**Objective:** Provide basic and clinical translational scientists with a working understanding of biomedical informatics principles and their applications in biomedical data collection, standardization, representation, and analysis.

<table>
<thead>
<tr>
<th>Intro to Biomedical Informatics</th>
<th>Data Standards &amp; Terminologies</th>
<th>Practical Tools in Informatics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Familiarize participants with the basic principles of biomedical informatics demonstrated by ongoing projects and services across the CTSI sites.</td>
<td>Describe the use of data standards for representation and exchange of clinical information in the context of electronic health records and clinical decision support.</td>
<td>Provide a demonstration of CTSI-specific applications and resources that facilitate the management and analysis of clinical and experimental data.</td>
</tr>
</tbody>
</table>

- Introduce the foundational concepts of biomedical informatics and its subfields
- Understand the role of informatics in evidence-based medicine
- Distinguish the different types of health information
- Learn about UCLA CTSI efforts related to this area and whom to contact for expert consultation
- Describe the use of standards for data coding, knowledge representation and exchange of clinical information
- Discuss the importance of controlled terminologies as a specific class of standards
- Learn about health information system architecture
- Demonstrate data collection using REDCap
- Discuss software tools and resources for data collection, extraction and representation, and analysis
- Showcase resources available through the CTSI, member campuses, and the UC system
<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture Topic</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/6</td>
<td>Introduction to biomedical informatics</td>
<td>Douglas Bell, MD, PhD</td>
</tr>
<tr>
<td>5/8</td>
<td>Public health informatics &amp; quality</td>
<td>Paul Fu, Jr MD MPH</td>
</tr>
<tr>
<td>5/13</td>
<td>Data standards</td>
<td>Robert Jenders MD, MS</td>
</tr>
<tr>
<td>5/15</td>
<td>Clinical decision support</td>
<td>Robert Jenders MD, MS</td>
</tr>
<tr>
<td>5/20</td>
<td>Introduction to bioinformatics</td>
<td>Eleazar Eskin PhD</td>
</tr>
<tr>
<td>5/22</td>
<td>Data collection &amp; analysis</td>
<td>David Elashoff PhD</td>
</tr>
<tr>
<td>5/27</td>
<td>Advanced topics &amp; machine learning</td>
<td>Corey Arnold PhD &amp; William Hsu PhD</td>
</tr>
</tbody>
</table>
Module Resources

• Recorded webcast & materials
  – http://www.ctsi.ucla.edu/education/training/webcastmodules

• CTSI virtual home
  – http://www.ctsi.ucla.edu
  – Biomedical Informatics Program
    http://www.ctsi.ucla.edu/about/pages/bip2

• Other resources
  – American Medical Informatics Association
    http://www.amia.org
  – UC BRAID/UC ReX
    http://www.ucbraid.org/informaticsmdashuc-rex.html
  – xDR
    http://www.ctsi.ucla.edu/research/pages/xDR
  – UCLA Darling Biomedical Library Workshop Series
    http://uclabiomed.eventbrite.com/
  – LADR
    http://www.ctsi.ucla.edu/research/pages/LADR
CTSI Module 5 Workshop
Biomedical Informatics

Session 5B: Public Health Informatics and Quality

Paul Fu, Jr., MD, MPH, FAAP
Clinical Professor, Pediatrics, David Geffen School of Medicine at UCLA
Adjunct Professor, Health Policy and Management, UCLA Fielding School of Public Health
CMIO, Harbor-UCLA Medical Center
Essential Public Health Functions

Essential Service (ES) 1 – Monitor Health to Identify and Solve Community Health Problems

- **Accurate, periodic assessment of the community’s health status**
  - Identification of health risks
  - Attention to vital statistics and disparities
  - Identification of assets and resources

- **Use of methods and technology (e.g., mapping technology) to interpret and communicate data**

- **Maintenance of population health registries**

• Timely identification and investigation of health threats

• Availability of diagnostic services, including laboratory capacity

• Response plans to address major health threats

ES 3 – Inform, Educate, and Empower People About Health Issues

• Initiatives using health education and communication sciences to
  • Build knowledge and shape attitudes
  • Inform decision-making choices
  • Develop skills and behaviors for healthy living

• Health education and health promotion partnerships within the community to support healthy living

• Media advocacy and social marketing

ES 4 – Mobilize Community Partnerships to Identify and Solve Health Problems

• Constituency development
• Identification of system partners and stakeholders
• Coalition development
• Formal and informal partnerships to promote health improvement

• Policy development to protect health and guide public health practice
• Community and state improvement planning
• Emergency response planning
• Alignment of resources to assure successful planning

ES 6 – Enforce Laws and Regulations That Protect Health and Ensure Safety

- Review, evaluation, and revision of legal authority, laws, and regulations
- Education about laws and regulations
- Advocating for regulations needed to protect and promote health
- Support of compliance efforts and enforcement as needed

• Identification of populations with barriers to care
• Effective entry into a coordinated system of clinical care
• Ongoing care management
• Culturally appropriate and targeted health information for at risk population groups
• Transportation and other enabling services

ES 8 – Assure a Competent Public and Personal Healthcare Workforce

• Assessing the public health and personal health workforce

• Maintaining public health workforce standards
  • Efficient processes for licensing /credentialing requirements
  • Use of public health competencies

• Continuing education and life-long learning
  • Leadership development
  • Cultural competence

Evaluation must be ongoing and should examine:

- Personal health services
- Population based services
- The public health system

Quality Improvement

Performance Management

ES 10 – Research for New Insights and Innovative Solutions to Health Problems

- Identification and monitoring of innovative solutions and cutting-edge research to advance public health
- Linkages between public health practice and academic/research settings
- Epidemiological studies, health policy analyses and public health systems research

<table>
<thead>
<tr>
<th></th>
<th>Public Health</th>
<th>Medicine</th>
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</thead>
<tbody>
<tr>
<td><strong>Focus</strong></td>
<td>Population</td>
<td>Individual</td>
</tr>
<tr>
<td><strong>Intervention</strong></td>
<td>Assess, Policy, Assurance</td>
<td>Medical, Surgical Care</td>
</tr>
<tr>
<td><strong>Process</strong></td>
<td>System Management</td>
<td>Patient Management</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>Healthy Communities</td>
<td>Healthy Individual</td>
</tr>
</tbody>
</table>
Definition:
Public Health Informatics (PHI) is the systematic application of information and computer science and technology to public health practice, research, and learning.

Public Health Informatics

• Analyzes structure, relationships and behavior of systems that store, process and use information
• Integrates information from diverse sources and into work processes where it can generate value
• Develops methods for effective acquisition and presentation of information
• Manages change among people, processes and technology to enable effective use of information systems

Subfields of BMI

Biomedical Informatics
Methods, Techniques, Theories

Bioinformatics

Imaging Informatics

Clinical Informatics

Public Health Informatics

Molecular Cellular

Tissues Organs

Scope

Patients

Populations

health or medical informatics

applied informatics
Dr. John Snow (1813-1858)

- Relevant 1854 London Streets
- Location of the deaths from Cholera
- Position of 13 water pumps
Dr. John Snow (1813-1858)

Population based orientation rather than patient based

Systematic application of geographical information

Added value: Cholera control

(Reynolds, 2011)
A vast array of data

190 data sources are being used to collect progress of Healthy People health objectives

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>School Health Policies and Programs Study (SHPPS)</td>
<td>National Vital Statistics System: Mortality (NSVS:M)</td>
<td>National Profile of Local Health Departments (NHLHD)</td>
<td>National Ambulatory Medical Care Survey (NAMCS)</td>
<td>United States Renal Data System (USRDS)</td>
<td>STD Surveillance System (STOSS)</td>
<td>Medical Expenditure Panel Survey (MEPS)</td>
<td>National Hospital Ambulatory Medical Care Survey (NHAMCS)</td>
<td>Continuing Survey of Food Intake by Individuals (CSFI), 1994-1996</td>
</tr>
<tr>
<td>HIV/AIDS Surveillance System</td>
<td>Medical Expenditure Panel Survey (MEPS)</td>
<td>Monitoring the Future Study (MTF)</td>
<td>National Ambulatory Medical Care Survey (NAMCS)</td>
<td>National Household Survey on Drug Abuse (NHSDA)</td>
<td>National Health and Nutrition Examination Survey (NHANES)</td>
<td>National Health Interview Survey (NHIS)</td>
<td>National Hospital Ambulatory Medical Care Survey (NHAMCS)</td>
<td>National Health and Nutrition Examination Survey (NHANES)</td>
</tr>
<tr>
<td>1999 National Worksite Health Promotion Survey (NWHPS)</td>
<td>School Health Policies and Programs Study (SHPPS)</td>
<td>State Tobacco Activities Tracking and Evaluation System (STATE)</td>
<td>STD Surveillance System (STOSS)</td>
<td>United States Renal Data System (USRDS)</td>
<td>Youth Risk Behavior Surveillance System (YRBSS)</td>
<td>United States Renal Data System (USRDS)</td>
<td>Youth Risk Behavior Surveillance System (YRBSS)</td>
<td></td>
</tr>
</tbody>
</table>
Key Public Health Data Challenges

• Data collected categorically:
  – exist in silos
  – lacks standards and interoperability
• PH reporting is slow, not suitable for responding to bioterrorism and emerging infectious diseases
• Major gaps exist between public health and health care
Legal Mandate

• Local health officers shall exercise due diligence in ascertaining the existence of outbreaks of illness or the unusual prevalence of diseases, and shall immediately investigate the causes of same
The same infrastructure and capabilities used to support data capture at the point of care for emergency preparedness can most definitely be used to implement non-attack public health intervention.
Public Health Needs

Public Health Communication

- Public Health officials need a mechanism to communicate directly with clinical personnel for a variety of reasons:
  - tracking disease outbreaks
  - research surveys
  - public health detailing visits
  - medication or vaccine recalls

Public Health Data Gathering

- Public Health officials regularly need to assess the health of their communities
- Surveys conducted at the local, state, and federal levels
Redesigning EHRs to Support Public Health

- Facilitate patient-provider communication by providing suggestions or scripts for providers on how to discuss sensitive topics
- Using the EHR to allow patients to access, contribute to or correct their own medical record
- Support patient education opportunities
- Produce tailored preventive health information, reminders, and alerts based on personal clinical records
- Assist in identifying potential tailoring variables

Public Health Alerts

- If public health officials could distribute relevant messages directly to providers at the point-of-care, they could target their interventions/monitoring more effectively.

Public Health Ad-hoc Reporting

- If public health officials had a means to get aggregate count information from provider clinics throughout a region, they could track healthcare in virtually real-time.
A set of measures released by the Center for Medicaid Services to demonstrate “meaningful use” of EHRs

Would apply to eligible providers and eligible hospitals

Focus on

- Safety, quality, efficiency
- Clinical Outcomes, prevention
- Patient empowerment

Requirement to comply with 15 measures and more in stages from 2011-2015
Syndromic Surveillance

Immunization Registries

Public Health Alerts & Ad-hoc Reporting
<table>
<thead>
<tr>
<th>Stage 1 Objective</th>
<th>Stage 1 Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capability to submit electronic data to immunization registries or Immunization Information Systems and actual submission in accordance with applicable law and practice</td>
<td>Performed at least one test of the certified EHR technology’s capacity to submit electronic data to immunization registries and follow-up submission if the test is successful (unless none of the immunization registries to which the EP, eligible hospital or CAH submits such information have the capacity to receive such information electronically)</td>
</tr>
<tr>
<td>Hospitals Only: Capability to submit electronic data on reportable (as required by state or local law) lab results to public health agencies and actual submission in accordance with applicable law and practice</td>
<td>Performed at least one test of certified EHR technology’s capacity to provide submission of reportable lab results to public health agencies and follow-up submission if the test is successful (unless none of the public health agencies to which the EP, eligible hospital or CAH submits such information have the capacity to receive such information electronically)</td>
</tr>
<tr>
<td>Capability to submit electronic syndromic surveillance data to public health agencies and actual submission in accordance with applicable law and practice</td>
<td>Performed at least one test of certified EHR technology’s capacity to provide electronic syndromic surveillance data to public health agencies and follow-up submission if the test is successful (unless none of the public health agencies to which the EP, eligible hospital or CAH submits such information have the capacity to receive such information electronically)</td>
</tr>
</tbody>
</table>
**Stage 2 Objective:** Hospitals only; Capability to electronic data to immunization registries or immunization information systems

**Stage 2 Measure:** Successful ongoing submission of electronic immunization data from certified EHR technology to an immunization registry or immunization information system for the entire EHR reporting period

**Stage 2 Objective:** Capability to submit electronic data to immunization registries or immunization information systems and actual submission except where prohibited and in accordance with applicable law and practice

**Stage 2 Measure:** Successful ongoing submission of electronic immunization of electronic immunization data from Certified EHR technology to an immunization registry or immunization information system for the entire EHR reporting period
**Stage 2 Objective:** Capability to submit electronic syndromic surveillance data to public health agencies and actual submission except where prohibited and in accordance with applicable law and practice

**Stage 2 Measure:** Successful ongoing submission of electronic syndromic surveillance data from Certified EHR technology to a public health agency for the entire EHR reporting period

**Stage 2 Objective:** Capability to identify and report cancer cases to a state cancer registry, except where prohibited, and in accordance with applicable law and practice

**Stage 2 Measure:** Successful ongoing submission of cancer case information from certified EHR technology to a cancer registry for the entire EHR reporting period

**Stage 2 Objective:** Capability to identify and report specific cases to a specialized registry

**Stage 2 Measure:** Successful ongoing submission of specific cases information from certified EHR technology to a specialized registry for the entire EHR reporting period
Cervical Screening
Smoking status and cessation counseling
Breast Cancer Screening
Colorectal Cancer Screening
Diabetes urine screening
Public Health Agencies and PHI

• May handle PHI as covered entities, non-covered entities, or hybrid entities – which means they perform both functions
  – Public Health Agency as a covered entity
    • Public Health Agency runs STD clinics, providing patient diagnosis and treatment
  – Public Health Agency as a non-covered entity
    • Mandated by state statute to receive provider reports of identified patients with certain illnesses (usually communicable diseases) for epidemiological investigations
Public Health Agency as a Covered Entity

• The patient must provide authorization for the public health agency to release PHI
• It should be in writing; paper or electronic
• Specific description of the information (e.g., lab report or entire record)
• Purpose for the release & applicable limitations
• An expiration date
Public Health Agency as a Covered Entity

• The public health agency does not need permission from the patient to release PHI in the following scenarios
  – When required or permitted by federal, state, or tribal statutes
  – Required public health reporting
  – Treatment (e.g., referrals, lab orders), Payment (e.g., billing), Healthcare operations (e.g., quality improvement activities)

• HIPAA does not regulate these activities by public health agencies

• However, it allows exceptions for covered entities to disclose PHI to the public health agency without patient authorization
HIPAA PH Exceptions for Covered Entities

Prevent/Control (as authorized by law):
- Disease
- Injury
- Disability

Report vital events
- Deaths
- Births

Conduct:
- Public health surveillance
- Investigations
- Interventions

Foreign government agency
- Acting in collaboration with a public health authority
HIPAA PH Exceptions for Covered Entities

Violence (as authorized by state or local law)
- Child abuse and neglect (many states require reporting by covered entities – some involve the public health agency)
- Domestic violence
- Neglect of elderly/incapacitated

Quality, safety or effectiveness of a product or activity regulated by FDA
- Adverse events
- Tracking FDA regulated products
- Product recalls, repairs or replacement
- Conducting post marketing surveillance
HIPAA PH Exceptions for Covered Entities

- Person at risk of contracting or spreading a disease
- Workplace medical surveillance
- Health Oversight (e.g., disclosure to a state Medicaid program)
- Worker’s compensation
Public Health Agencies as Hybrid Entities

• Many public health agencies perform both covered and non-covered activities under HIPAA
• The agency must designate its components that are covered under the HIPAA Privacy and Security Rule
• The covered entity part of the agency must treat PHI as any other covered entity would, and not share with other parts of the agency unless it complies with HIPAA and applicable state and local laws.
Traditional Surveillance

- Case definitions
- Historically low compliance
- Laboratory confirmation can be slow
- Still important (e.g. H1N1 in NYC)
Traditional Reporting is Labor Intensive

(NYCDOH, 2010)
What is Syndromic Surveillance?

• “Real-time” public health surveillance using data that is routinely collected for other purposes
Syndromic Surveillance

- Pre-diagnostic indicators of disease
- Readiness scenarios: bioterrorism, pandemics
- Objectives:
  - Timely, sensitive, specific surveillance
  - Detect outbreak before ‘astute clinician’
- Typical Process:
  - Collect data
  - Process & code data
  - Establish baseline
  - Identify outbreak
  - Sound alarm
# Diverse Data Types

<table>
<thead>
<tr>
<th>Data source</th>
<th>Level of data</th>
<th>Data type</th>
<th>Setting</th>
<th>Care phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medication sales</td>
<td>Aggregate</td>
<td>Drug category</td>
<td>Pre-clinical</td>
<td>Pre-diagnostic</td>
</tr>
<tr>
<td>School absences</td>
<td>Aggregate</td>
<td>Frequency</td>
<td>Pre-clinical</td>
<td>Pre-diagnostic</td>
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<tr>
<td>Nurse hotline call</td>
<td>Individual</td>
<td>Call type</td>
<td>Pre-clinical</td>
<td>Pre-diagnostic</td>
</tr>
<tr>
<td>Chief complaint / Reason for Visit</td>
<td>Individual</td>
<td>Text, brief</td>
<td>Clinical</td>
<td>Pre-diagnostic</td>
</tr>
<tr>
<td>EMS call</td>
<td>Individual</td>
<td>Run type</td>
<td>Clinical</td>
<td>Pre-diagnostic</td>
</tr>
<tr>
<td>Temperature</td>
<td>Individual</td>
<td>Vital sign</td>
<td>Clinical</td>
<td>Pre-diagnostic</td>
</tr>
<tr>
<td>Radiology Report</td>
<td>Individual</td>
<td>Text, narrative</td>
<td>Clinical</td>
<td>Pre-diagnostic</td>
</tr>
<tr>
<td>Chest X-ray</td>
<td>Individual</td>
<td>CPT code</td>
<td>Clinical</td>
<td>Pre-diagnostic</td>
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<tr>
<td>Diagnosis code</td>
<td>Individual</td>
<td>ICD9 code</td>
<td>Clinical</td>
<td>Diagnostic</td>
</tr>
<tr>
<td>Progress Note</td>
<td>Individual</td>
<td>Text, narrative</td>
<td>Clinical</td>
<td>Diagnosis</td>
</tr>
</tbody>
</table>

Health IT Workforce Curriculum
Version 3.0/Spring 2012

Public Health IT

Biosurveillance
The Primary Care Information Project (PCIP) uses different EHR data sources to conduct & pilot syndromic surveillance activities.

Some syndromes tracked using EHR data are:

- Influenza-like Illness (ILI)
- Fever
- Gastrointestinal (GI)

Case definitions for these syndromes based upon text in these structured fields:

- Chief Complaint
- Measured Temperature
- Diagnosis (ICD-9-CM Code)
System Screenshot
New Response Requirements

- Fast detection
- Fast science
- Fast & effective communication
- Fast & effective integration
- Fast & effective action
- Globalization, connectivity, and speed
Potential Syndromic Surveillance Data Sources

Day 1
- Feels fine

Day 2
- Headaches & fever
- Buys Tylenol

Day 3
- Cough
- Calls nurse hotline
- Pharmaceutical sales

Day 4
- Sees private doctor
- “Flu”
- Nurse’s hotline
Potential Syndromic Surveillance Data Sources

Day 5
- Worsens, calls ambulance
- Seen in ED
- Managed Care Org.
- Absenteeism
- Ambulance dispatch (EMS)
- ED logs

Day 6
- Admitted
- “Pneumonia”

Day 7
- Critically ill
- ICU
- Traditional surveillance

Day 8
- Expires
- “Respiratory failure”
Analysis:
Test Observed vs. Expected

(Buck, 2010.)
Challenges of Outbreak Detection

Measuring Accuracy

- Natural occurring vs. simulations

Outbreak types

- Surge easier to detect than slow building outbreaks

Size

- Smaller is harder to detect

Timeliness

- Earlier is harder to detect
Information Exchange

• Health Information Exchange (HIE)
  • the secure sharing of electronically stored information among different information systems and providers

• Regional Health Information Organization (RHIO)
  • organization responsible for the exchange of information within a specific area
Diagnose and Investigate Health Issues

RHIOs are organizations that support information exchange

Public health officials can access RHIO for disease case investigation purposes

Data may include demographics, laboratory values, medications
• The development of one system that collects individual data on chronic diseases could be utilized to understand the continuum of disease prevention, progression, treatment, and outcomes

• The linking of current public health registries to patient data
• Electronic laboratory reporting
• Screening of reported physician-based diagnoses
• Accessing additional information during public health investigations
• Consolidation of data for biosurveillance
• Antibiotic-resistant organism surveillance
• Population-level quality monitoring
Purpose of Registries

- A registry provides information necessary for conducting epidemiological studies

Types of information:
- Cancer statistics
- Mortality
- Exposures to toxic agents

Information can be used to:
- Estimate survival rates
- Evaluate health effects of exposure to contaminants
- Hypothesize and research disease etiology
- Provide source of potential participants in investigative studies
Characteristics distinguishing registries from other sources of publicly available data:

- Specific to a disease, a group of similar diseases or exposure to contaminants
- Data collected represents information from many sources
- Collects data prospectively on individual patients by referencing active systems, such as hospital discharge information
- Follow-up investigates current status of individuals enrolled in registries
- Costs are high due to expensive nature of collecting data from many diverse sources over a long-period of time which requires extensive human and technical efforts
Maintenance of Registries

- Federal government
- State government
- Universities
- Hospitals, both individual and associations of hospitals
- Non-profit organizations
- Private entities
To update public health information tools, (registries and epidemiological databases), information must be exchanged between:

- Federal agencies
- Communities
- Public health departments
- Clinical institutions
Components of Epidemiology

• The science of a systematic methodology to understand the causal relationships between:

  - Determinants and disease
  - Health of populations and subgroups of populations as a collective system rather than individual components
  - Analysis of prevalence, incidence and risk
Causes of Disease

Environmental causes of disease:
- Potential behavioral, social, cultural influences on routine lifestyle choices
- Exposure to drugs & situational contaminants that influence the frequency of the disease within a population

Mechanistic causes of disease:
- Potential biological factors, such as genetic mutations
Populations and Samples

(Fletcher, 2005.)
• An observation raises a research question that is formed into a hypothesis about potential causes for disease.
An epidemiological study:

- Examines statistical association between potential environmental and/or mechanistic causes of disease
- In order to measure the effect of these causes in the frequency of disease within a population or population subgroup

A causal inference as a result of an epidemiological study:

- Can be used to develop prevention programs for the community
Types of Epidemiology

Classic types of epidemiology:
- Field-based
- Descriptive

Modern forms:
- Analytic
- Experimental
- Clinical
- Molecular
Clinical Epidemiology

• Clinical epidemiology relies on observations of individual patients within clinical practice to provide evidence for decision-making concerning diagnostic and health interventions
By relying on experience with health outcomes observed in previous patients

Evidence-based practice strives to improve the effectiveness and reduce the costs of patient care
Current Applications of Epidemiology

- Identification of emerging health issues and causes
- Assessment of risks from environmental exposures
- Identification of population subgroups with high risk for disease
- Measuring effectiveness of new intervention programs
- Mapping geographic movement of emerging disease for clinical preparation
- Identification of variations among health practitioners and patient usage of health services
Sources of Data

- Vital statistics
- Active and passive public health surveillance
- Epidemiological databases
- Registries
Health Research

- Study design
- Estimation
- Inference
- Confounding and interaction
- Quality and presentation of data
Evidence-Based Practice

• Growing movement in medicine and public health
• A requirement for funding by many agencies
• Dissemination into community can influence change
Evidence-Based Recommendations

- Relevance of health research to target population
- Assessment of benefits, harms and values of the effect
- Quality of evidence and magnitude of effect combined to define grade for recommendations
Descriptive Epidemiology – Questions to Ask

How much?
- Frequency

When?
- Time

Where?
- Place

Among Whom?
- Person
Frequency of Disease

Burden
- Morbidity
- Mortality

Course
- Incidence
- Prevalence
- Case Fatality
Dimensions of Health Conditions

**Time: Changes in disease occurrence**
- Seasonal patterns
- Epidemics

**Place: Geographical boundaries**
- Rooms, buildings structures
- Countries, states, cities

**Person: Characteristics of the populations**
- Age
- Income levels
Types of Health Prevention

- Primary
- Secondary
- Tertiary
Target Population

- Individuals
- Groups at high-risk
- Communities
- Populations
Intervention Methods

- Education
- Incentives for changing behavior
- Laws and policies
- Solutions
Evaluation

Quality Improvement

Patient Safety

Assessment of Health Outcomes

Reassessment of Remaining Problems
Clinical Preventive Services

- Screening
- Counseling for Behavioral Change
- Immunization
- Preventive Medication
- Other Interventions
Clinical Prevention Approaches

- Range of test values
- Diverse patient perspectives
- Training
- Techniques of administration
- Time-based
- Diet, exercise, behavior cessation
• How do you quantify the ‘goodness’ in health care?

• “Every system is perfectly designed to achieve exactly the results it gets.”

  - Avedis Donabedian
Principles for Quality Measure Development

Relevance/meaningfulness
- How many people does the measure impact?
- How much health benefit could be achieved?

Scientific evidence
- How strong is the association between the intervention/clinical service and health benefit?

Feasibility
- Does the burden of data collection exceed the benefit of measurement?
- Are the available data reliable and validate for assessing this indicator?

Usability
- How broadly is this measure adopted by health care professionals or settings?
Reasons to Measure Quality

**Improving Quality of Care**
- Process
  - Underuse (e.g. Chlamydia screening)
  - Overuse (e.g. antibiotic prescriptions)
  - Misuse (e.g. medications to avoid in the elderly)
- Outcomes (e.g. control of blood pressure)
- Safety

**Informing Purchasers/Consumers**
- Comparison of providers or organizations with regional or national averages
- Ranking of providers or organization

**Improving Value of Care**
- Access & utilization (e.g. well child visits, hospital stays)
- Efficiency (e.g. cost per diabetic to control A1c)
- Payment (e.g. pay-for-performance)
<table>
<thead>
<tr>
<th>Resources for Validated Performance Measures</th>
<th>Types of Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambulatory Quality Alliance (AQA)</td>
<td>• Physician and other Clinician Performance  &lt;br&gt;• Acute/Chronic Care  &lt;br&gt;• Surgery/Procedures  &lt;br&gt;• Consumer Assessment of Health Providers Survey (CAHPS®) - Clinician and Group Survey  &lt;br&gt;• Cost of Care</td>
</tr>
<tr>
<td>Joint Commission on Accreditation of health care Organizations (JCAHO)</td>
<td>• Hospital Accreditation and Certification  &lt;br&gt;• Patient Safety</td>
</tr>
<tr>
<td>National Committee for Quality Assurance (NCQA)</td>
<td>• Health care Effectiveness Data and Information Set (HEDIS)  &lt;br&gt;• Health Care Organization Accreditation  &lt;br&gt;• Provider Recognition Programs</td>
</tr>
<tr>
<td>National Quality Forum (NQF)</td>
<td>• Patient and Family Engagement  &lt;br&gt;• Population Health  &lt;br&gt;• Safety  &lt;br&gt;• Care Coordination  &lt;br&gt;• Palliative and End-of-Life Care  &lt;br&gt;• Overuse</td>
</tr>
<tr>
<td>National Quality Measures Clearinghouse sponsored by the Agency for health care Research and Quality (AHRQ)</td>
<td>Resource for clinical practice guidelines for  &lt;br&gt;• health care providers -- integrated delivery systems  &lt;br&gt;• health plans -- purchasers</td>
</tr>
</tbody>
</table>
Data Sources

• How reliable are these data sources for the different types of measurement?

Administrative data sources

• Operations (call logs, wait times, complaints)
• Claims (payment for services rendered)
• Diagnostics (labs, imaging)

Clinical information (chart review, electronic health records)

Surveys (patient perception/experiences)
Using EHRs for Automated Quality Reporting

- EHR users document patient data into EHR
- Patient data are aggregated & formatted into standardized quality measures & transmitted to NYC health department
- Some EHR users have systems that aggregate patient data into a standardized format
- Others require another entity/software program to aggregate data prior to transmitting to NYC health department

(Shih, 2010.)
Quality Measures in Data Warehouse
Example: Smoking

ANATOMY OF QUALITY DATA IN HEALTHCARE QUALITY INFORMATION NETWORK (HQIN)

From Each Provider Transmitting to HQIN:

\[
\frac{\text{# of Patients receiving or meeting a recommended treatment goal}}{\text{# of Eligible patients for a recommended service or treatment goal}} = \% \text{ of Patients meeting a quality goal}
\]

Example:

<table>
<thead>
<tr>
<th>Measure*</th>
<th>Numerator</th>
<th>Denominator</th>
<th>% met goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice 1 Provider A Smoking Status</td>
<td>10</td>
<td>20</td>
<td>50.0</td>
</tr>
<tr>
<td>Practice 2 Provider A Smoking Status</td>
<td>5</td>
<td>8</td>
<td>62.5</td>
</tr>
<tr>
<td>Practice 2 Provider B Smoking Status</td>
<td>20</td>
<td>35</td>
<td>57.1</td>
</tr>
<tr>
<td>Practice 3 Provider A Smoking Status</td>
<td>3</td>
<td>3</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>sum</strong></td>
<td><strong>38</strong></td>
<td><strong>66</strong></td>
<td><strong>57.6</strong></td>
</tr>
</tbody>
</table>

Provider average: 9.5 / 16.5 = 57.6
Practice average: 8.5 / 16.2 = 53.1

*Currently, there are 37 quality measures being reported based on TCNY indicators

(Shih, 2010.)
<table>
<thead>
<tr>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide summary of care through electronic messaging to communicate</td>
</tr>
<tr>
<td>with patients on relevant health information</td>
</tr>
<tr>
<td>Record smoking status for patients 13 years of age or older for more</td>
</tr>
<tr>
<td>than 50% of patients 13 years of age or older that have smoking status</td>
</tr>
<tr>
<td>recorded as structured data</td>
</tr>
<tr>
<td>Height, weight, BMI and growth charts for patients 0-20 years old.</td>
</tr>
<tr>
<td>Hypertension: Blood pressure measurement</td>
</tr>
<tr>
<td>Ischemic Vascular Disease Patients with LDL under control</td>
</tr>
<tr>
<td>Adult Weight Screening and Follow-up</td>
</tr>
<tr>
<td>Preventive Care and Screening Measure Pair:</td>
</tr>
<tr>
<td>a) Tobacco Use Assessment, b) Tobacco Cessation Intervention</td>
</tr>
<tr>
<td>Colorectal cancer screenings</td>
</tr>
<tr>
<td>Breast cancer screenings</td>
</tr>
<tr>
<td>Ischemic Vascular Disease Patients on aspirin prophylaxis</td>
</tr>
<tr>
<td>Preventive Care and Screening: Influenza Immunization for patients</td>
</tr>
<tr>
<td>50 years old or older</td>
</tr>
<tr>
<td>Pneumonia Vaccination for older adults.</td>
</tr>
</tbody>
</table>
Having electronic medical records doesn’t mean quality reporting accurately reflects practice performance

- Example: Majority of smoking status and smoking cessation intervention not captured for automated quality measure reporting
What is ‘Population Health’?

- Relatively new term
- Has its origins in Canada
- Debate over exact emphasis or precise definition exists
  - Is it a ‘concept of health’ or a ‘field of study of the determinants of health’
- Population Health *not synonymous* to Public Health
Patterns of health determinants over the course of life

Health outcomes and distribution in a population

Policies and interventions at the social and individual levels
Definitions

An outcome oriented definition

- “The health outcomes of a group of individuals, including the distribution of such outcomes within the group”

Broad definition

- “health of a population as measured by health status indicators and as influenced by social, economic, and physical environments, personal health practices, individual capacity and coping skills, human biology, early childhood development, and health services.”
Population Health = Population + Health

Population can have varying scope

- Clinic, Hospital
- Community, City, State
- Ethnic, Socio-economic

Health can be defined to include both absence of disease and well being
Population health has broader emphasis than how public health is usually defined.

Public health defined as a set of government agencies that work to “assess” and “assure” the conditions that are needed to maintain healthy societies.
Population Health Measures

Determinants or Process Measures

- Disease specific (number of mammograms)
- Smoking counseling rates

Outcome measures

- Usually summative aggregate measures
- Some candidates
  - Quality Adjusted Life Expectancy (QALY)
  - Years of Healthy living
  - Health Adjusted Life Expectancy (HALE)
EHR Functions for Population Health

EHRs can support assessment of several population health measures

Determinant Measures

- Smoking rates
- Screening services dispensed
- Socio-economic measures

Outcome measures

- Lesser support
EHR Functions for Population Health

Functional components of EHR that support population health

Guideline driven decision support modules
- Alerts to enable preventive screening
- Forms for disease specific data capture

Registry functions
- Able to create or query for a population of patients

Reporting functions
- Create reports for different measures
Future Innovations

- Genetic testing
- Spoken dialogue systems
- Virtual health agents
- PHRs
- Telemedicine
- Location/mobile services
- Crowdsourcing