Introduction to Pharmacoepidemiology Methods

- Background re: Epi Methods
- Present
- Future
Options in Research Design

• Analytic Studies
  – Experimental Study
  – Cohort Study
  – Case-Control Study

• Descriptive Studies
  – Analyses of Secular Trends
  – Case Series
  – Case Reports
Case-Control Studies

Disease

Present (cases) Absent (controls)

Present (exposed)

Absent (not exposed)

Factor

Cohort Studies

A  B

C  D
Prospective vs. Retrospective Studies

- **Prospective Study**
- **Retrospective Study**

Events Under Study

Time
Pharmacoepidemiology: Unique Characteristics

1. A large population needs to be studied
2. Randomized clinical trials are unlikely to be productive
3. Answers often must be obtained very quickly
"Less than one in ten thousand—something like one in fourteen thousand—gets these side effects. Hardly anybody gets these side effects. They're extremely rare. You should be very proud."
Hypothesis Generating

Hypothesis Strengthening

Hypothesis Testing
Current Status of Pharmacoepidemiology
Data Sources for Pharmacoepidemiology Studies

- Spontaneous case reports of adverse reactions
- Aggregate population-based data sources
- Computerized collections of data from organized medical care programs
- Data collected for pharmacoepi on an ongoing basis
- Existing data collected as part of other ad hoc studies
- Data collected de novo
Spontaneous Reports of Adverse Reactions: Advantages

- Incorporates all drugs
- Incorporates all prescribers
- Relatively inexpensive
Spontaneous Reports of Adverse Reactions: Disadvantages

- Under- or over-ascertainment
- Under-reporting
- External events can change ascertainment or reporting
- No denominators
Using Vital Statistics and Sales Data to Perform Analyses of Secular Trends

- Advantages: Fast and relatively inexpensive
- Disadvantages:
  - Cannot differentiate among alternative exposures with consistent trends
  - Findings can be artifactual
Computerized Collections of Billing Data: Sources of Data

- Provider: Pharmacy
- Provider: Hospital
- Provider: Physician
- Payor
- Data User
Computerized Collections of Medical Billing Data: Advantages

- Size
- Cost
- Complete
- Can be population-based
- Can include outpatient drugs and diseases
- No recall or interviewer bias
Computerized Collections of Medical Billing Data: Disadvantages

- Uncertain validity of diagnosis data
- No information on some potential confounding variables
- Only includes illnesses severe enough to come to medical attention
- Some results may not be generalizable, e.g., on health care utilization
Medical Records Databases (e.g., GPRD, THIN)

Advantages
- Completeness of data
- Quality of data
- Easy access to primary medical records

Disadvantages
- GP data only
- Completeness of outcomes uncertain
- May be a skewed group of docs
Data Collected for PMS on an Ongoing Basis: BCDSP Hospital-Based Surveillance

**Advantages**
- Denominator known
- Quality of data

**Disadvantages**
- Inpatient drugs only
- Short-term effect only
- Common effects only
- Old: data cannot be used to study new drugs
Data Collected for PMS on an Ongoing Basis: Drug (Slone) Epidemiology Unit

**Advantages**
- Study of rare illnesses
- Quality of data

**Disadvantages**
- Hospitalized dzs only
- Denominator unknown
- ?Validity of rx data
- Cannot be used to study new drugs
Existing Data Collected as Part of Other Ad Hoc Studies

- Advantages: Cost, speed
- Disadvantages: Incomplete data, lack of quality control
Data Collected De Novo For the Study Being Conducted

- Advantage: Completely tailored data
- Disadvantages: Cost, time delay
Prescription Event Monitoring

Advantages
- Large population
- Quality of data

Disadvantages
- Participation rate
- Cost
- Time delay
- Limited numbers of drugs
Future of Pharmacoepidemiology
Future Scientific Developments

- Applications of new epi methods
- Drug utilization review programs
- Evaluation of causality in case reports
- Systematic screening for ADRs
- Appropriate role of data mining
- Studies of beneficial drug effects
- Studies of pharmacoeconomics
- Studies to aid in individualizing drug therapy
- Quality of life studies
- Large simple trials
Future Logistic Approaches

• More data bases
• US Medicare
• Pharmacy-based surveillance
• Poison control centers
• Others?
Molecular Pharmacoepidemiology

• Use of molecular methods to measure genetics in traditional case-control studies
• Use of molecular methods to measure individuals’ probability of drug response
New Structures Which Will be Affecting the Future of Pharmacoepidemiology

- Hospital initiatives
- CERTs
- Patient Safety Initiatives
- CPOE
- HIPAA
- Risk management
- Medicare Part D
- IOM!?!?
Key Problem of “Historical” Pharmacoepidemiology

- Adverse drug events are the most common iatrogenic causes of patient injuries.
- Most are the result of an exaggerated but otherwise usual pharmacological effect of the drug.
- Yet, historically these have been ignored by pharmacoepidemiology, as they do not represent a focus of commercial and regulatory interest.
Potential Threats to the Continued Development of Pharmacoepidemiology

• Scientific errors
• Funding limitations
• Absence of training programs
• Corruption by studies conducted purely for marketing purposes
• Inappropriate use in litigation
“Decisions usually involve risk.”