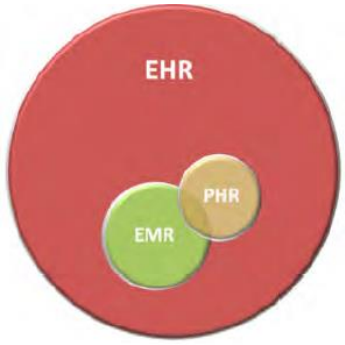
EHR – Data Analytics

1. Explain the difference between descriptive, predictive and prescriptive analytics.
   - **Descriptive:** describes a current or past situation – standard types of reporting
   - **Predictive:** using descriptive data, can simulate and model trends from the past and helps predict what might happen
   - **Prescriptive:** uses descriptive & predictive data to help determine what to do given a situation to optimize outcomes = most sophisticated & is the goal of data analytics in healthcare

2. Define the concept of data mining and personalized medicine as forms of data analytics.
   - **Data mining:** collecting & modelling data to discover previously unknown patterns or relationships
   - **Personalized medicine:** modeling with predictive value in the care of a patient

3. Identify 3 limitations and challenges of healthcare data analytics.
   - The data can be incomplete
   - Just because in the system a person has dispensed a drug at this time & date, doesn't mean the person picked it up at this time, or started the drug once they received it
   - Ethical concerns such as data ownership
   - Transforming the data to suit other purposes such as billing

4. Compare and contrast an electronic health record (EHR), from an electronic medical record (EMR) and a personal health record (PHR).



   - **Electronic Health Record (EHR):** an electronic record of health-related information on an individual created/managed by healthcare clinicians and staff across more than one healthcare organization (ex// PharmaNet)
   - **Electronic Medical Record (EMR):** same as EHR but specific to only one healthcare organization (ex// local pharmacy records)
   - **Personal Health Record (PHR):** an electronic record of health-related information on an individual, drawing from multiple sources, and created/managed by the individual (ex// myehealth)

5. List the 8 key components of an EHR.
   1. Health information & data that can be accurately reported
   2. Manage results from labs, imaging, specialist consults
   3. Manage ordering new prescriptions, referrals, blood work requisitions
   4. Provide decision support with alerts and reminders
   5. Communication feature through messaging or connections with web portals (ex// PHR)
   6. Patient support via education & information output to PHRs
   7. Admin functions including scheduling, billing, automated features, reporting of metrics
   8. Manage reporting for Public Health including immunization status, culture and sensitivity reports

6. List 4 advantages to using an EHR over paper-based record keeping.
    - Improve legibility of notes
    - Can improve access anytime, anywhere
    - Eliminates "missing" files
    - Reduced duplication with automation
    - Enables data analytics
    - Reminders for overdue tests or visits
    - Clinical decision support tools embedded in the program
    - Electronic lists of diagnoses, allergies, medications, etc
7. List one disadvantage to using an EHR over paper-based record keeping.
    - Takes time
    - Laptops/computer more expensive
    - Ethical issues

EHR – Access and Implications on Care, ePrescribing & Billing

1. Recognize when an Electronic Health Record can be used in the typical workflow of caring for a patient and provide a reason why this data can be helpful.
    - No actual answer given in class, think about this "open-ended" question

2. Define computerized physician order entry (CPOE) in contrast to ePrescribing.
    - **CPOE =** a feature in EHR systems that help process any orders (ex// for medications, labs, consults etc); **relies on coding**
    - **ePrescribing** = specific to submitting medication orders only

3. Explain how CPOE is connected with different sets of data and information systems as part of an electronic health record.
    - Integration with decision-support tools
    - Links to interaction checkers
    - Adverse drug event reporting systems

4. Explain one reason why the use of CPOE can lead to more problems.
    - Poor implementation (including untrained tutors)

5. List 3 possible problems with the use of CPOE.
    - Increase in mortality
    - Increased risk of alert fatigue
    - Increased time taken to deliver care

6. Provide examples of the processes and features of an EHR including demographic information, documenting a clinical encounter, submitting a lab requisition, creating a new prescription, and billing.
    - Scheduling component
    - Clinical encounter (including subjective vs. objective notes)
    - Submitting a lab requisition (create fields over template)
    - Creating prescription
    - Billing

EHR – Team-based records, admin features

1. Compare and contrast the key concepts of syntax and semantics and be able to provide one example of each.
   - **Syntax:** language format rules (ex// health language – HL7)
   - **Semantics:** meaning/interpreting of a language (ex// ICD9, SNOMED-CT)

2. Explain the difference between transport and content standards.
   - **Transport standards:** standards of communication between multiple systems
   - **Content standards:** standards of how the data being transported is packaged (ex// HL7)

3. Provide 1 advantage of SNOMED over ICD9.
   - SNOWMED allows for layering of different codes to create a good description (ex// burn + left finger + cause from hot water)
   - ICD9 gives one code for every single thing (ex// separate code for left finger vs. right finger vs. foot burn)

4. Provide 3 examples of common myths/problems when choosing an EHR system.
   - A new EHR will fix all of your problems
   - Mobile platforms are the best
   - EHR's will eliminate errors
   - I don't need training, how hard can it be?
   - Not including other clinicians in the planning and implementation
   - Thinking one person can still use paper-based while everyone else transitions to EHR

5. Provide 1 example of how technology can enable and inhibit collaborative practice and explain how this applies to software design.
   - Asynchronous use of "e-visits"
   - Easy access to other clinicians (ex// via chat)
   - Different professions will use the EHR differently, access different modules

6. Describe one advantage of using an EHR for administrative functions and be able to apply this to examples in practice.
   - Increase in automation of simple tasks
   - Examples:
     - Automated email reminders of appointments or refills due
     - Appointment cancellation and rebooking online
     - Clinician work schedule online
     - Allow patients to update their extended health information online
     - Allow patients to get price quotas or to see if their drug would be covered

Genomics in the Community Pharmacy

1. Recall 3 reasons why genome sequencing in the context of pharmacogenomics might be worth the cost to the patient.
   - Genome allows for truly personalized medicine
   - Acquire once query indefinitely
   - Sequence today for questions of tomorrow

2. Describe, in the context of data analytics (descriptive, predictive, prescriptive), where personalized medicine is in currently.
   - Personalized medicine is currently in the descriptive stage because it is only observational data
   - It will grow more predictive as the sequenced population grows!

3. Explain 1 difference between whole exome sequencing (e.g. the BC project) versus sequencing only for current actionable variants (e.g. 23&Me).
   - The BC project is a complete decoding of all genes, not selected variants

4. List 3 possible barriers to the adoption of pharmacogenomics.
   - Lack of incentives for clinicians to conduct tests or implement procedures that might prevent adverse effects
   - Lack of education in clinicians
   - Few studies to prove cost-effectiveness of pharmacogenomics testing; insatiable desire for more evidence
   - Lack of clear guidelines for translating genetic variations into actionable recommendations
   - Health systems do not provide financial reimbursements for preventive-medicine services
   - Concerns about incidental findings
   - Inertia in health care systems

Adverse Drug Event Reporting

1. Compare and contrast adverse drug reaction and adverse drug event.
   - **Adverse Drug Reaction (ADR):** a response to a drug that is noxious & unintended, and occurs at doses normally used for prophylaxis, diagnosis or therapy of disease
   - **Adverse Drug Event (ADE):** any unfavorable and unintended sign (including abnormal lab findings), symptom, or disease temporarily associated with the use of a medicinal product, whether or not considered related to the medicinal product

2. Provide 5 examples of limitations currently seen in the PharmaNet allergy field.
   - Free text
   - Unable to enter from hospital
   - Quality of information highly variable
   - Often not used or incomplete
   - Static

Software Development Lifecycle

1. List and describe each of the 6 steps in a software development lifecycle.
    1. **Requirement analysis** (aka requirement engineering): determine user expectations (= requirements) for a new or modified product; requirements must be quantifiable, relevant & detailed = functional specifications
    2. **Architecture:** making fundamental structural choices which are costly to change once implemented
    3. **Proof of concept (PoC)**: realization of a certain method or idea to demonstrate its feasibility
    4. **Development:** process of computer programming, documenting, testing, and bug fixing involved in creating and maintaining applications and frameworks involved in a software release life cycle & resulting in a software product
    5. **Testing:** execution of a software component or system component to evaluate one or more properties of interest (does software run correctly? does output satisfy user's requirements?)
    6. **User acceptance testing (UAT):** process of verifying that a solution works for the user; aka beta-testing