EXPLORING EPIDEMIOLOGY

#1: Early Epidemiology

Throughout history, people have faced infectious diseases. Because we transmit many of these infections to others, it's an important societal goal to reduce their potential impact in our communities. In the past few centuries, we have made marked progress, and much of that has been the result of a field of science known as epidemiology. Epidemiology is a discipline focused on where, why and how disease occurs in a population in order to inform prevention strategies. With modern tools, epidemiology continues to advance; however, like most human endeavors, we needed to learn to walk before we could run. Before AI assistance, computer processing, mathematical models and outbreak maps, there were early epidemiologists, people like Hippocrates, Thucydides, and Ibn Al-Nafis, trying to make sense of the world.

Hippocrates: The "Father of Medicine"

At the heart of epidemiological study are efforts that have remained unchanged since ancient times: observe, document, and use that information to develop strategies for addressing disease outbreaks. Although it may seem simple now, we have the ancient Greek physician, Hippocrates, often referred to as the "Father of Medicine," to thank for codifying these essential steps. Hippocrates was among the first to suggest that disease is caused by factors like habits, location and seasonality rather than supernatural forces. He arrived at this conclusion by observing the effects of disease on populations and theorizing about their causes, specifically exploring how symptoms and factors might be linked to the development of disease. It is from his work that we gained key terms, like "endemic," and "epidemic." Endemics describe predictable or constant disease spread, whereas epidemics describe sudden increases in cases of disease beyond what is normal or expected.

Image of Hippocrates on coin courtesy of National Gallery of Art, Washington

Hippocrates' epidemiological method was to make observations as he treated his patients and form hypotheses about connections between the symptoms he was seeing and a specific disease. Crucially, he documented his thoughts thoroughly so that the diseases could be recognized and treated by other physicians. While this method met with enough success that it has been used by epidemiologists ever since, it is important to note that observation alone will not always lead to accurate conclusions. For instance, Hippocrates' observation that bad smells are often associated with areas rife with disease and poor health outcomes was the origin of the "miasma theory" of disease. The theory was that putrid or otherwise "bad" air, called miasma, caused many illnesses, and it remained the prevailing theory in medical science until the late 1800s when germ theory led us to understand that diseases are caused by specific pathogens, not "bad" air.

Thucydides: The Disease Chronicler

Some of the earliest epidemiologists were historians rather than public health experts. However, their meticulously recorded thoughts, observations and interviews sometimes led to important new health-related information. One example is Thucydides, a contemporary of Hippocrates in ancient Greece. His work chronicled the Peloponnesian War, during which a plague struck Athens. The disease began in the port district, but spread quickly, killing many, including the Athenian king, and it nearly killed Thucydides too. The disease was particularly brutal and had a broad range of symptoms that makes identifying it today difficult. Paleoepidemiologists, scientists who study past diseases, have proposed several possible culprits, including typhus, measles, smallpox, bubonic plague, or even multiple concurrent disease outbreaks. However, the exact cause remains uncertain.

Thucydides' work was important, however, because he documented the fact that people who survived the plague did not seem to get reinfected. He built on this initial observation by interviewing people about their experiences, and, after speaking to many survivors, he observed that even those who were caring for the sick did not get the disease again. Thucydides' method of making an observation and conducting interviews to gather data helped him build a comprehensive picture of what was happening in the city. In a pattern that would continue for thousands of years, small methodological refinements, like this, would help advance the science of epidemiology.

Ibn Al-Nafis: The Inquisitive Mechanic

Hippocrates' writings opened a new chapter in how physicians thought about disease. They now had the tool of data-driven guidance as they thought about what might be happening during illness. One person guided by this new approach was Ibn Al-Nafis, an Arab physician, anatomist and scholar in the 13th century. Al-Nafis expanded on prior observations by focusing not only on elements like climate and geography, but also demographics, like age, gender, and job. He also recorded details like the season in which individuals were diagnosed with a disease and tied elements like poor diet, alcohol consumption, and a sedentary lifestyle to the onset of some diseases. Based on his knowledge of human anatomy, Al-Nafis hypothesized that not only differences in demographics, but also differences in a person's body – for example, an individual's metabolism – played a part in whether someone got sick. Al-Nafis' work moved the field toward connecting individual demographic and biological differences with differences in relative risk among members of a community.

In Sum

Hippocrates found the first piece of the puzzle, but it took the work of many doctors, scientists, and concerned citizens to build the field of epidemiology. The simplicity of its beginnings belies the importance and impact of public health efforts, and as populations grew and interactions between previously isolated communities increased, the risks caused by infectious diseases and the need for public health tools also grew.

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Think about it

1. What did each of the three individuals described in the article add to the field of epidemiology?
   What are examples of how this element is used in epidemiology today?

2. Why are interviews of individuals important in epidemiological research? How are interviews different from anecdotes, such as we might see on social media today?