time: 0810      Sign      X Cancel      ? Help



Figure 12.5--Message Box

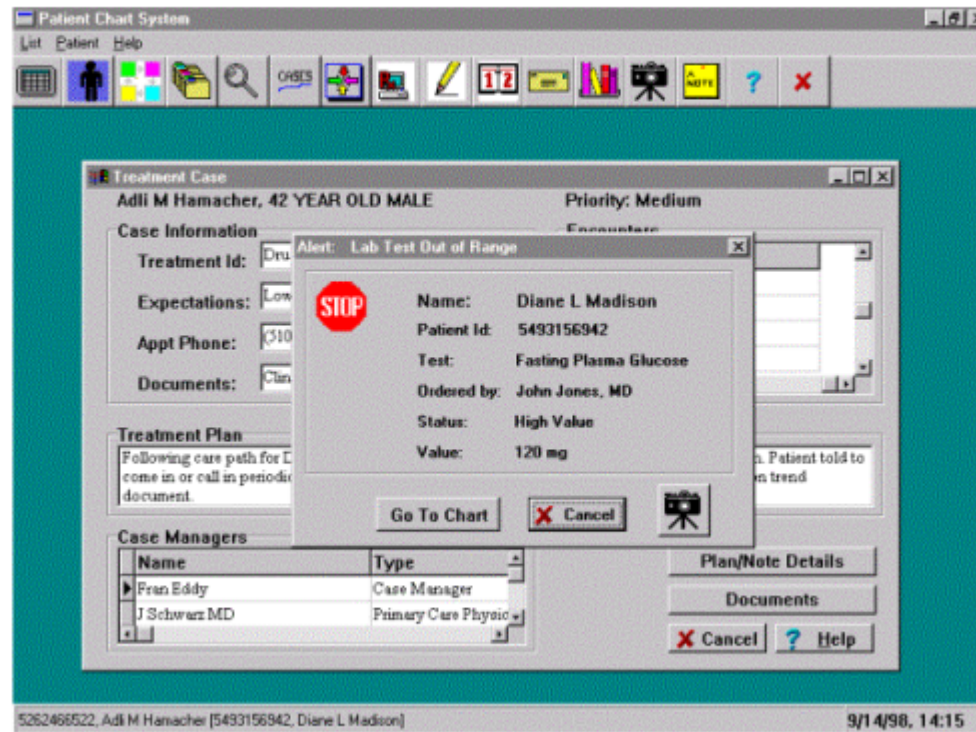


Figure 12.16--Patient Chart/Visit Synopsis

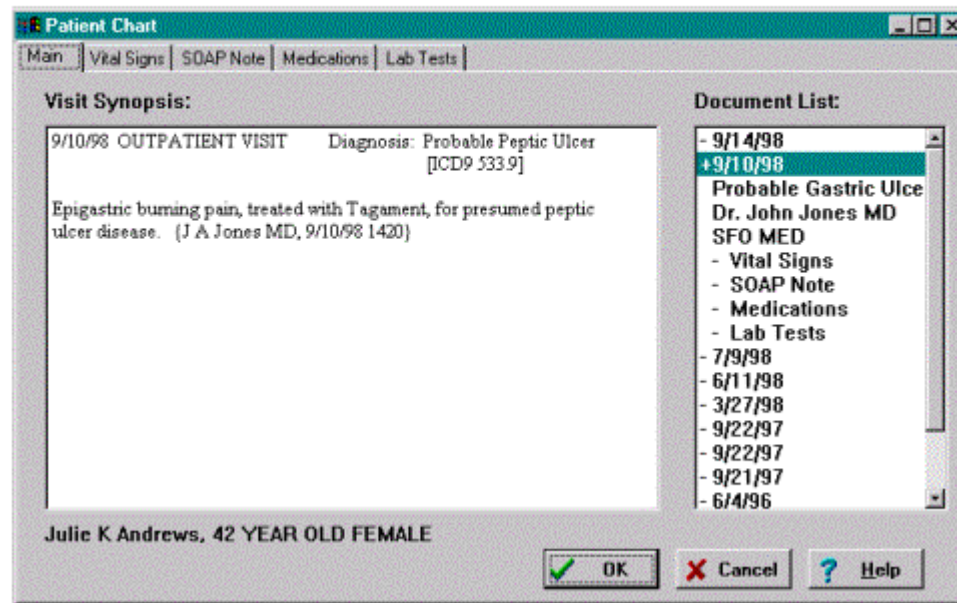


Figure 12.31--Encounter Synopses

Synopsis	
Julie K Andrews, 42 YEAR OLD FEMALE	Diagnosis/Chief Complaint: Upper GI Bleeding
09/10/968 OUTPATIENT VISIT	Diagnosis: Gastric Ulcer <input type="button" value="Select"/>
Epigastric burning pain, treated with Tagamet for presumed peptic ulcer disease	
07/09/98 OUTPATIENT VISIT	Diagnosis: PAP Smear Class I: Negative <input type="button" value="Select"/>
Pap smear given. Class I: Normal pattern.	
06/11/98 OUTPATIENT VISIT	Diagnosis: Cystitis <input type="button" value="Select"/>
Urge incontinence. Nocturia. Assumed acute cystitis. Urinalysis. Initially treated with Septra. After lab test, medication changed to Sulfamethoxazole.	
<input type="button" value="Previous"/> <input type="button" value="Next"/> <input type="button" value="Cancel"/> <input type="button" value="Help"/>	



Figure 12.30--Trend Document

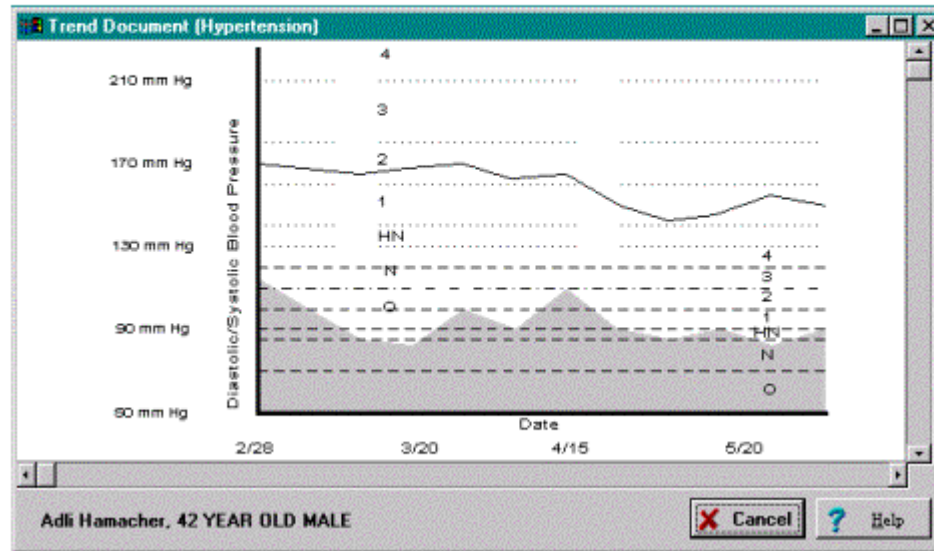


Figure 12.27--Treatment Plan and Notes

**Treatment Plan and Notes** [Window Title Bar]

Adli M Hamacher, 42 YEAR OLD MALE      Priority: Medium

Treatment Id: Drug Therapy for Hypertension

**Treatment Plan**

Caregiver: Joseph Schwartz, MD  
Created : February 28, 1998  
Following care path for Drug Therapy for Hypertension, test out medications for hypertension. Patient told to come in or call in periodically for blood pressure check, which will be automatically recorded on trend document

**Treatment Notes**

Caregiver: Joseph Schwartz, MD  
Created : February 28, 1998  
1: Commencing with first medication for hypertension of Beta-blocker, Divalil, due to exercise-induced angina.

Caregiver: Lee Aldrich, MD  
Created : March 20, 1998  
2: Divalil moderately successful. Commence with Calcium Channel Blocker, Diltrasem.

Caregiver: Joseph Schwartz, MD

[New Note] [Change Plan] [X Cancel] [ ? Help ]





Figure 12.25--List of Cases

The 'Cases' dialog box displays the following information:

- Case Name:** Adli M Hamacher, 42 YEAR OLD MALE
- Chief Complaint:** Chest Pain
- Defined Outcome Cases:** A list containing 'Defined Outcome Case [High Blood Pressure]' and 'Defined Outcome Case [Prostate]'. The first item is highlighted.
- Buttons:** OK (with a green checkmark), Cancel (with a red X), and Help (with a question mark).
- Status:** Radio buttons for 'New', 'Existing' (which is selected), and 'Inactive'.

Figure 12.26—Defined Outcome Case

The 'Defined Outcome Case' window displays the following information:

- Case Name:** Adli M Hamacher, 42 YEAR OLD MALE
- Priority:** Medium
- Case Information:**
  - Treatment Id:** Drug Therapy for Hypertension
  - Expectations:** Lower Blood Pressure
  - Appt Phone:** (310) 555-2242 (with a 'Transfer' button)
  - Documents:** Clinical Pathway, Trend Document
- Encounters:** A table with two columns and two rows, currently empty.
- Treatment Plan:** Following care path for Drug Therapy for Hypertension, test out medications for hypertension. Patient told to come in or call in periodically for blood pressure check, which will be automatically recorded on trend document.
- Case Managers:** A table with two columns and two rows, currently empty.
- Buttons:** Plan/Note Details, Documents, Cancel (with a red X), and Help (with a question mark).



Figure 12.29--Care Path

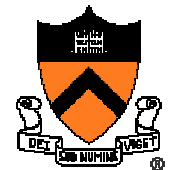
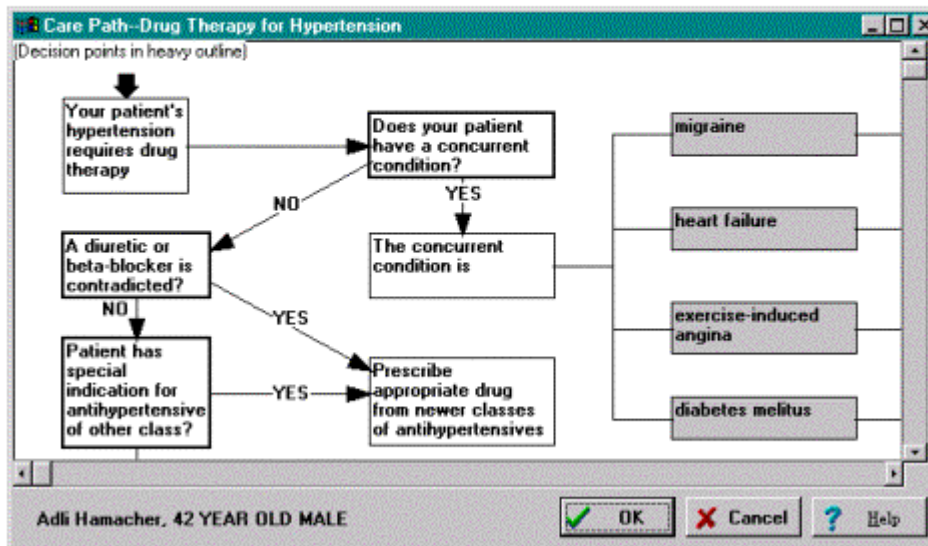
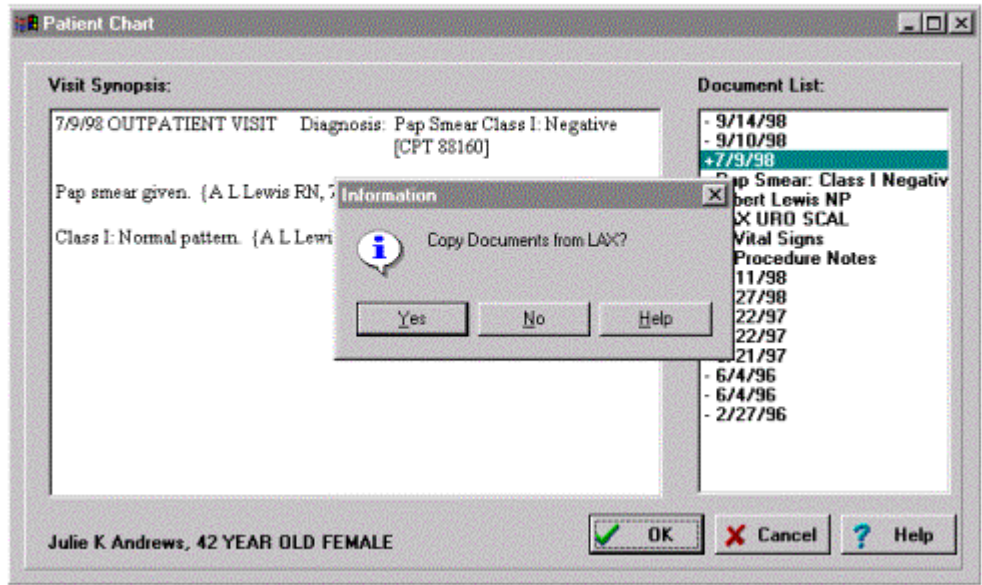


Figure 12.34--Document Located Remotely Selected



**Figure 13.26—Security Concepts**

<b>Security Concept</b>	<b>Description</b>	<b>Examples of Techniques to Implement</b>	<b>Use in the Automated Patient Medical Record System</b>
Person Authentication	For a person using a system, is he who he says he is?	Passwords, smart cards, biometric identification devices in comparison to stored information on each user; sign-on/sign-off, automatic logoff, digital certificates (server certificates) and digital signatures, firewalls	User sign-on and sign-off to system.
Application Authentication	For an application making a request for a service controlled by another application, possibly in another computer and organization, is the application the one identified and in the system and organization identified?	Kerberos, digital certificates (server certificates) and digital signatures, application to application controls (SSL/TLS), host to host controls (IPSec), IP/network address, firewalls	Communication between system and clinical systems, and especially between the system and the CPR and source document repositories.
Terminal or Other Hardware Device Authentication.	The terminal or other hardware device together with its location are identified.	Recording hardware identification of terminal, associated type of terminal, and allowable locations, DLC (Data Link Control) or MAC (Media Access Control) address, logical unit, firewalls.	Terminals and other devices in public areas vs. secured areas.



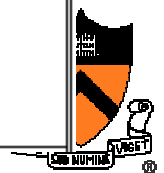
Authorization / Access	The information and services within an application system a person, another application system or device is allowed to access.	Access lists, LDAP	Access to information, secure terminals in secure departments (psychiatry, genetics), ordering capabilities (especially for narcotics), access to remotely located records.
Visibility	The functionality in an application system provided to a person.	Role-based access, person-based access	Functionality provided for meet caregiver's role or individual needs.
Administrative Procedures	Contingency plans for system emergencies; business policies on access control, employee termination procedures, physical protection of data, and consent for use and disclosure of information.	Overall site and organizational security policy based upon assess of risks, including documentation, data backup plan, disaster recovery plan, emergency mode operation, record of access, inventory, employee termination procedures (locks changed, userid removal, cards returned), new personnel clearance procedures and agreement signing, security incident procedures, user education, visual identification of patients, need to know procedures, procedures for loss of a computer or PDA, protection against social engineering, identification of why a system went down.	Operational policies supporting security.



Physical Safeguards	Security of physical computer systems and other equipment	Equipment in secure locations, access badges, cabinets with keys, physical attachment of terminals, identification of terminals and allowable locations, assessment of risks.	Protection of computers and other equipment.
Integrity of Data	The receiver has assurance that data sent is not altered and is from the said user or system.	One way hash with message digest, digital signature, replay checking, encryption / decryption, virus checking, intrusion detection systems, authorization and access control.	Communication between systems and/or people, including with the CPR and source document repositories.
Encryption / decryption	Conversion of plaintext to ciphertext / conversion of ciphertext to plaintext; may be combined with compression	Encryption algorithms, PKI, SSL/TLS, IPSec	Same as PKI
Public Key Infrastructure (PKI)	A set of capabilities to allow secure communication across a line by one party with a private key and the other with a public key.	Digital certificate, asymmetric and symmetric encryption, certificate authority, registration authority, public key, private key, digital signature, cross certification, time stamping, certificate revocation, trust mode., secure storage of private keys.	Communication between caregivers caring for a patient. Communication with CPR and source document repositories. Communication with insurers, including the federal government.
Confidentiality	The organization is assured that the data can only be seen by someone who has authorization to see it.	Authorization and access control to a document and to elements within a document when necessary, encryption, PKI, firewalls, intrusion detection systems	Privacy of medical record information of a patient.



Chain of Trust	For EDI, in which trading partners have specific agreements with each other, this chain of trust can be controlled by contractual agreements. For communication with outside healthcare organizations and medical providers, this chain of trust may have to be governed by laws and healthcare industry standards.	Contracts, service request authentication, cross certification, laws and industry standards	Communication with insurance and financial systems via EDI; communication with CPR and source document repository; request and granting of permission to copy or disclose patient records.
Identity Verification	The organization has assurance of the legitimate identify of each person, application, local device, and organization involved.	Registration authority; assignment of provider and patient identifiers by HCFA, biometric devices; hardware card identification of a device and a location	Recording passwords and unique identifiers of humans especially from biometric devices for later authentication; this information could be stored on smart cards secured by the user. Intelligent procurement of hardware. HCFA identification of healthcare organizations and of providers and patients.
Electronic signature	Identification of caregiver who created document which is equivalent of caregiver's signature	Undetermined, but most likely candidate is biometric information. See references [8,9] for requirements for an electronic signature.	Signing source documents; identifying caregivers doing ordering.
Nonrepudiation Evidence	The sender cannot deny sending the information or an electronic signer of a document cannot deny signing the document.	Electronic signature, digital signature, biometric system, smart card, intrusion detection devices, firewalls	Signing source documents; identifying caregivers doing ordering. Communication of medical information.



Availability of Service	The system is available for use when needed.	Load balancing, firewalls, fail-over recovery, clustering, parallel disk arrays, multi-processors, on-line backups and logging, intrusion detection systems, virus checkers, service level agreements, firewalls, ups (uninterruptible power supply)	Availability of automated medical record system and all clinical systems. Protection against bugs and other unintentional errors. Protection against attacks on systems.
Disaster Recovery	Information is available after a fire, earthquake, a major criminal act, or other major disaster.	Off-site duplication of information for backup. Backup computer systems.	Off-site duplication of medical record information for backup purposes. Backup computer systems for access to the medical record.
Auditing / Recoverability	Security-critical operations are recorded and information is recoverable.	Backups of information; log files; recovery system software; a procedure for emergency access to encrypted information	All systems.
Remote Access	Secure access from outside the healthcare organization; protection against theft	Remote access authentication and/or authorization systems that may include encryption and certificates, and logging (RADIUS, TACACS+), Virtual Private Networks (VPN), local system sign-ons, encryption of data on local databases	Remote terminals. Any access to the automated patient medical record system from outside the organization.
Request / Grant Permission for Medical Records	The creator (HMO or physician) and/or owner (the patient) of a source document can grant permission to an authorized party to copy or disclose the document, and authorized parties can request permission to copy source documents, perhaps with certain categories of permissions granted by policy	To be determined	Requests for medical records and their sending.





# Future

- Personnel/administrative costs will continue to rise, while automation costs will decrease
- Standardization of terminology and care
- Maturing networking technology
- Integration with decision support
- Development of patient specific educational materials
- Graphical interfaces, wireless networking and integrated workstations will enhance clinician acceptance



# Integrated Workstation

