Is a health study the answer for your community?

A guide for making informed decisions

For decades, environmental health scientists at Boston University School of Public Health have worked with community groups to address environmental health problems. We wrote the Health Studies Guide to assist community groups and individuals who think that some form of environmental health investigation or health study may be useful or necessary in their community. Readers of this guide may have concerns about drinking water contamination, or the relationship between emissions from a power plant and asthma in their community. People may suspect that a certain disease in their community, such as lupus, has an environmental cause or trigger. All of these are reasons for wanting a health study. Hopefully this Guide will help readers think this through.

Chapter 2: Framing your Concern as a Research Question

The Guide can be found on our website at

http://www.bu.edu/sph/health-studies-guide/

Chapter 2 : Framing Your Concern as a Research Question

This chapter will help you focus your concern, framing it like a research question so that it can be addressed by one of the study types described in Chapters 3 and 4. Remember, a good study is one that is designed to answer your question—so now it is time to make sure you know what question you are asking. But as you learn more about different kinds of studies in later chapters you may also think about different ways to frame your question.

Before conducting a study researchers go through a process known informally as scoping; that is, defining the scope of the study. The scoping process should lead to a clear statement of your research question. In scoping a study, researchers answer these questions:

- What is the major concern we will address in our study?
- Whom do we want to study?
- Where and when do we want to do our study?

Key words

absorbed dose
ambient pollution
average daily dose
cancer registries
concentration
dermal exposure
disease cluster
dose
emissions
epidemiologic
epidemiology
hand-to-mouth
in utero
ingestion
inhalation
media
medium
micro-environment
parts per billion
parts per million
risk factors
route of exposure
source
surveillance
toxicology
toxicologist

Defining the problem: What is your concern?

In Chapter 1, we talked about the difference between an exposure (a pollutant or toxic substance) and a health outcome (a disease, or a condition, or even death). Now you can begin to think about whether the specific question you want answered is most related to exposure, outcome, or both (the exposure-outcome relationship).

Are you particularly concerned by an exposure, such as the presence of a particular chemical in the air, water, or soil, or a pollution source in your neighborhood? Or are you primarily concerned by a particular health problem in your community, such as leukemia, arthritis, or autism? Maybe you suspect a chemical exposure in the environment is making people sick and you want to study this connection. Perhaps a government agency such as the Agency of Toxic Substances and Disease Registry (ATSDR) has proposed a study and you want to evaluate it. See Table 2.1 for examples of concerns translated into study questions. Once you have clarified your concern, you will be in a position to choose the right type of study to look at your question.

Table 2.1. Examples of concerns to be addressed by a study

My concern is…	My study will address…
particulates emitted by a power plant in town	An **exposure**: Have we been exposed to something harmful?
too much breast cancer	An **outcome**: Are there more cases here than one would expect?
possible link between kids' poor school performance and our town's old lead water pipes	An **exposure-outcome relationship**: Is a harmful exposure affecting our health and well-being?

If your concern is an exposure…

Many people or communities are interested in a particular exposure of concern—for example, a chemical in the drinking water supply or visible pollution from a smokestack. People in these communities may suspect that the pollution has some impact on their health, but they are primarily concerned with identifying—and addressing—the exposure.

Even if you are interested in the relationship between an exposure and an outcome, learning as much as you can about the exposures of concern to you is a good place to start. You may not have to go further to make your case, or what you learn may be helpful later in relating these exposures to health outcomes. Two questions may help you decide whether an exposure study is what you need:

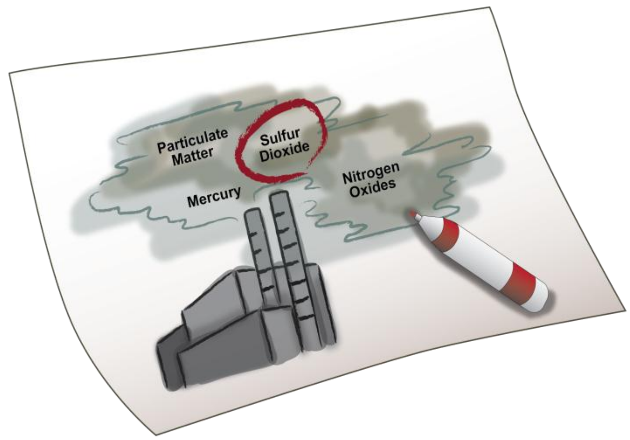
1) **Do standards exist for the exposure of concern?**

   For many substances the state or federal government has set standards corresponding to exposures that are considered *acceptable*. Of course, these standards may not truly be safe. Even so, the standards give you something to which you can compare your own exposure, a benchmark. If you find that your exposures are higher than the standards, you are more likely to get the government to agree that there is a problem. For example, some standards set limits on **emissions**: how much of a pollutant can be emitted legally from a power plant or from your car's tailpipe. Other standards restrict the amounts of **ambient pollution** allowed: for example, the concentration of a chemical in the outdoor environment, such as ozone or particulate matter in your town's air. Other standards address the concentration of pollutants in food (for example, mercury in tuna) or even in people (doctors regularly test children's blood for elevated lead levels). In each of these cases, a comparison of measurements against the existing standard may be enough to demonstrate that your concern is legitimate, from the point of

view of scientists and policy makers, and therefore deserving of action. The website of your state's Department of Environmental Protection is a good place to start if you're looking for an environmental standard.

2) **Can you narrow down the exposures of concern?**

If you are designing a new health study, you may be tempted to consider a number of exposures in your community—the waste site, the power plant, the drinking water, the food. While this reflects the reality in many communities, an exposure study is most feasible if it focuses on a particular source and, within that source, a narrow range of substances. Within a waste site are hundreds of chemicals. A coal-burning power plant emits a number of air pollutants (for example, sulfur dioxide, mercury, and particulate matter). Drinking water may contain a large number of possible contaminants, both biological (for example, bacteria) and chemical (for example, chlorine). Try to be as specific as possible. It is difficult for scientists to study more than one exposure at a time, so try to narrow your interests to those that are of most concern. It is very important to be able to clearly and consistently identify (and even measure) the exposure of interest.



An exposure study will try to answer other detailed questions such as: How close does one need to live to the site to be considered exposed? For how long? Suppose the people in one house had lived near the waste site for 30 years, while their next-door neighbors moved in last year. What is the difference in their exposures? Also think about how people come into contact with the exposure. For example, if you think the soil around a school is contaminated, why is that a concern? Does anyone actually touch the soil or come into contact with it?

For more details on understanding exposures in your community, see *Considering Your Question model of exposure and disease* on p.23, and the *Mapping* and *Studies of Exposure* sections of Chapter 4.

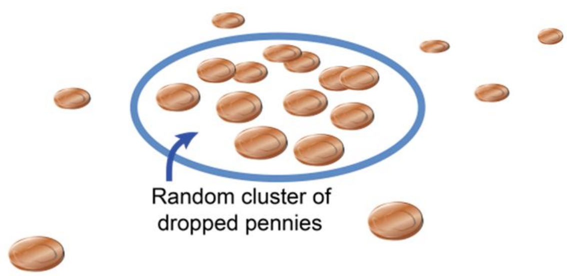
It is difficult for scientists to study more than one exposure at a time, so try to narrow your interests to those that are of most concern.

If your concern is a health outcome...

People are naturally concerned when they believe they see too much of a disease in their community. There are two basic ways people might think about "too much disease."

1) **Does my neighborhood have a disease cluster?** Sometimes people notice that a number of their neighbors have a specific illness (for example, childhood leukemia), so that there seem to be too many cases of the same disease in their neighborhood. Often these concerned residents plot the cases they are aware of on a map, and when they do this, they may see a geographic cluster of cases. Although this seems like a simple idea, in fact it is very hard to establish whether such a set of cases is a truly unusual **disease cluster** or is just part of the normal geographic variation in the occurrence of disease.

   Here is an analogy: If you toss 100 pennies up into the air and let them fall onto a carpet, you will see areas where the pennies cluster close together and areas where the pennies are spread out, but there is no particular meaning to this pattern. In the case of possible disease clusters, researchers use statistical methods to tell "real" statistically meaningful clusters from "random" ones, but these methods are out of the reach of most folks who are untrained in statistics. Even scientists often disagree about the results of cluster analyses. Public health agencies regularly receive requests from communities to assess whether cancer clusters exist, and, if so, what is causing them? These agencies often feel they *must* respond to cancer clusters with a study. Unfortunately, most cancer cluster studies are inconclusive: they fail to find a relationship between an exposure and the cancer, so they cannot say what is causing the cluster. The usual reason for this is that number of cases was too small to detect a relationship between exposure and disease, even if it really exists (more about this in Chapter 6). Ultimately, the study of a cluster of childhood leukemia in Woburn, Massachusetts in the late 1970s (see sidebar on next page) proved to be an exception to this general rule although there are still people who question the cause of leukemia in Woburn.



2) **What is the disease pattern in my region?** The other approach to thinking about whether there is "too much disease" in a given location is known as disease **surveillance.** In this context, *surveillance* means surveying the landscape of disease by systematically monitoring disease rates for geographic areas. For example, surveillance methods can be used to monitor and compare the rates of childhood leukemia across the 50 states, across the counties of one state, or across smaller areas defined by the US Census. All 50 states have **cancer registries** that collect information on cancer cases. It may be helpful to ask a public health professional to walk you through the cancer profile site or your state's cancer registry. Perhaps you should consider going door-to-door in your community to collect health outcome information directly from

Surveillance data are used to compare rates of disease on the level of state or county, whereas communities are usually concerned about disease clusters in a town or neighborhood.

your neighbors. A community survey may be the best way to measure the incidence of cancer or other outcomes such as birth defects, miscarriages, asthma, or autism that may not be well-documented in a state registry.

In general, surveillance data are used to compare rates of disease on the level of state or county, whereas communities are usually concerned about disease clusters in a town or neighborhood. It is possible to compare rates of disease for small areas using surveillance methods; however, there are significant difficulties. First, small Census areas don't necessarily match up with neighborhoods defined by the people who live there. Also, disease data are confidential: the cancer registry must protect the identity of individual cases, and that makes it difficult for ordinary people to get information for small local areas. Finally, just as it is hard to tell "real" and random disease clusters apart, it is difficult to tell "real" local peaks in disease rates from random ones in small populations.

Regardless of how you think about "too much disease," if your community is interested in a particular health outcome, try to define the outcome as clearly and consistently as you can. Some health outcomes are easier to identify than others. Cancer, for example, is diagnosed by a doctor and reported to a cancer registry; on the other hand, there are many different types of cancer, and most have unique causes. Therefore, just "cancer" is not specific enough as a health outcome. In order for a health outcome to be studied successfully, it must be clearly and consistently defined.

What if the outcome of concern to you—for example, stomachaches, flu-like symptoms, or skin rashes—is vague, short-lived, or hard to define? Many outcomes that are more frequent but less severe than cancer do not get counted or tracked, and this makes them harder to study. Even so, these symptoms or health conditions are worthy of investigation and challenge scientists to get creative.

Sidebar: Cancer Clusters and the Woburn Story

Some cancer cluster studies have gained significant public attention. For example, in the late 1970s, residents in Woburn, Massachusetts, raised concerns over environmental contaminants (particularly solvents in the water supply) and health. Suspecting higher than normal cancer rates, especially in children, residents went door to door to identify cases. They then mapped the cases using pins on a wall map, and by visual inspection it appeared that the cases were clustered in the eastern part of town (See Figure 2 under Mapping in Chapter 4.) In response to these concerns, the Massachusetts Department of Public Health, with help from the U.S. Centers for Disease Control and Prevention (CDC), investigated cancer incidence for childhood leukemia, liver cancer, and kidney cancer between 1969 and 1978. Analysis showed that childhood leukemia rates were elevated, specifically on the eastern side of town. Kidney cancer incidence was also higher than expected compared to national rates. However, the study reported that it could not link any particular environmental exposure to the elevated cancer (Parker & Rosen 1981). Meanwhile, two municipal water wells had been closed in 1979 after they were found to be contaminated by industrial chemicals.

Residents then initiated their own further study with researchers at Harvard School of Public Health to investigate whether use of tap water from public wells contaminated with solvents (trichloroethylene and perchloroethylene) was related to the cancers. Their research found an association between risk of childhood leukemia and maternal consumption of drinking water from two specific contaminated wells (Lagakos, Wessen, & Zellen, 1986). It also linked certain birth defects and fetal and infant death with consumption of this water. This community-initiated research brought national attention to the case,

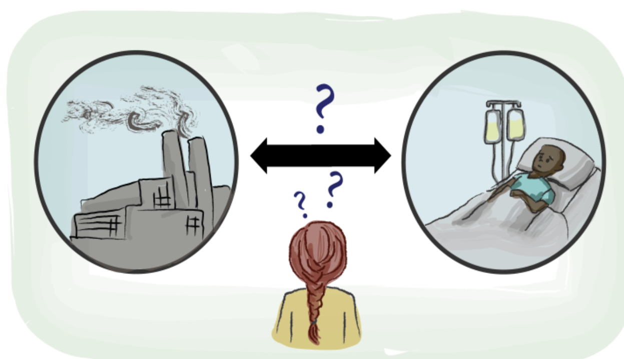
Sidebar: Cancer Clusters and the Woburn Story (*Continued*)

with the story being made into a book and movie, both entitled *A Civil Action* (Harr, 1996). More than 10 years later, the Massachusetts Department of Public Health published the results of a case-control study, which confirmed the results of the community study. Children whose mothers drank contaminated well water while pregnant had an eight-fold risk of cancer compared to children of mothers who had not been exposed (MDPH 1997).

The Woburn study is a rare example in which a cancer cluster was widely accepted as being connected with a particular exposure—yet even now many epidemiologists remain unconvinced. Clusters with small numbers of cases are extremely difficult for researchers to study, since most statistical tools are designed for large samples. Additionally, the role of chance in determining the location of cases means that clusters are difficult to distinguish from random groupings. For more detail, see *Statistical testing for the presence of clusters* in Chapter 6.

If your core concern is the relationship between an exposure and an outcome…

When a community has established that there is an excess of disease in the area, the next step is often to try to connect it back to an exposure. Some communities start at this point, with both an apparent excess of disease and an exposure they suspect caused the disease in their community, and want to investigate the connection between the two. That is, the primary concern is the relationship between the exposure and the outcome.



The question that often drives such people to want a health study is, "*Why* are we sick?" Built into this question is another question: "Why are we sick and other people are healthy?" At the heart of most health studies lies a comparison—between healthy and unhealthy or between exposed and unexposed. Usually we are comparing groups, for example, a group of people who have asthma compared to a group of people who do not; or a group of people who live near a power plant compared to a group of people who do not.

Some study types make a comparison between rates of disease in different groups, while others might compare levels of pollution. More complex studies, however, attempt to connect these two factors—to understand both *where disease is present* and *what caused it*, by comparing both the exposure *and* the disease in carefully selected groups. We call these studies **epidemiologic** studies. (The field of **epidemiology** began with the attempt to understand patterns of epidemic disease. The surveillance and cluster methods described above are also often referred to as epidemiologic studies,

> At the heart of most health studies lies a comparison —between healthy and unhealthy or between exposed and unexposed.

but in this guide we will use this term when discussing study designs that specifically concern the *relationship* between exposure and outcome.)

For example, suppose we chose a group of people who are exposed to a hazardous chemical in their drinking water and another, similar group who have a different water supply and so are not exposed. We might then compare the rates of a bladder cancer in the two groups to see whether the exposed group is more likely to become ill than the unexposed group. If this occurs, it is strong evidence that the chemical in the water causes bladder cancer. To accomplish this, however, we needed to collect detailed data on both exposure and disease in the different groups. Not surprisingly, epidemiologic studies are far more difficult and complex than studies of exposure or outcome alone. In addition to the need to understand both exposure and outcome, making the link between disease cases and exposure requires statistical methods. Thus, as in Woburn, epidemiologic studies typically involve not only community members but also professionally trained researchers, statisticians, or government agencies.

In the laboratory, scientists who study toxic chemicals—**toxicologists**—try to determine whether a disease is connected to a particular exposure by giving chemicals to laboratory animals and observing what happens. But epidemiologists can't do experiments on people. Instead, epidemiologists investigate what has already happened: Who was exposed, when, and what were the health outcomes among the exposed and unexposed? Or they may watch as a situation develops; for example, following the lung development of children as they age in a city with polluted air compared to children in a city with cleaner air. Epidemiologists must try to take advantage of real-world experiments that are untidy, unsystematic, and not set up to provide easy answers. And, unlike lab rats, people in the real world are exposed to many different chemicals, stressors, and other **risk factor**s that may also contribute to disease, complicating the comparison between groups. This makes doing epidemiologic studies very challenging.

What is more, being exposed doesn't necessarily mean you will have the outcome, and having the outcome does not necessarily mean you were exposed. Some people get cancer due to genetic factors rather than environmental factors, and many people are exposed to toxic substances without ever getting cancer or any other health outcome.

Being exposed doesn't necessarily mean you'll have the outcome, and having the outcome doesn't necessarily mean you were exposed.

However, environmental health scientists are not satisfied with the explanation that some people are just unlucky or that "chance" is the reason some people are sick while others are healthy. They seek to understand all the reasons that might explain why people get disease. These may be genetic, behavioral, or environmental, or some combination of these.

If your community is interested in studying a link between a specific exposure and a specific outcome, first clearly define your exposure and your outcome. You will most likely want to enlist the aid of a researcher in this process. As you learn more in the next two chapters about the types of studies designed to examine exposures, outcomes, and their relationships, you may rethink the kind of concern you want to address.

Framing Your Research Question: *Who? When? Where?*

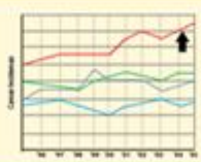
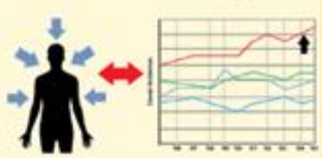
In an ideal world, we would like to understand the entire situation: the exposure, the disease, and the connection between them. But that is a difficult connection to make, and very often you do not need to go that far. As a practical matter, defining your research question may help you understand that you can achieve your goals by doing less rather than more.

For example, imagine you are in the community that is concerned about lead in drinking water: It will probably be enough for you, in collaboration with an academic partner or public health professional, just to document the *exposure* (lead), and to be able to describe or measure it. You don't need to show an *outcome* of lead exposure (which might be, for example, lowered IQ). This may be the best strategy for two reasons. First, there is a large research literature that documents the relationship between lead and IQ. And second, the presence of lead in drinking water is already carefully regulated by federal and state governments. In this situation, simply demonstrating the exposure might be enough to make your point. A health study that was capable of identifying a relationship between lead in your community's water and poor performance by children in school—an epidemiologic study—would take years and be very expensive. You might consider doing the *minimum* you can do to *achieve your goals*.

Table 2.2 adds a third column to Table 2.1 with examples of good research questions. In refining your core concern into a research question, try to specify the who, when, and where, as these examples have done.

You might consider doing the minimum you can do to *achieve your goals.*

Table 2.2: Sample concerns and research question

My concern is...	My study will address...	My research question is...
Particulates emitted by a power plant in town	An **exposure**: Have we been exposed to something harmful? 	Over the past 5 years, have people on the east side of town been exposed to high concentrations of airborne particulates emitted by the power plant?
Too many cases of breast cancer	An **outcome**: Are there more cases here than one would expect? 	Over the past 10 years, does our town have a higher rate of breast cancer in women than other, similar communities do?
Possible link between children's poor school performance and our town's old lead water pipes	An **exposure-outcome** relationship: Is a harmful exposure affecting our health and well-being? 	Is lead in our drinking water responsible for the current poor performance of local children in school?

Who is Your Study Population?

There are many ways to pose this question. Who is sick? Who do you think might be exposed to chemicals? Are you interested in workers and their occupational health? Children in a school? Residents on a street? An entire town or city? Is it a diverse population with regards to socioeconomic status, race, or ethnicity? Or are you interested in a small group of people who are relatively similar in income and education? If you are studying a fatal disease, are you interested in learning about those who have already died in addition to those who are living?

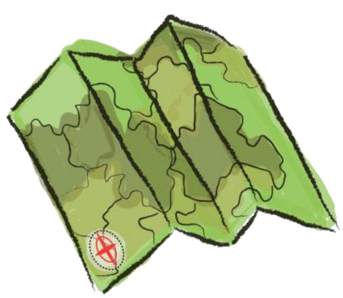
Whom you decide to include in your study will affect the number of people in the study, a very important factor because it affects the statistical power of the study to detect any association between exposure and outcome. This concept is discussed in detail in Chapters 5 and 6.

Finally, certain characteristics of the group you plan to study may affect the type of study you do or how you choose to do it. For instance, it may be difficult to learn about the experience and concerns of people who speak a different language, do not seek medical care, or are not comfortable talking to strangers. Once you have a population in mind to study, think about whether the questions you plan to ask are appropriate.

When Did Exposure and/or Disease Occur?

Some diseases people experience now are caused by exposures that happened years earlier. In order to study the disease today, we have to look back many years to think about what people were exposed to. Or we may want to study people who are not sick yet but are exposed to something in the environment and are concerned about becoming ill in the future. Are you interested in looking at what may happen in the future or at what has happened already? Perhaps you want to know about exposures and outcomes at this moment, like a photograph capturing everything *as is*. As far as exposures and health outcomes are concerned, what *did* happen, what *is* happening, and what *will* happen are all different questions that would point you to different study designs.

Where is Your Study Population Located?



If you are interested in a particular street or neighborhood, you may go door to door or search local records and data sources and involve local residents. However, if you want to study something that includes the entire city, state, or country, you may not be able to get personal data as easily and your study may include large numbers of people living in very different areas with very different environmental exposures. What factors will determine the geographic scope of your study population?

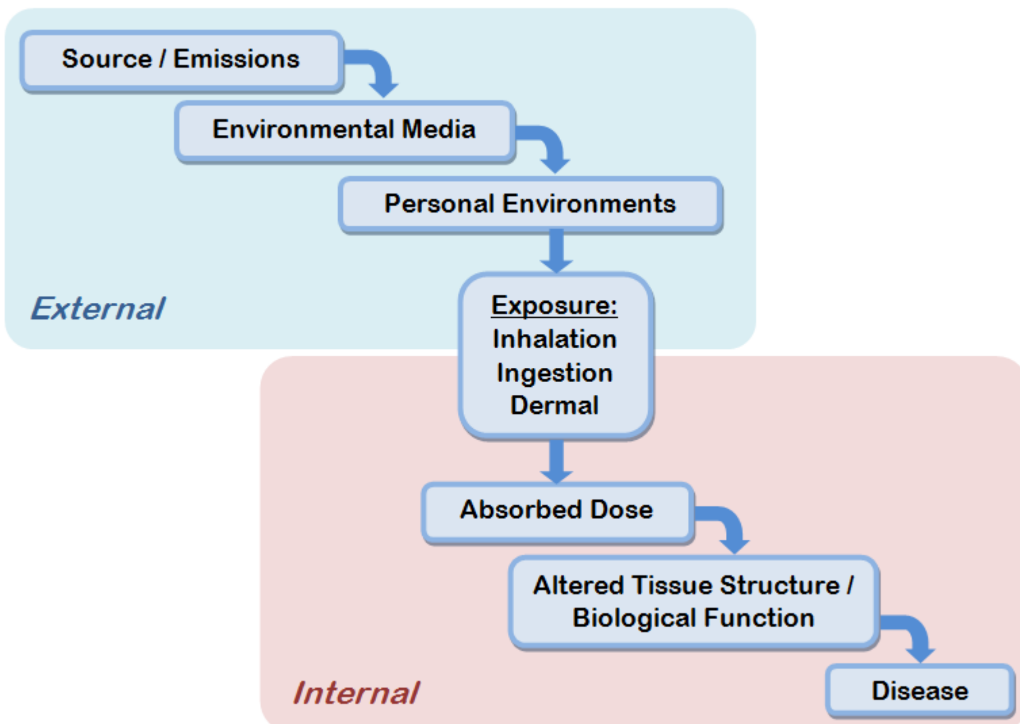
If you are driven by an exposure concern, consider where people are likely to be exposed. For example, if you are concerned about a landfill, how would you identify the potentially affected population in relation to the landfill? Or a drinking water supply? The who, where, and when questions are often related.

Considering your question with a model of exposure and disease

To pull these pieces together it may be helpful to consider your question in the context of the relationship that you think exists between the exposure and the health outcome. One way to do this is to sketch a diagram of how exposures and outcomes are generally linked (see Figure 2.1 below) and see which of these links your question addresses.

Our diagram is a model for how we understand the relationship between exposure and disease and helps us when designing a study. For example, considering how a pollutant or chemical travels in the air so that people are eventually exposed may help us choose where we to take environmental samples or what populations to include. (As we'll see in Chapter 5, many other factors, which we call *confounders*, may also be added to the model.)

Figure 2.1. A basic model for an exposure-related disease.



These models are most useful if you're concerned with an exposure or with an exposure and the related health outcomes. If you're primarily concerned with a health outcome but aren't aware of specific toxic exposures, you may not be able to complete every part of the model—but it will still help you understand what you should be looking for. Chapter 3 explains how certain study types focus on one or more aspects of the above model. An effective health study does not need to address all these components but knowing what it does and doesn't address will help you design your study and interpret results.

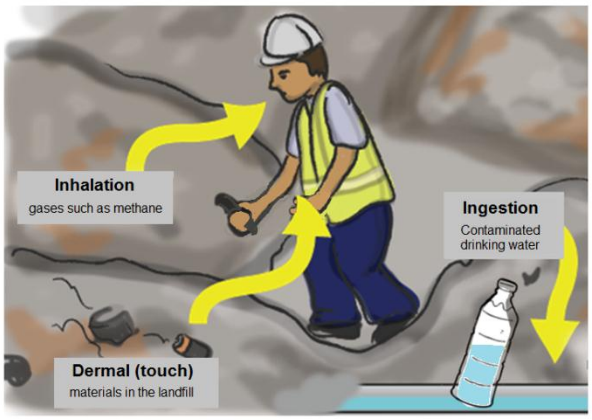
> Knowing what components a health study addresses and doesn't address will help you design your study and interpret results.

The figure starts with the **source** of the exposure—for example, a power plant that emits particulate-matter air pollution, or a house painted with lead paint.

The next steps describe how a chemical or hazard makes its way into our bodies. First, what is the environmental **medium** (plural **media**) by which the hazard travels? Particulate air pollution is usually encountered by people in the air. Lead paint from a house may chip off into the soil, or it may be ground up into dust in the household. A groundwater contaminant like perchloroethylene (PCE) is transmitted through the water. Knowing the medium by which the hazard travels may require some background research. It is the key to understanding how people come into contact with the hazard, or how they are exposed.

The **personal environment** is the area immediately around the study population. For air pollution, we're not necessarily concerned with the air quality at the smokestack—we're worried about the air in our neighborhood or inside the home, school, or workplace. The micro-environment is often an ideal place to take an environmental sample; for example, lead paint that is ground into dust may find its way into the micro-environment of the living room.

One of the best reasons for using an exposure-disease model is that it forces us to think about the **route of exposure**. This is the pathway by which a hazard moves from the micro-environment into the body, and it is closely related to the medium by which the hazard moves. The most common routes of exposure are **inhalation** and **ingestion** (eating or drinking). Some types of hazards, like solvents, can enter the body through the skin, or **dermal exposure**.



In most cases, you will be concerned with inhalation or ingestion, and understanding these routes will clarify your research question. For example, let's say you are concerned about cadmium, a toxic metal in a landfill nearby. Many toxics (especially metals like cadmium) are not volatile, meaning, they are not likely to migrate from the land into the air. Therefore, inhalation is not a likely route of exposure. Unless you're working in the landfill, you are unlikely to be concerned with dermal exposure. What about ingestion? If the cadmium were to leach into the groundwater, and if your water came from a nearby well, that might be a source of exposure. On the other hand, if your drinking water is from a town water system located at a distance, ingestion may not be a relevant route.

In addition to these major routes of exposure, there are several others that might be considered. Anyone can be exposed ***in utero*** before they are born to toxic chemicals carried by the mother, or to which the mother is exposed. *In utero* exposure is a critical concern for childhood disease, and researchers are now beginning to understand that many adult diseases or conditions are related to *in utero* exposures. An important exposure route for children is **hand-to-mouth** behavior: Since young children spend a lot of time on the ground, and since they put their hands (and everything else) into their mouths, they often ingest things that adults don't. (Smokers can also be subject to significant hand-to-mouth exposure.) Some medical patients are directly exposed to chemicals **intravenously**, although this is usually in a carefully controlled setting.

The right-hand side of Figure 2.1 is the domain of **toxicology**, and we will review it lightly here. Toxicology is the study of how a particular chemical causes a particular change in biological function or tissue structure; toxicologists usually rely on animal studies, as well as other laboratory work, to explore these relationships.

The most important part of the right-hand side of our model is the **dose**. Knowing the route of exposure (for example, ingestion of contaminated water), the concentration in the medium (precisely how much chemical is in the water), and some extra information (how much water does a person drink in a day?), a researcher can attempt to calculate the amount of a chemical that enters a person's body in a given time. Toxicologists and medical researchers then try to understand the detailed mechanism by which some dose of a chemical causes disease.

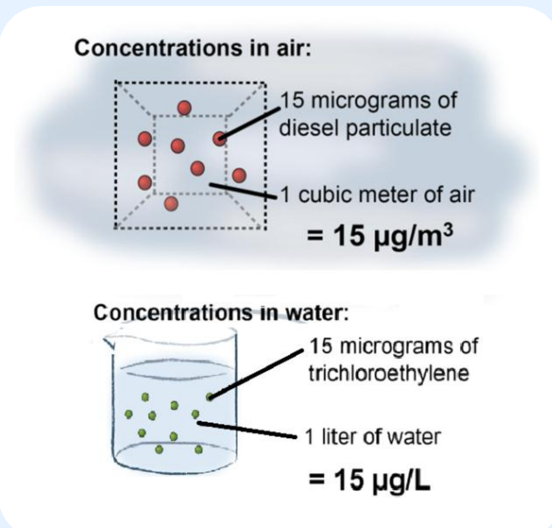
The details of these steps are complex. However, one type of community study that will be discussed in Chapters 3 and 4, a body burden study, can directly measure the amount of a toxic chemical in the body (the **absorbed dose**)—through a blood test, urine test, or some other method.

Missing from this model of exposure and disease is time. The timing of exposure in a person's life is extremely important (more in Chapter 5). Obviously, if the exposure occurs after the disease, it is unlikely that the disease is caused by exposure. But *when* a person is exposed may be even more important than the dose. There are critical windows of time, especially in fetal and adolescent development, where small exposures to some chemicals may have large effects.

Sidebar: Measuring chemicals: concentration and dose

In most of the study types that follow, the aim is to measure or estimate the amount of a hazard to which a community is exposed. These types of measurements fall into two basic categories—concentration in the environment and dose in the body—that relate to the diagram in Figure 2.1.

When we want to know how much of a chemical is in the environment, we measure a **concentration**: the amount of the chemical in the air, water, or soil. For example, the concentration of lead in soil is often measured in **ppm** (**parts** of lead **per million** parts of soil) or **ppb** (**parts per billion**). If we say that a sample of soil is contaminated with 200 ppm lead, we mean that for every million parts of soil, there are 200 parts of lead. Ppm and ppb are convenient and frequently used environmental measures.



Concentrations are often expressed a little differently for air and water. In air, we might express the weight of pollution in a volume of air: 15 micrograms (µg, a measure of weight or mass) of diesel particulate pollution in one cubic meter (m3) of air, or 15 µg/m3. In water, volumes are usually expressed in liters: for example, we might have 15 µg of trichloroethylene in a liter of water, or 15 µg/L.

Sidebar: Measuring chemicals: concentration and dose (*continued*)

When we want to measure how much of a toxic chemical enters the body, however, we need more information. The amount entering the body is called the **dose**, and it is most typically measured as an **average daily dose**: The amount of a chemical that a person takes in during an average day. For example, if your water is contaminated with 15 µg/L of trichloroethylene, and you drink two liters of water every day, your dose is 30 µg of trichloroethylene per day. (In practice, doses are often per kilogram of body weight, so that they can be compared between different people. We will see this type of dose in Chapter 4.)

Setting a Timeline

Finally, there is another important "when" question: When will you finish your study? Are you under pressure to produce results? Is there any specific deadline? Are you limited by your resources? It is important to set a realistic schedule for your work. It may be helpful to work backwards from a deadline, assigning times to each phase of the work, setting aside ample time to plan the study, gather data, and share results.

Summing Up

This chapter was intended to help develop your community health concern into a workable research question. Scoping begins by narrowing your research question and defining the concern: What is the problem? Can you translate your concern into terms of exposure, health outcomes, or both? Whom do you want to include in your study and why? Where is the focus of your investigation—a neighborhood, street, or town? Homes connected to a certain water supply? When did exposures and/or disease occur—is it ongoing? Is there a latency period between exposure and disease onset? Once you have your research question formulated into the terms of a health study and a clear understanding of what you want to know, you are ready to start considering which types of health studies can address your question.

Key Points from Chapter 2

– Understand the difference between an exposure and outcome and how a study can target either or both.
– Epidemiologic studies are time consuming and usually more expensive than other types of health studies because they combine the complexities of an exposure study and an outcome study with the extra difficulty of understanding how one caused the other.
– Simplify your study wherever possible. Remember the questions in Chapter 1: What is your goal, and what do you need from a study to advance that goal?
– The question posed by the study will determine what the study will address.

Further Reading

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Chapter 2 Worksheet: Developing a Research Question

Check the boxes and fill in the blanks using the sample responses as examples.

1. Identifying your concern(s) (**What**):

Are you concerned only about an exposure? ___ yes ___no

If yes, what exposure? ____

Are you concerned only about a health outcome? ___ yes ___no

If yes, what outcome? ____

Are you concerned about a possible link between an exposure and a health outcome?

___ yes ___no

If yes, what exposure? ____

And what outcome? ____

2. **Who** is the focus of concern?

What groups (for example, children ages 5-12, women under age 30, atomic energy workers)?

____

____

About how many people do you think are affected? A rough estimate is fine: Fewer than 100? hundreds? A thousand? Tens of thousands? Fill in an estimate for each:

______ households

______ adults

______ children

4. **Where** is the concern? (for example, on my street, the school baseball field, areas near agricultural facilities)

____

____

5. **When** did the exposure or outcome (or both) occur?

____

____

6. State your research question.

____

____