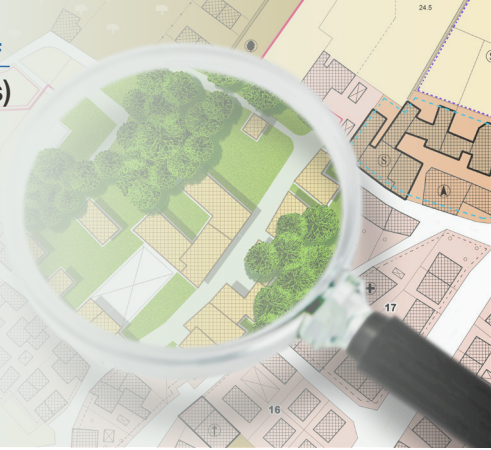


# Investigating Cancer Clusters and Unusual Patterns of Cancer: Challenges and Limitations

In 2022, CDC/ATSDR published [Guidelines for Examining Unusual Patterns of Cancer and Environmental Concerns](#) (hereafter referred to as 2022 Guidelines) to provide state, tribal, local, and territorial public health agencies, and other partners access to information about current scientific tools and approaches to evaluate unusual patterns of cancer and environmental concerns in communities. The revised guidelines propose an approach to identifying and investigating unusual patterns of cancer, however, challenges and limitations of these types of investigations remain. The following frequently asked questions (FAQs) aim to address some of the common questions associated with community-level investigations of unusual patterns of cancer.



## What is a cancer cluster?

A cancer cluster is defined in the 2022 Guidelines as “a greater than expected number of the same or etiologically related cancer cases that occurs within a group of people in a geographic area over a defined period of time.” According to the American Cancer Society, one of every two men and one of every three women will be diagnosed with some form of cancer at some time in their lives. Therefore, we can expect a certain number of cancers to occur in a given place over a given time period.

## What does the phrase cancer etiology mean?

Etiology is the cause or causes of a disease. The term “cancer etiology” refers to the cause or causes of cancer. Etiology includes many risk factors. Examples of risk factors include too much exposure to [ultraviolet rays](#), which can cause skin cancer, or exposure to asbestos, which can cause mesothelioma.

## What is the difference between a cancer cluster and an unusual pattern of cancer?

A cancer cluster occurs when a greater than expected number of the same or etiologically related cancer cases occurs within a group of people in a geographic area over a defined period of time. An unusual pattern of cancer may involve a greater than expected number of the same or etiologically related cancer cases within a certain time period, but not within a given geographic area. Both situations may warrant further assessment by local or state health officials.

All cancer clusters are considered unusual patterns of cancer. However, some unusual patterns of cancer may not meet the definition of a cancer cluster. An example of an unusual pattern might involve individuals diagnosed with cancer who are all served by the same water system. In this case, the pattern on a map may look unrelated unless further examination of their water sources occurs.

## Why is investigating unusual patterns of cancer so challenging?

There are several issues that make such investigations and analyses challenging, which are described in more detail below. These include, but are not limited to, issues with

- mathematical limitations (for example, small numbers of individuals with cancer in an area of concern),
- defining a cancer case,
- determining the time period when the unusual pattern started, and
- defining the geographic areas of focus.

In addition, cancers can have multiple causes. Sometimes cancer risk may be related to diet and other lifestyle risks. Cancer risk may also be inherited in your genes. Sometimes cancer can also be caused by exposure to one or more environmental risks. There may also be cancer risk related to the interactions between your lifestyle choices, demographics, the environment, and/or your genes. All these factors make investigating and analyzing cancer patterns difficult.

## What are the mathematical challenges and limitations?

Public health relies on a field of math called biostatistics. In biostatistics, statistical challenges may occur depending upon the number of individuals diagnosed with cancer and the methods available to determine if there is an elevated rate of cancer. Most often a standardized incidence ratio (SIR) helps make that determination. However, small numbers of cases can result in estimates that are imprecise or that are inaccurate. If the estimate is imprecise, that means there are a wide range of possible true estimates. If the estimates are inaccurate, then they do not represent the true estimate. Sometimes, health officials must draw conclusions about a larger population by looking at a smaller group of people from that population. Mathematical challenges may be more common in rural areas or for rare cancer types, because case numbers can be low.

## What is a standardized incidence ratio (SIR)?

A standardized incidence ratio (SIR) is a number that compares the number of cases of a certain type of health outcome, in this instance cancer, that actually occurred to the number of cases that would be expected to occur in a specific geographic area and time period. The expected number of cases is usually estimated based on cancer rates for a larger area, such as the entire state. It is standardized to account for differences (like age) in the two populations being compared. More information about the SIR can be found in the CDC/ATSDR [SIR Fact Sheet](#).

## What challenges are involved with establishing a case definition?

A case definition is used to determine the study criteria for analysis. Deciding the criteria for which people to include as cases in a cancer study or analysis is very important and challenging. The types of cancer being studied should be specific and should include cancers associated with the same risk factors. Information about if and when people were exposed to something in the environment suspected of causing cancer is often difficult to ascertain. Another challenge is deciding what geographic area and time period to study.

## Why do time periods present challenges?

Many types of cancer take years or even decades to develop, so information on possible exposures that occurred long ago can be difficult to evaluate. Also, some people move out of a given area over time. It is possible that the number of cancer cases included during a specific time period may be undercounted because some individuals with cancer may have moved away. Similarly, the number of people counted as exposed due to living in the area might be overcounted if new people have moved into the area more recently.

## Why does geography present challenges?

Deciding what geographical area to study is not straightforward. The boundaries of a neighborhood, census tract, municipality, or county may not define the population at risk for exposure. Although it might be easy to pick a town or neighborhood to study, an exposure area may not be defined by these geographical boundaries. This means that some cancer cases or patterns could be missed by limiting our search to existing boundaries.

## If a cancer investigation doesn't suggest that environmental factors are related to cancer, does that mean a cluster or unusual pattern doesn't exist?

Not necessarily. It may mean several things. Given the frequency with which cancers are diagnosed, situations may arise where an unusual number of cancers are diagnosed among people in a particular location. In addition to this happening by chance, unusual patterns may also be related to one or more of the following:

- Higher prevalence of recommended cancer screening in a particular geographic area generally lead to identifying more cancer at an earlier stage, when treatment is likely to work best
- Behavior and lifestyle risk factors
- Occupational exposures
- Lack of sufficient data to assess the relationship between cancer and the environmental factor



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