Medical Record Keeping

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Why Keep Records?

- Basis for historical record
- Communication among providers
- Anticipate future health problems
- Record standard preventive measures
- Identify deviations from the expected
- Legal record
- Basis for clinical research

Who Keeps Records?

- Doctor
- Nurse
- Office staff, admissions
- Administrator
- physical therapist
- lab personnel
- radiologist
- pharmacist
- patient

Forms of Clinical Data

- Numerical Measurements
  - Lab data
  - Bedside measurements
  - Home instrumentation
- Recorded signals (e.g., ECG, EEG, EMG)
- Images (X-ray, MRI, CAT, Ultrasound, Pathology,
  ...
- Genes (SNPs, expression arrays, pedigrees, ...)
- Coded (?) discrete data
  - Family history
  - Patient’s medical history
  - Current complaint
  - Symptoms (patient)
  - Signs (doc)
  - Physical examination
  - Medications
- Narrative text
  - Doctor’s, nurse’s notes
  - Discharge summaries
  - Referring letters

Organization of Data

- Doctor’s journal (traditional)
- Time order of collection, per patient (Mayo)
- Source of data
- Problem-Oriented Medical Record (POMR)
  (L. Weed, 1969)
  - Notes organized by problems
  - SOAP: subjective, objective, assessment, plans

POMR

- Data Base
- Problem List
- Plans (by problem)
  - diagnostic, therapeutic, patient education
- Progress Notes (by problem)
The Data Base

- Identifying information (name, age, sex, race, religion, insurance info, etc.)
- Patient profile (occupation, education, marital status, children, hobbies, worries, moods, sleep patterns, habits, etc.)
- Medical history
  - Chief complaints
  - History of present illness
  - Past medical history
  - Review of systems
  - Family history
  - Medications
- Physical examination
- Laboratory data and physiologic tests (complete blood count, electrocardiogram, chest x-ray, creatinine, urinalysis, vital capacity, tonometry, etc.)

The Problem List

- "those features in the patient’s psychobiological makeup that require continuing attention"
  - Social history
  - Risk factors
  - Symptoms
  - Physical findings
  - Lab tests
- Causally organized; e.g., GI bleeding caused by duodenal ulcer appears under the ulcer

Example Problem List

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<th>Date</th>
<th>Inactive</th>
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</table>

Problem-Related Plans

- Diagnostic: lab tests, radiology studies, consultations, continued observations, …
- Therapeutic: medications, diet, psychotherapy, surgery, …
- Patient education: instruction in self-care, about goals of therapy, prognosis, …

Plans per problem

1. Diarrhea
   Dx:
   - stool for occult blood, culture, ova, and parasites, microscopic fat; and muscle fibers
   - Sigmoidoscopy
   - Barium enema if persistent
   Rx: Avoid foods that exacerbate
   Ed: Informed that more info is needed to make a diagnosis, will aim for symptomatic therapy for now.

2. Pyuria
   Dx:
   - BUN
   - Repeat urinalysis
   - Urine culture
   Rx:

3. Obesity
   Rx: 1500 kcal diet, Weight Watchers
Progress Notes

- Subjective: interval history, adherence to program
- Objective: physical findings, reports of lab, x-ray, other tests
- Assessment: Appraisal of progress, interpretation of new findings, etc.
- Plan: Dx, Rx, Ed.

Example SOAP Note

#3 RHD with mitral stenosis
S: 2 flight dyspnea, mild fatigue. No orthopnea, hemoptysis, ankle edema. Child has strep throat.
O: BP 120/70. P 78 regular
Neck veins normal, lungs clear.
Grade ii diastolic rumble, wide opening snap, P2 slightly ↑
P: Dx: Cardiac fluoroscopy
Rx: Continue chlorothiazide and penicillin V 250mg b.i.d.—2 weeks
Ed: Reinstructed about antibiotic coverage for tooth extractions, sched. for next month. (Will contact oral surgeon.)

POMR characteristics

- Augment with data flow sheets
- Importance of clinical judgment
- Benefits:
  - Communication among team members, explicitness
  - Education and audit
  - Clinical research

POMR evidence

- Difficult adoption
- Some duplication
- Some doctors liked it
- Paper-based POMR slow, computer-based maybe faster
- Demand-oriented MR: by time, by source, by problem, etc. Dynamic arrangement.

Mayo experience

- Paper records, mostly
- Pneumatic tube delivery, therefore limited size
- Formal procedures for reaping and organizing records at discharge
- Comprehensive index

The Computer-based Patient Record

- Made strong case for CPR
- Recommended CPRI (Institute), but it never caught on
- Today’s standards grow more out of communication standards: HL7 (labs) and DICOM (digital images)
Paper record: Strengths

- Familiar; low training time
- Portable to point of care
- No downtime
- Flexibility; easy to record subjective data
- Browsing and scanning
  - Find information by unanticipated characteristics (e.g., Dr. Jones’ handwriting)

Paper record: Weaknesses

- Content: missing, illegible, inaccurate
  - E.g., one hospital study: 11% of tests were repeats to replace lost information
  - Too thick (1.5 lbs avg.)
  - Fail to capture rationale
  - Incomprehensible to patients and families

Sample paper record defects

- 75% of face sheets had no discharge disposition, 48% no principal Dx
- Agreement between encounter (witnessed) and record: 29% med hx, 66% Rx, 71% info re current illness, 72% tests, 73% impression/Dx, 92% chief complaint
- 20.8% of Medicare discharges coded incorrectly (DRG inflation)

More paper record defects

- Unavailable at up to 30% of patient visits
  - Two clinic visits in a day
  - Docs keep records in their office
  - Failure to deliver
  - Misfiled in file room
- Discontinuity across institutions
  - In/outpatient records separate

Ethnographic Design

- Xerox PARC analysis of office work
  - Sociologists, Anthropologists, Engineers
  - Much of work is
    - communication,
    - assignment of responsibilities,
    - problem solving

Medicine is an Information Industry

- 35-39% of hospital operating costs due to professional and patient communications
- Physicians spend 38%, nurses 50% of their time charting
- Exponential growth of medical knowledge and literature
**Intro to BioMedical Informatics**  
**September 14, 2004**

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**Individual Users of Patient Records**
- Providers
  - Chaplains
  - Dental hygienists
  - Dentists
  - Dietitians
  - Lab technicians
  - Nurses
  - Occupational therapists
  - Pharmacists
  - Physical therapists
  - Physicians
  - Physician assistants
  - Podiatrists
  - Psychologists
  - Radiology technologists
  - Respiratory therapists
  - Social workers

- Management
  - Administrations
  - Financial managers and accountants
  - Quality assurance managers
  - Records professionals
  - Risk managers
  - Unit clerks
  - Utilization review managers

- Reimbursement
  - Benefit managers
  - Insurers (Fed., State, private)

- Other
  - Attorneys
  - Gov’t policymakers, legislators
  - Lawyers
  - Health care researchers, clinical investigators
  - Health Sciences journalists and editors
  - Patients, families

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**Institutional Users of Patient Record**
- Healthcare Delivery
  - Alliances, associations, networks, systems of providers
  - Ambulatory surgery centers
  - Dental clinics (blood, tissue, organs)
  - HMO’s
  - Home care agencies
  - Hospitals
  - Nursing homes
  - PPO’s
  - Physician offices, group practices
  - Psychiatric facilities
  - Public Health Departments
  - Substance abuse programs

- Management and Review
  - Medicare peer review organizations
  - Quality assurance companies
  - Risk management companies
  - Utilization review/management comp.

- Reimbursement
  - Business Health coalitions
  - Employers
  - Insurers

- Research
  - Disease registries
  - Health data organizations
  - Health care technology developers and manufacturers
  - Research Centers

- Education
  - Allied health professional schools
  - Medical, nursing, public health schools

- Accreditation
  - Accreditation organizations
  - Inst. licensure agencies
  - Prof. Licensure agencies

- Policymaking
  - Fed, State, Local gov’t agencies

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**Primary Uses of Patient Record**
- Patient care delivery (Patient)
  - Foster continuity of care
  - Secrecy diseases and causes
  - Support decision making about Do and Re
  - Assess and manage risk
  - Facilitate care via Clin. Practice Guidelines
  - Document patient risk factors
  - Assess and document patient expectations and satisfaction
  - Generate care plans
  - Determine preventive advice
  - Record clinicians
  - Support nursing care
  - Document services provided

- Patient care delivery (Provider)
  - Document services received
  - Consolidate proof of identity
  - Self-manage care
  - Verify billing

- Patient care delivery (Supplier)
  - Bill for supplies
  - Verify billing

- Patient care delivery (Insurer)
  - Determine disabilities (workmen comp)
  - Allocate resources

- Other
  - Analyze trends and develop forecasts
  - Analyze quality assurance
  - Prepare quality assurance
  - Patient care support
  - Document services for payment
  - Submit insurance claims
  - Analyze quality assurance
  - Determine disabilities (workmen’s comp)
  - Manage & report costs

**Secondary Uses of Patient Record**
- Education
  - Document health care professional experience
  - Prepare conference and presentations

- Regulation
  - Evidence in legislation
  - Foster peer review surveillance
  - Assess compliance with standards
  - Accreditation professionals and hospitals
  - Compare healthcare organizations

- Policy
  - Allocate resources
  - Condict strategic planning
  - Monitor public health

- Research
  - Develop new products
  - Conduct clinical research
  - Assess technology
  - Study patient outcomes
  - Study effectiveness and cost-effectiveness of care
  - Identify populations at risk
  - Develop registries and databases
  - Assess cost-effectiveness of EHR systems

- Industry
  - Conduct R&D
  - Plan marketing strategy

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**User Requirements**
- Record Content
  - Uniform core data elements
  - Standardized coding systems and formats
  - Common data dictionary
  - Information on outcomes of care and functional status

- Record Format
  - “Front-page” problem list
  - Ability to “flip through” the record
  - Integrated among disciplines and sites of care

- System Performance
  - Rapid retrieval
  - 24/7
  - Available @ convenient places
  - Easy data input

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**User Requirements (cont.)**
- Linkages
  - To other info systems (e.g., radiology, lab)
  - Transferability of information among specialties and sites
  - With relevant literature
  - Other registries and institutional databases
  - To records of other family members
  - E-billing
  - Training and Implementation
  - Minimal training required
  - Graduated implementations

- Intelligence
  - Decision support
  - Clinician reminders
  - “Alert” systems, customized

- Reporting
  - “Derived documents”, e.g., insurance forms
  - Easily customized output, UI
  - Standard clinical reports, e.g., discharge summary
  - Custom and ad hoc reports
  - Trend reports and graphics

- Control and Access
  - Easy patient access
  - Safeguards of confidentiality

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Why is this hard?

- Characterize edema:
  - Where?
  - When?
  - How often?
  - Temporal variation?
  - Severity
  - Symmetry
  - What other characteristics?
- *Uncertainties* in all of the above

- Thousand diseases, syndromes, clinical states
- Few thousand symptoms, signs, observables
- Few thousand specific lab tests
- Thousands of meds, variations, combinations, routes, dosage schedules, ...
- ??? Treatments

Not just database, knowledge representation

- "Sometime before his 5th birthday, Johnny had scarlet fever, which caused changes in his heart sounds."
- LEG <S> WEAKNESS PROXIMAL ONLY
- (EDEMA with LOCATION = FACIAL or PERI-ORBITAL, PAINFULNESS = not PAINFUL, SYMMETRY = not ASYMMETRICAL, ERYTHEMA = not ERYTHEMATOUS)

Inadequate Coding Systems

- Low degree of refinement
  - E.g., ICD-9’s categories for Chronic Bronchitis
    - Simple
    - Mucopurulent
    - Obstructive
    - Other
    - Unspecified
- Poor coverage of symptoms
- Difficulty of automatic coding
  - Gabrieli’s 10M-phrase thesaurus

Current Status of EMR

- Fully computerized in many hospitals
  - Labs, pharmacy, billing
- Some computerization
  - Visit histories, discharge summaries, vaccination records, emergency dept notes, pathology & radiology notes
- Little computerization
  - Anything outside hospitals & large clinics
  - History, physical, plans, rationale, ...

Current Ideas

- Improved Coding
- Data Capture
  - Dictation to text, or speech understanding
  - Text to meaningful code extraction
  - Comprehensive instrumentation
  - Capture at point of generation
- Integration to Workflow
  - Direct physician order entry, protocols, expert systems
- "Aware" environments