

Cancer Incidence Data Review: Results for Eight Southwestern Pennsylvania Counties, 1985-2021

Frequently Asked Questions

Why was this review conducted?

In response to community members' requests, this review of existing cancer data is part of the Department of Health's (DOH) ongoing effort to monitor cancer cases in the 8-county area (Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Washington, and Westmoreland counties) southwestern Pennsylvania.

What is cancer and what causes it?

According to the Mayo Clinic, "cancer refers to any one of a large number of diseases characterized by the development of abnormal cells that divide uncontrollably and have the ability to infiltrate and destroy normal body tissue. Cancer often has the ability to spread throughout your body. Cancer is the second-leading cause of death in the world. But survival rates are improving for many types of cancer, thanks to improvements in cancer screening, treatment and prevention."¹

Cancer comes in many forms and can impact different parts of the body (e.g., skin, lung, blood). The genetic mutations that result in cancer can be inherited, may result from damage from harmful substances, environmental exposures, as well as inherited genetic changes, random events, and/or viruses or occur spontaneously (i.e., without a known cause). There are also different causes and risk factors for different types of cancers. For example, lung cancer has been associated with smoking cigarettes. Because so many risk factors influence a person's health, it is extremely difficult for scientists to attribute a cancer diagnosis to a specific cause.

What is a cancer registry and how is it used by researchers?

The Pennsylvania Cancer Registry (PCR) is a statewide data system responsible for collecting information on all new cases of cancer diagnosed or treated in Pennsylvania. The PCR has had statewide data collection since 1985. The PCR is part of the National Program of Cancer Registries (NPCR) administered by the Centers for Disease Control and Prevention (CDC).

The cancer registry data that are used to produce statistics on the number of cancer cases does not include information on many of the known cancer risk factors such as smoking status or other lifestyle factors (e.g., diet, age, family history, occupational exposures, alcohol consumption). Therefore, those risk factors are not accounted for in these analyses. Science is also still developing on the causes of different types of cancers. For these reasons, it is not possible to associate the occurrence of one cancer type to a specific risk factor.

What data were included in this review?

The most recent PCR data and the American Community Survey population estimates from 1985 to 2021 were used in this review. PCR data for 2022 and 2023 were not yet available for this analysis. DOH examined the number of newly diagnosed cases (i.e., incidence) of 23 different cancer types among adults and selected childhood cancers in an eight-county area in SW PA compared to the number of these cancers in the rest of PA.

¹ <https://www.mayoclinic.org/diseases-conditions/cancer/symptoms-causes/syc-20370588>

What methods were used in this review?

The main statistical method used in this review is the **standard incidence ratio (SIR)** calculation. The SIR compares the observed number of cancer cases in the study area population to the number of cancer cases that might be expected based on a larger population (i.e., reference population). The expected number is based on the cancer experience (cancer incidence rate) in a larger population, usually a state, excluding the study population. The SIR is calculated by dividing the observed number of cancer cases by the expected number of cases. The SIR used in this review were adjusted for age. SIRs were calculated for both males and females where applicable. This means the calculation accounts for the age of patients which is a major cancer risk factor. However, it does not consider other important cancer risk factors as they are not available to evaluate.

An SIR of 1 indicates the cancer incidence (i.e., the number of newly diagnosed cancer cases during the selected time period) in the study area is the same as in the reference population. The reference population for this analysis was the state of Pennsylvania. An SIR greater than 1 indicates a higher incidence in the study area than the state as a whole, while an SIR less than 1 indicates a lower incidence in the study area compared to the rest of the state. As an example, an SIR of 0.5 means that the incidence rate of that cancer type in the study population is 0.5 times lower than the statewide rate. Since 0.5 is 50% less than 1.0, an SIR of 0.5 would indicate a decrease of 50%. Similarly, an SIR of 1.5 indicates that the incidence rate for that cancer type in the study population is 1.5 times higher than the statewide rate. Since 1.5 is 50% greater than 1.0, the SIR indicates an excess of 50%. An SIR of 1 means that there is no difference (i.e., no increase or decrease) in the cancer incidence between the study area and the statewide rate.

A **confidence interval (CI)** was also calculated for the SIR to determine how likely it is that the observed number of cases is high or low by chance. The CI provides an estimated range of values that are likely to include the SIR. The CI also provides the precision of the SIR. A narrow CI indicates more precision, and a wide CI suggests less precision. For example, a narrow confidence interval (e.g., 1.03–1.15) allows a fair level of certainty that the calculated ratio is close to the true ratio for the population. A wide interval (e.g., 0.85–4.50) leaves considerable doubt about the true ratio, which could be much lower or much higher than the calculated ratio. The CIs are also used to determine statistical significance. If the CI includes 1 (e.g., 0.8 – 1.2) the SIR is not statistically significant, whereas if the CI does not include 1 (e.g., 0.7 – 0.9 or 1.2- 17) the SIR is statistically significant. A statistically significant SIR means the difference between observed number of new cancer cases and expected number of new cancer cases is greater than what might be expected to happen by chance alone.

What is the main message of this review?

The objective of this analysis was to determine if the eight-county area experienced a higher number of newly diagnosed cancer cases compared to the rest of Pennsylvania. This analysis is not capable of determining the cause(s) of any increase or decrease in the number of observed cancer cases. Many of the risk factors that contribute to the development of cancer (genetics, lifestyle factors such as smoking, and other exposures) were not able to be included in this analysis.

This report shows snapshots of the cancer incidence in the study area and in the state. Key takeaways from this analysis include:

- Many cancer types showed statistically higher SIRs among males and females during different time periods, while some cancer types showed significantly lower SIRs in the study area compared to the rest of Pennsylvania.

- No cancer type showed a statistically significant and consistent increase among both sexes across the time periods evaluated. Generally, researchers would expect a consistent increase in cancer rates when they are associated with toxic environmental pollutants.
- Only age could be considered for calculating cancer SIRs for males and females in this analysis. Other important cancer risk factors such as genetics, lifestyle factors including smoking status, or environmental exposures were not included in the analysis.
- The results may be used for developing studies to better understand the risk factors associated with specific cancers.

Are there increased cancer risks in Pennsylvania due to environmental exposures?

The risk of developing cancer includes many factors. In addition to an individual's unique genetic makeup and health behaviors, additional characteristics about a person (e.g., occupation, residential location) can also influence cancer risk. DOH reviewed cancer registry data to examine incidence of any of the 23 major cancer types among residents in the 8-county area (Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Washington, and Westmoreland counties) in southwestern Pennsylvania. The review included selected cancer types in children 0-19 years. In the analysis, DOH looked for any increase or decrease in the number of new cancer cases, as well as any consistent trend across four time periods (1985 to 1994, 1995 to 2004, 2005 to 2014, and 2015 to 2021). These analyses revealed:

- Higher bladder cancer incidence rates among male residents in the eight-county area, consistently across all four time periods with 4%, 8%, 12%, and 9% percent increases across the four time periods examined. Bladder cancer among females in the eight-county area showed a statistically significant increase only during 2005-2014.
- Testicular cancer showed statistically significant increases in the eight-county area during all time periods except during 1985-1994 in the current analyses.
- Kidney cancer rate was significantly elevated only among females during the last time period, 2015-2021.
- An elevated incidence rate for non-Hodgkin lymphoma was observed over one time period (1995-2004) in this analysis for both sexes and among females for another time period (2005-2014).
- No statistically significant increase in the observed number of pediatric cancers in the eight-county area compared to the rest of PA except in the case of female pediatric bone cancers during 2005-2014 where there was a 52% increase in the eight-county area compared to the rest of PA.

There are several risk factors for cancer, and these analyses did not focus on specific environmental exposures, but whether there was excess cancer in the area of concern. This type of analysis cannot determine if past exposures to contaminants caused, or contributed to, the observed cancer cases. No cancer type showed a consistently increasing trend in incidence among both sexes across all time periods. For most cancers when the leading risk factor is an environmental exposure, researchers would expect a consistent increase in cancer incidence among both sexes across several time periods.

What are the strengths and limitations to the findings of this analysis?

These analyses can be used by researchers to generate questions and evaluate the need for future research. However, there are many limitations to this kind of analysis, including that this type of analysis

does not provide information on causation (i.e., this risk factor caused this type of cancer). Many factors contribute to cancer development, including genetics, environmental exposure, lifestyle, infections, age, hormones, etc. Information on most of these factors are not part of the cancer registry data and therefore are not included in the analyses. Information on what causes a specific type of cancer is often not known. There are other limitations associated with the use of cancer registry data. For instance, it may not include all cancer cases from Veterans Affairs facilities. Additionally, only cancers diagnosed in Pennsylvania are reported to the PA cancer registry. Cancer may take a long time to develop and if a person moves out of Pennsylvania before a cancer diagnosis, that case may not get reported to the PA cancer registry. Likewise, a person who lived elsewhere their entire lifetime may be included in the PA cancer registry if the cancer is diagnosed immediately after moving to PA.

Does this review indicate that fracking is responsible for increases in cancer rates?

These types of studies and analyses cannot link any observed increase or decrease in cancer incidence rate to a particular cause. Identifying the exact cause for a specific type of cancer is very difficult. It is also very difficult to know exactly what an individual's exposures and risk factors might be.

Why does DOH not do a study that can specifically answer if fracking causes cancer?

As noted above, cancer has several risk factors, and it takes a long time (several years) to develop. The individual may be exposed to the same/similar contaminants from multiple sources. It is difficult to precisely identify and measure the exposure from a particular source and assess its contribution in the development of cancer in an individual. DOH can review the data on health outcomes (e.g., cancer, asthma hospitalizations) and determine if the numbers are increasing or decreasing over time, but DOH may not be able to definitely say that there is a single, specific cause-effect relationship.

Why is it difficult to determine what the cause of cancer is?

Cause and effect is the relationship between two events where one event causes the other. Establishing a cause-effect relationship in environmental studies is very difficult. The ideal — but unethical — way to establish a cause-effect relationship would be to expose one group to a harmful chemical and compare their health status to another group that is not exposed to the chemical. To assess this type of relationship, researchers use estimates of exposures that can be measured (e.g., occupation, residing near a contaminated area). In addition to these estimates of exposures, researchers also need to consider other factors not related to the exposure which can also cause the cancer. These include things like diet, age, smoking status, and genetics. It also depends on how long a person was exposed. A person who smoked for 10 days has a different exposure than someone who smoked for 10 years. While each of these factors is important, it is difficult to be able to gather all this information and understand how all these possible factors affect a person's health.

Specifically, for an individual there is:

- Difficulty in estimating the exposure levels/duration precisely or the timing of these exposures (e.g., a person could have been exposed to a large dose of something for a long period of time or a small dose over a short period of time).
- Difficulty in knowing if there are multiple sources of exposures or an inability to pinpoint the source(s) (e.g., a person could be exposed at work and at home which increases their exposure level).
- Difficulty in accurately measuring factors such genetics, lifestyle differences, and other lifetime exposures. Cancer takes a long time to develop. It is often difficult to obtain reliable/accurate information on all relevant past exposures and risk factors.

What does DOH plan to do with the information from this review?

DOH has posted this information on its website and is also available to respond to any comments/questions related to this review. DOH will continue to monitor cancer incidence rates as new data becomes available.

Additionally,

- DOH has developed a physician guidance presentation to support health care providers to better address health concerns from their patients that may be linked to environmental exposures especially from industrial activities. This presentation will be available on TRAIN-PA website soon.
- DOH worked with the PA department of education to develop resources for K-12 teachers in Pennsylvania for integrating environmental health and science into the curriculum.
- DOH is also considering options to implement a pilot asthma screening program to help understand the extent of un/under-diagnosed asthma among school children so that outreach efforts can be made for better asthma management.
- DOH publishes fact sheets and other education materials on various environmental exposures to inform residents about potential health risks and ways to minimize/avoid harmful exposures.
- DOH's health assessment team assesses cancer risks associated with environmental exposures from hazardous waste sites.
- DOH participates in environmental justice planning efforts in the state, helping to advocate for improved health and distribute relevant materials and resources to vulnerable populations.

What other activities is DOH doing related to industrial activities?

The Division of Environmental Health Epidemiology (DEHE) within DOH, Bureau of Epidemiology, maintains an electronic database to record health related complaints from a variety of industrial operations. For example, the DEHE publishes bi-annual reports based on its ONGP Health Information Database: ([OilGas \(pa.gov\)](https://www.pa.gov)). DEHE also participates in regional and national conferences involving topics related to industrial activities (e.g., League of Women Voters' Shale and Health Conference, Shale Network Workshop, Council of State and Territorial Epidemiologists (CSTE), etc.).

What is DOH doing to address results of this review?

Noting that multiple factors may cause cancer such as poor nutrition, tobacco use and exposure, exposures to environmental carcinogens, sun exposure, lack of physical activity, etc. PA DOH supports programs and initiatives that focus on these factors to reduce cancer incidence and mortality. Many of these initiatives are outlined in the [2023-2033 Pennsylvania Cancer Control Plan](#). Additional information on many of these initiatives can be found [here](#).

What is DOH doing in response to the results of the University of Pittsburgh studies?

After the release of the UPitt studies, DOH joined the UPitt team in explaining the studies' findings to community members and answered questions in a community meeting held in August 2023. At the request of community members following the public meeting, members of the DOH leadership team visited ONGP sites in the study area in September 2023. DOH and DEP continue to meet with the PA Chapter of Physicians for Social Responsibility (PSR) and the Environmental Health Project (EHP) to listen to concerns and relay any updates that the departments may have. To continue to improve

communication efforts with residents, DOH has updated processes for residents to submit an online form for environmental health concerns and has established a formal process with DEP to route health concerns received by them to the DOH.

Additionally, DOH developed physician education materials on environmental exposures to provide information about the potential link between environmental exposures and adverse health outcomes to help guide decision making for patients with potential exposures. DOH also worked with the Department of Education to develop resources for K-12 teachers for integrating environmental health and science into the curriculum. DOH is also considering options to implement a pilot asthma screening program to help to understand the extent of un/under-diagnosed asthma among school children so that outreach efforts can be made for better asthma management.

Where can I get a copy of the review?

Information and data from this review is available on the DOH website: [Cancer Incidence Data Review: Results for Eight Southwestern Counties, 1985-2021](#)

Where can I direct my questions or comments about the review?

Contact DOH for additional information via phone (717) 787-3350 or email dehe@pa.gov.