[Narrator] You hear on the news that a disease is spreading rapidly in your city. The hospitalization rate is steadily increasing, several people have died, and public health experts are trying to identify the cause. The disease appears to be affecting some groups of people more than others. Data about the disease also suggests that some groups are more likely to experience severe symptoms and be hospitalized than others.

A team of public health experts is investigating the disease outbreak. The team is collecting data and information to identify communities most affected. They are also working with local organizations and making recommendations for how to distribute community resources, reduce disease spread, and support health equity.

Health equity means ensuring that everyone has the chance to be as healthy as possible and no one is disadvantaged because where they work, learn, live, and play.

The team may begin by considering possible exposures. In this disease outbreak, an exposure is contact with a disease-causing agent. The consequences of an exposure often depend on factors such as age, immunity, and a person's other health conditions.

A risk factor is a characteristic or behavior that increases a person's risk for being exposed to an infectious agent or experiencing severe disease. For instance, the bacteria that causes cholera is often found in contaminated water. People become infected by drinking this water. So, drinking untreated water is a risk factor for cholera.

Similarly, having the BRCA1 gene mutation is a risk factor that increases a person's risk for developing breast cancer.

Infectious diseases only occur if a person is exposed to a specific infectious agent, such as a virus. So, to get the flu, you must be exposed to the influenza virus. Because the flu is a respiratory disease, risk factors, such as being in poorly ventilated, crowded, indoor areas with people during flu season increase the risk for exposure and developing the flu.

Risk factors for noninfectious diseases, like heart disease, cancer, autism, and Alzheimer's disease aren't as easy to determine. Often a disease may have multiple risk factors. For example, cigarette smoking, high cholesterol, and high blood pressure are all risk factors for heart disease. Some risk factors such as cigarette smoking may be linked to multiple diseases.

How do public health experts determine something is a risk factor for a disease? They use math of course!

Specifically, they count, divide, and compare. An easy way to remember this is to think C.D.C.--count, divide, compare!

First, they count the number of cases of disease and divide it by the total number of exposed people. This is the risk for disease in people who are exposed. For example, the risk for lung cancer among smokers.

Then, they do the same calculation for the nonexposed people — this is the risk for disease in people who are not exposed. For example, the risk for lung cancer among nonsmokers.

Finally, they compare these risks by dividing the risk among the exposed group by the risk among the unexposed group. This comparison is called the risk ratio.

The risk ratio provides a measure so experts can see if the amount of disease among the exposed group is similar to, greater than, or less than the amount of disease in the nonexposed group. The risk ratio also quantifies how strongly associated an exposure, or having a particular factor, is to a disease.

If the ratio is 1, then the exposed population has the same risk for disease as those who were not exposed, so the exposure does not increase or decrease the risk for disease.

A risk ratio above 1 indicates that the exposed group has a greater risk for getting the disease than the unexposed group. For example, the risk ratio for breast cancer among women with the BRCA1 gene mutation is about 6, meaning that women with the BRCA1 gene mutation are about 6 times more likely to develop breast cancer than women without that mutation. The larger the risk ratio, the stronger the association between an exposure and a disease.

It is important to remember though that a risk ratio doesn't actually tell you how common a disease is, it just tells you the risk for the disease in the exposed groups as compared with the unexposed groups.

Some risk ratios are less than 1, indicating that the amount of disease among the exposed group was less than among the unexposed group. You find risk ratios less than 1 for factors that may be protective, like getting the flu vaccine to produce immunity to the flu or wearing sunscreen to avoid getting skin cancer from the sun's ultraviolet rays.

Factors that affect health in a positive way are called protective factors. Protective factors decrease a person's risk for developing an undesirable health outcome.

A person's health is affected by many factors, including their biology, their choices and behaviors, and their environment. Risk factors can be roughly categorized into these three groups: biological risk factors, behavioral risk factors, and environmental risk factors.

Some of these factors that influence health, such as a person's age or their genes, are impossible to change.

However, some of these factors can be changed by the personal behaviors made by individuals, such as whether they smoke or exercise.

But many factors are complex and not as simple as an individual making a choice. These factors that influence health may be related to the environment around a person. Examples include stress at a job, having safe areas outside to play, or access to resources like healthy food, health care, and quality education.

Biological risk factors such as age and genetics are part of who someone is and can't be changed. However, sometimes, when these risk factors are known and increase a person's risk for disease, actions can be taken to lower the risk.

For example, people who have a family history of high blood pressure, a known risk factor for heart disease, can try to lower their risk by eating less sodium in their diet. Their genetics may make them more susceptible to high blood pressure, but their behavior can help lower their risk for getting it, or help decrease the severity of high blood pressure, if they do get it.

For another example, flu can be especially severe in very young and in older age groups. A person's age can't change but all people six months of age and older can get a seasonal flu vaccine every year to help lower their risk for getting flu or help decrease the severity of flu if they do get it.

Behavioral risk factors such as lifestyle choices and following prevention measures can increase or decrease risk.

Because they can be changed, or modified, some people may have the ability to change these behaviors and reduce their risk for disease.

For example, smoking may increase the risk for diseases like lung cancer, while drinking more water and fewer sugary drinks may help protect against obesity.

Prevention strategies like washing your hands regularly can help decrease your risk for disease.

Behavioral scientists, like Brandon, study the behaviors of people and how they may contribute to disease or protect against disease and other poor health outcomes. Brandon also works with statisticians to understand the factors that put members of his community at risk. Brandon collaborates with other public health experts to design tailored strategies to help improve health outcomes for different groups of people.

Brandon works to encourage healthy lifestyles through behavior change and educational outreach. For example, because smokers are more likely to develop lung cancer than those that do not smoke, and 9 out of 10 adults who smoke cigarettes daily first try smoking by age 18, Brandon might work with local schools to develop appropriate campaigns to discourage kids from ever starting to smoke. Brandon might also help answer questions about how a sex education program can provide students with the knowledge and skills to help them make healthy choices and avoid human immunodeficiency virus, HIV; sexually transmitted disease,

STD; and unintended pregnancy. He might also work with a local clinic to help answer questions for people hesitant to get the flu vaccine.

A person's health can also be influenced by environmental risk factors in environments where people work, learn, live, and play. These social determinants of health can affect a wide range of health risks and outcomes and aren't always entirely within an individual's control. But education and public health initiatives can help address these social determinants.

There are five major categories of social determinants of health: education access and quality, health care access and quality, neighborhood and the built environment, social and community context, and economic stability.

Education access and quality includes the effect that educational opportunities have on people's health and well-being. People with higher levels of education are more likely to be healthier and live longer. Providing high-quality educational opportunities for children and adolescents and helping them do well in school can lead to safer, higher-paying jobs, better insurance, and access to healthier environments.

Health care access and quality is the connection between the availability of health care services and health. Increasing insurance coverage and access to health care professionals can make sure more people get important health care services, like preventive care and treatment for chronic illnesses. This also includes access to health information so people can make informed health decisions.

Neighborhood and the built environment is the connection between where people live and their health. Improving access to and the quality of housing, transportation, and recreation areas can all improve physical and mental health. Increasing the availability of healthy foods, air and water quality, and the safety of neighborhoods – by reducing crime and violence– also positively affects health.

Social and community context includes relationships and interactions with family, friends, coworkers, and community members that can have a major effect on people's health. A sense of community or civic participation might positively affect health, but discrimination or hostile workplace conditions might negatively affect health. Racism is a system that assigns value and determines opportunity based on the way people look or the color of their skin. This gives some people unfair advantages and causes other people to be treated unfairly. Addressing factors contributing to these differences is important for improving overall health and well-being of communities.

Economic stability is the connection between financial resources and health. Income and other financial resources greatly affect a person's ability to access healthy food, stable housing, and other needs that influence both physical and mental health. Providing programs such as career

counseling and maintaining policies that help people pay for food, housing, and health care, can help people achieve economic stability.

An individual's wellbeing and health outcomes are affected by a complex combination of biological, behavioral, and environmental risk factors.

Part of Brandon's job as a behavioral scientist is to educate people about factors that influence health and how they can make better choices to limit risk factors they can control to improve personal health outcomes.

Brandon and other public health experts work to understand how systems and policies influence health so that they can promote those that help support health equity. Remember that health equity is only reached when every person has the opportunity to reach their full health potential and no one is disadvantaged because of their social determinants of health.

As a recap, let's answer the question "Who is at risk?" Some people have risk factors that increase their risk for getting a disease or experiencing more severe illness.

In a disease outbreak, an exposure is contact with a disease-causing agent. There are many factors that determine whether an exposure will lead to an infection or to experiencing severe disease.

A risk factor is a characteristic or behavior that increases a person's risk for being exposed to an infectious agent or experiencing severe disease.

There are also protective factors, which protect a person and reduce their risk for disease.

Risk factors can be identified using a ratio. When the risk ratio is greater than one, the factor is associated with a higher risk for the disease. If less than one, the factor may be protective against the disease!

Risk factors can be roughly categorized into three groups: biological risk factors, behavioral risk factors, and environmental risk factors.

You have control over some risk factors, like behaviors, but not others, like biological factors such as age and genetics.

External, or environmental, factors also influence health, and you may not have full control over some of these. These social determinants of health are the conditions in the places where people live, learn, work, and play that affect a wide range of health risks and outcomes.

By applying what we know about social determinants of health, we not only improve individual and population health but also move us toward achieving health equity.