My name is Kathleen O’Rourke. Welcome to the start of class

Epidemiology is the study of how disease is distributed in populations and the factors that influence or determine this distribution. The overall purpose of epidemiology is that by understanding disease, we can prevent and control disease, and improve health. For those who find acronyms helpful, think of it as the 3 Ds of epidemiology:

Distribution: we want to understand how disease is distributed. The assumption is that disease is not a random event and occurs at different rates in different populations. Understanding this distribution can give us clues to the 2nd D

Determinants: What factors cause disease to increase or decrease? Looking at these factors can give us clues as to the cause of a disease. These factors can be called risk factors or risk regulators.

Deterrents: Finally, we want to understand either factors that can prevent disease, reduce disease, or cure disease.
I like this description of epidemiology presented by a professor of Epidemiology at Columbia University. He states that epidemiology is as epidemiology does. So in that regard, at the end of this lesson, I am giving you an epidemiological problem to solve: identifying the cause of a gastrointestinal outbreak in a small community. See the assignment “Thinking like an Epidemiologist” for details.

Epidemiology serves to provide key methodology for public health and is the cornerstone of research. There are two types of research: quantitative and qualitative. Quantitative falls under epidemiology and is more concerned with statistical analysis, evaluating numerical data and associations. Qualitative deals with understanding why a behavior or disease occurs, and is generally taught within behavioral health. The combination of the two methods is actually ideal in fully understanding a research study.

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For example, I once worked on a study of postpartum complications in Bolivia, where we looked at complications among women in a high risk maternity center. Most women in our study delivered at home and came to the hospital with postpartum complications or planned to deliver at home but came into the hospital with labor and delivery complications. As you can imagine, this was a high risk group and we had approximately 1,000 women in our study. But we only had 3 women with postpartum infection. Epidemiologically, we could describe these three cases but we knew the number was much smaller than we would have expected. When we added a qualitative component and patients were asked about infection, we discovered that postpartum infection (sobreparto as it was called by the women) was actually quite common but it was not seen as a reason to go to the hospital. Treatment consisted of staying at home with warm blankets and hot foods. Without this qualitative information, we would not have been able to understand this infection. I once had a friend in Community and Family Health who said “Just when it gets interesting, the epidemiologists go home.” I’ll leave you to decide if that is true.

Epidemiology is the tool by which we answer public health questions. Epidemiology has some basic assumptions: (1) human disease does not occur at random, (2) Causal and preventative factors can be identified through systematic investigations of different populations or subgroups of populations in different places and times.

There are a number of important questions at this time. Some are concerned with understanding the rate of certain diseases, such as drunk driving, measles, influenza. Others are concerned with prevention methods or treatments. Understand that the study of epidemiology occurs within the context of the community. Furthermore,
epidemiological questions can be of great interest to the community and answers to these questions do not solely come from epidemiologists but also politicians and people with a vested interest. You only need to look at current news issues.

In contrast to clinical medicine in which a medical care provider diagnoses and treats disease, epidemiologists are concerned with populations. Aunt Ethel may have smoked 3 packs of cigarettes a day and lived to be 98, but we do know that for the general population, cigarette smoking is a strong risk factor for many diseases and leads to increased mortality. This information is based upon research that looks at large numbers of people. There will always be individuals who have different experiences. You will have smokers who do not develop lung cancer and non-smokers who do. It is the bulk of the evidence that is important. Additionally, epidemiology is more concerned with disease prevention than clinical practice. Clinicians will try to prevent disease to a limited capacity but many prevention efforts are on a larger scale public health level, safe sex programs, disease screening programs, providing data for the implementation of policy.

Epidemiologists are concerned with identifying risk factors for disease. A risk factor is defined as a behavior, environmental exposure, or inherent human characteristic that is associated with an important health related condition. Although risk factors are associated with an increased probability of disease, they do not always cause disease. A classic example is that people who carry matches with them are at higher risk for lung cancer. Obviously, it is the cigarettes they also carry and smoke as opposed to the matches that actually increases the risk for lung cancer. There is an important model of disease, the Glass model, which we will be studying later which uses the
term risk regulator to describe changeable behavioral and environmental factors and risk factor for the more genetic factors. But in most epidemiological literature, you will hear the term risk factor used in a variety of settings.

Suppose you went to a deserted island and found a population of people about whom you knew nothing, and I told you some people drank a tea from a local plant and 30% of those individuals had elevated blood sugar levels. Based on this information, was the tea associated with diabetes, or was it not possible to know?

- Tea causes elevated blood sugar
- Tea is associated with elevated blood sugar
- Not enough information

The correct answer is C. To answer this question, we need a comparison group. If 30% of the people who drink the tea have diabetes, what percent of people who do not drink the tea have diabetes? What percent of the entire population have diabetes? If 60% of the people who did not drink the tea had diabetes, then the tea could be protective. This information is the first step to understanding if there is an association. And even if only 5% of people who did not drink the tea had diabetes, we cannot speak of causation. It is possible that the tea was a treatment for the symptoms of diabetes. So much of epidemiology is based upon knowing the underlying rate of a condition, and comparing differences in disease between those exposed and not exposed.
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To understand these associations, we need a denominator. Some are pretty easy. If I wanted to do a study of students at the College of Public Health at USF, that group would be easy to identify. It is relatively easy to identify patients at the Moffitt Cancer Center. Others are trickier, like people who serve as the catchment area for Moffitt (those who would go to Moffitt if they had cancer) or all people with asthma living in Tampa. We will learn more about identifying populations this semester.

Epidemiology is categorized into two groups: descriptive and analytical. Let me take a minute to describe these two types. In general, descriptive epidemiology describes disease in terms of person, place, and time, and is used to generate hypotheses, while analytic epidemiology is focused on identifying the cause of disease, generating hypotheses, and ultimately preventing disease.
These two study types work together as in situations in which there is a new disease, HIV/AIDS, for example, the first step may be in comparing people with and without the illness to identify possible risk factors. Basically researchers sought to find the differences between people who had and did not have this new immune disorder. Initially most cases were identified in gay men but of course that changed over time. One early hypothesis, later disproven, evaluated the use of “poppers”, a slang term for amyl nitrate, which was used by many gay men to enhance their sexual experience. With time and many studies, we identified HIV, a retrovirus, spread through blood and body fluids to be the main risk factor.

This graphic shows a nice illustration of an epidemiologic investigation. Once researchers suspect an exposure is associated with a disease, they form a hypothesis, and then develop an epidemiological study to measure this association. Finally, the goal is to determine if this relationship is causal. This is not generally done through one study but over a series of investigations.

So what is a hypothesis? It is a way in which a statement is created so that it can be tested in a research study. We often talk of the null hypothesis which is a statement that there is no association between the exposure and disease and we test that to see if there is evidence to reject this null hypothesis, thus indicating that there may be a relationship.
We will review this concept later and it will also be covered in your biostatistics classes. The more specific a hypothesis is, the better. For example a hypothesis that education is associated with a healthier lifestyle is just too broad to really test well. It is better to say, people who have 12 or more years of education have lower rates of cigarette smoking when compared to people with less than 12 years of education. One might even hypothesize the rate of change expected, such as using terms like “are twice as likely to smoke”.

Hypotheses are used to advance epidemiological research and help us in identifying a research study. When I work with students on their special project, the first thing I ask them for, once they have identified a general area of interest is their hypothesis. We then use that to determine what data we need, who should be in the study, and how we are going to analyze it.

As we do research, we are often interested in evaluating person, time, and place. What characteristics of the person led to disease? When might they have been exposed, as a child or adult for example, and where were the exposed. This TED talk provides an example of the importance of place in identifying disease risk, and I think you will find it interesting.
Epidemiology Studies the distribution of disease in a population using a quantitative approach or Person, Place and Time.

It considers the determinants of disease using a systematic approach and compares disease between groups. Using hypotheses to conduct studies.

It wants to identify deterrents to disease to ultimately improve public health.

Epidemiology provides the overall methods of public health.