1. Characterizing outbreaks by time.
   ✷ Point source. Calculating likely exposure period...
      (latest reported case – longest incubation time) – (first reported case – shortest incubation time)

   ✷ Common source.

   ✷ Propagated source. Note that * = generation period.

2. Attack rate = (# of cases) / (population at risk) x 100%
   Also known as “incidence” and “incidence rate.” Attack rate is the typical term when discussing
disease outbreaks.

3. The ubiquitous “food poisoning” question. Was it the mayonnaise, the milk, the chicken, etc?
   To answer this type of question, identify whether or not the problem is presented as a case-control
   or cohort study, then create tables and estimate the relative risks or odds ratio for each food.
**Topic 2. Comparing groups fairly.**

1. **Prevalence vs. incidence.** Prevalence is simply a count of people with a given disease out of the total population at a given time. Incidence is a **rate**, reflecting how many new cases occur per unit of experience (e.g. person-years). Start keeping track of things called “rates” because trick questions can be written about them.

2. **Mortality rate.** How many people have died out of a total population during a specified time period.

3. **Case-fatality rate.** Number of people who died of a disease divided by the total number of people with the disease.

4. **Prevalence = Incidence x Mean Duration.**

5. **Relative Risk.** 
   \[ RR = \frac{I_e}{I_o} \]
   - \( I_e \) = Incidence of a disease among exposed population
   - \( I_o \) = Incidence of a disease among unexposed population
   - \( I_t \) = Incidence of a disease among the total population

6. **Types of bias.** Memorize the names and definitions. Our shorthand definitions here may not be enough, and this may not be a complete list, so study your notes from class as well! These will show up on every Epidemiology exam this semester.

   **Selection biases.**
   - Berkson bias. Hospital admissions are generally sicker than the general population. Generalizing these patients to the rest of the population, or using general population as controls, is not always appropriate.
   - Survivor treatment bias. People who die very early from the disease don’t get the treatment so making them “controls” for treated patients may exaggerate the benefit of the treatment.
   - Competing medical issues bias. Hospitalized patients have multiple comorbidities that may complicate their participation in a controlled study.
   - Bias by indication. Non-randomized patients may have more than one reason to be given the study drug by their doctor.
   - Bias by contraindication. Non-randomized patients may have reasons not to be given study drugs by their doctor.
   - Unmasking bias. Innocent exposure may yield signs or symptoms that make us search more rigorously for a disease in one arm of the study and not in the other.
   - Prevalence-incidence bias. A late look at exposed/affected patients may miss the fatal, short-lived, mild or silent cases of a disease.
   - Volunteer bias. Generally, people who volunteer for a study perform better in study outcomes than the rest of the population.

   **Measurement biases.**
   - Recall bias. People might get questioned more rigorously if they are in the “exposed” or “affected” arm of a study, and may remember more health details. Tends to falsely increase the strength of association of the exposure to the disease.
   - Family information bias. A new case of a disease in a family makes patients more likely to remember other cases in their families.
   - Diagnostic-suspicion bias. Knowledge of the exposure status leads to a more rigorous attempt to diagnose disease. A problem in cohort studies.
7. Confounding. A variable associated with the exposure and the disease may lead to a false impression about the association between them.

8. Mortality.
   - Direct age adjustment. Uses death rates from the observed population and the age distribution from a standardized population.
     More: You are given a standard distribution (e.g. standard age distribution), which you apply to your population’s age-specific rates to find the total number of “expected” deaths given the standard stratification. This way, age will no longer be a discrepant factor between the two groups, and you can compare communities as though their cases had identical distributions. In other words, you will have removed the effect of disparate age distributions to allow a valid comparison between groups. The total number of deaths you calculate for each community will now be divided by the total number of cases to give you a rate that allows a valid comparison between groups.
   - Standardized mortality ratio (SMR), also known as “Indirect rate adjustment.”
     = observed deaths / “expected” deaths
     Uses death rates from a standardized population and the age distribution from the observed population.
     More: You are given standard rates, which you apply to your own stratified characteristic (e.g. to your community’s person-time stratification) to find the total number of “expected” deaths given the standard rates. You then compare your observed total number of deaths to this expected total number of deaths. One hundred times the ratio of your total number to their number multiplied gives the “SMR.” An SMR of 135%, for example, indicates that your community suffers 35% greater mortality than would be expected based on the mortality in the reference population.
     Examples: “Asbestos workers have a risk of cancer mortality approximately 35% higher than men in the general population.” “After taking gender and age into account, the mortality rate for Champaign County residents is 112% that of Illinois state as a whole.”
   - Proportional mortality = deaths due to disease X / all deaths in that time period
   - Proportional mortality ratio (PMR) = PM in study group / PM in comparison population.
     This value, while cheap and easy to calculate, may give false impressions.
     Example: “The proportion of deaths attributable to cancer is almost twice as great among nuclear shipyard workers as among a comparable US population.”

Topic 3. Cohort and case-control studies.
1. The formulas. These will show up on every Epi exam this semester.
   - Relative risk ............ RR = I_e/I_o
   - Attributable risk ...... AR = I_e-I_o
     Also called “individual AR”
     Examples: “20 out of every 10,000 drivers die each year because of driving under the influence.” “Out of every 10,000 drivers, 20 die each year who would not have, had they not been driving under the influence.”
   - AR %..................... AR% = (I_e-I_o)/I_e = (RR-1)/RR
     % of cases attributable to the risk factor
     Examples: “Nearly 38% of myocardial infarctions among young women who use oral contraceptives could be attributed to that exposure.” “As a young woman, you could reduce your rate of death from MI by 38% just by not taking oral contraceptives.”
   - Population AR .......... PAR = I_t-I_o = P_e(AR)
     # of cases in population attributable to exposure. P_e is the prevalence of the exposure. I_t is the incidence of the disease in the total population.
Example: “For every million men in the population this year, 425 men will get lung cancer who would not have if they did not smoke.”

\[ \text{PAR} \% = \frac{(I_t - I_o)}{I_t} = \frac{P_e(RR-1)}{P_e(RR-1)+1} \]

% of population at risk due to the exposure

Example: “5% of myocardial infarctions among premenopausal women is due to their use of oral contraceptives.”

\[ I_t = I_o(P_e) + I_o(1-P_e) \]

2. Cohort studies.
   - Identify people with and without the exposure of interest, follow them to find incidences of disease.
   - Allows calculation of incidence, risks and rates.
   - Prospective v. retrospective cohort studies.
   - Birth cohort effect.

3. Case-control studies.
   - Identify people who do and don’t have the disease of interest, then examine their pasts to see if they had a particular exposure.
   - Limitations: Cannot calculate incidence! A common subject for trick questions on exams. You also cannot calculate anything else with a “rate” in it, such as AR or PAR. However, you can calculate AR% and PAR%.
   - Can calculate odds ratio to estimate RR. Create a table, use AD/BC formula. Remember, OR approximates RR when a disease is rare. As prevalence of the disease increases in your population, OR becomes a less accurate measurement.
   - Do not use OR in a disease outbreak (the disease is not rare in that population).
   - How to select your controls: They must be different from the cases in that they do not have the disease; they should be similar to the cases in every other way possible; you don’t know whether the cases or the controls have had your exposure of interest until you survey them.
   - Case-cohort study: From a larger cohort, select cases and controls come randomly from the baseline cohort.
   - Nested case-control study: From a larger cohort, select cases and controls come randomly from members of the cohort when the new cases occur.

Once you have read through this review sheet, try and work out the following “Practice Set” problems given on the course website. Solving problems is the BEST way to study for the exam!

- Hepatitis
- Comparing Disease Frequencies
- Cohort and Case-Control Studies
A few other practice questions to consider...

1. The UICOM recently held a retirement reception but due to budget cuts had to go with the cheaper caterer. After the event, 90 of the 120 attendees reported having severe gastroenteritis for the weekend. The epidemiologist in you wanted to figure out which food(s) at the event might be responsible, so you interviewed all of the attendees: Of 60 people who recalled eating mini beef Wellingtons, 50 of them reported getting sick. Of 100 people who recalled eating spicy chicken satay, 85 reported getting sick. Of 40 people who recalled having vegetables with ranch dressing dip, 35 reported getting sick. Based on these interviews, which food is most likely responsible for the gastroenteritis outbreak?

2. As a lonely med student last Saturday night you decided to cruise a very crowded campus after-hours party. On Wednesday you read in the paper that 6% of students who attended after-hours parties that weekend were later diagnosed with viral meningitis, whereas 0.1% of students who did not attend these parties contracted the disease. Across campus, the attack rate of viral meningitis is 1%. Calculate the relative risk and all attributable risks to describe the association between viral meningitis and participation in campus after-hours parties last weekend.

3. As a beer connoisseur, you predict that among beer drinkers, drinking Budweiser products might be associated with earlier mortality from cirrhosis than drinking other brands of beer. To test this hypothesis you conduct a case-control study in which beer-drinking patients who recently died of alcohol-related cirrhosis were compared to control cirrhotic patients who are surviving. Your study finds that 60% of the recent deaths due to alcohol-related cirrhosis were long-time Bud drinkers, versus 15% of the control patients were Bud drinkers.

   a. Before we do any math, can you think of some biases that might come into play in the design of this study?

   b. According to these data, how many times does Bud drinking increase the risk of death due to cirrhosis? Are you calculating an OR or an RR? Why is that important?

   c. You have a close friend who is a social drinker on weekends, who happens to enjoy Bud Light. Your friend asks you, “If I’m at risk of having cirrhosis, then what fraction of my risk of dying from it is due to my choice of beer?” How will you answer?

   d. If 65% of American beer drinkers at risk for cirrhosis report selecting Budweiser products, what fraction of cirrhotic deaths among beer drinkers would you attribute to beer brand choice?