Demographic, Temporal, and Geographic Variations in Pediatric Cancer Incidence in Pennsylvania

Frequently Asked Questions

- **Why were these reports produced?**

  During community meetings where results of studies conducted by University of Pittsburgh (U Pitt) were discussed, community members requested additional analysis of cancer data. This report was produced to provide an overview of pediatric cancer trends and patterns in Pennsylvania.

- **What data and information were used to create this report?**

  The primary data source is the 1985 to 2020 Pennsylvania Cancer Registry (PCR) and the centennial Census population estimates. We also extracted national and state cancer incidence (i.e., newly diagnosed cases of cancer) data from the Center for Disease Control and Prevention's Wide-ranging ONline Data for Epidemiologic Research (CDC WONDER) for comparisons between Pennsylvania and the national averages. This report presents changes over time across the state of PA in overall and specific cancer incidence (i.e., the number of newly diagnosed cancer cases during the selected time period) among children under 20 years of age.

- **What methods were used in these reports?**

  The main statistical method used in this report 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 reference population. The expected number is based on the cancer experience (cancer incidence rate) in the reference population. For these analyses, the reference population included the pediatric population across Pennsylvania, excluding the pediatric population in the study area. The SIR is calculated by dividing the observed number of cancer cases by the expected number of cases. The SIR calculation accounts for the age of patients, one major cancer risk factor; however, it does not consider other risk factors.

  An SIR of 1 indicates that the cancer incidence in the study area is the same as in the reference population. The reference population for this study was the pediatric population for the rest of the state of Pennsylvania. An SIR greater than 1 indicates a higher incidence in the study area than the reference population, while an SIR less than 1 indicates a lower incidence. For 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 comparison area. 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 that of the comparison area. Since 1.5 is 50% greater than 1.0, the SIR indicates an excess of 50%. An SIR of 1 means there is no difference (i.e., increase or decrease) in the cancer incidence between the study area and the rest of the state.

  A confidence interval (CI) was also calculated for the SIR to determine how likely it is that the number of 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 precision for 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 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 report?**

  The objective of this analysis was to assess all cancers combined and selected common and rare types of cancer using the most recently available statewide cancer registry data among the pediatric population in Pennsylvania. The CDC WONDER data were used for Pennsylvania and national age-adjusted childhood cancer rate comparisons.

  This report found around 607 children (<20 years) were newly diagnosed with cancer on an annual basis in PA between 2000 and 2020. The age-adjusted cancer incidence rate was 192.5 cases per million persons from 2000 to 2020. From 2000 - 2020, the childhood cancer incidence rate was generally higher in PA than in the US. The overall childhood cancer incidence in Pennsylvania fluctuated and increased during the first half of the reporting period (2000−2010) and subsequently decreased from the highest rate (210.7 cases per million persons) in 2010 to 179.5 cases per million persons in 2020. In general, childhood cancer incidence rate for males for all cancers combined were higher than females during the time periods analyzed, similar to the national pattern. Also, all cancer combined childhood cancer incidence rates were higher among white children than black children, which is also similar to the national patterns. These patterns were not consistent among individual common or rare types of pediatric cancers.
  There were geographic variations in the incidence patterns of childhood cancers among Pennsylvania counties for the three time periods analyzed for common and selected rare types of childhood cancer.

- **What are the strengths and limitations to the findings of these reports?**

  The PCR data used in these analyses are considered the gold standard. Records included in the PCR have high levels of completeness and demographic information and all types of reportable cancers. However, there are many limitations to this kind of report. First, 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 PCR and therefore are not included in the analyses. If an area is identified with a higher SIR, extensive studies would be needed to assess for many risk factors. Other limitations on statistics including defining geographic boundaries, temporal trends, data quality, and cancer development (latency period) all pose challenges for these reports. Further, the PCR uses the address information when the patient was diagnosed; however, the whole residential history is not recorded. Therefore, it is not possible to determine if an exposure that could have led to the cancer diagnosis occurred in that area or was a result of prior exposures.

- **What is DOH doing to address observed increases in cancer rates?**

  Cancer is caused by genetic mutations that lead to uncontrolled cell growth and division. These mutations can be inherited, caused by environmental exposure, or occur spontaneously (i.e., without a known cause). There are multiple known factors that may increase the risk of cancer such as poor nutrition, tobacco use and exposure, exposures to environmental carcinogens, sun exposure, lack of physical activity, etc. Focusing on reducing these known risk factors for cancer can help reduce overall cancer rates. 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 does DOH plan to do with the information from these reports?**

  DOH published this report on its website along with a FAQ document related to the report. DOH is also available to respond to any comments/questions related to this report. Communities can use the results from these analyses to determine if there is an elevated cancer risk in their community. It can also be used by researchers to generate questions and evaluate the need for future research. We will also update this report in the future to monitor the trend of childhood cancer in the state.

- **Why is cancer rate higher in PA than in US?**

  The overall age-adjusted Pennsylvania childhood cancer incidences for all cancers combined were slightly higher in some years than the national average, but not all years, especially for the recent years in the analysis period. Age adjustment is a statistical process that allows for comparison between communities with different age distributions. Many factors could cause these differences, especially for childhood cancer. Exposure to environmental toxins like chemicals, pollutants, and radiation could increase childhood cancer incidence. For children, parents' exposure may also have some effects. The genetic factors could also be different between states with certain inherited conditions being more common in some states. Socioeconomic factors can affect people's healthcare access and obtaining healthy foods and healthy lifestyle management, thus affecting the cancer incidence rate.

  Rigorous screening programs may also increase the number of people diagnosed with cancer, thus increasing the rate. Reporting and data collection could contribute to the difference as well. Pennsylvania's cancer registry has been gold-certified for many years with an excellent cancer reporting system. States with a comprehensive reporting system could have more cases reported and recorded when compared to states with less robust cancer reporting systems. Furthermore, state data on childhood cancer incidents are usually small and thus unstable with larger fluctuation. Some of the years with small number of cases could have rates higher due to chance alone. Variation in childhood cancer incidences among all states is often observed.

- **How does data in this report compare to other states?**

  Although not included in this report, data are publicly available to compare childhood cancer incidence between states. The age-adjusted 2016-2020 childhood cancer incidence rate in Pennsylvania was lower than most of our northeastern neighboring states. Pennsylvania ranked the

18th highest, NJ ranked 6th, NY ranked 3rd, and Delaware ranked 8th. Most northeastern states have higher childhood cancer incidence than other states in the nation. Additional details can be viewed here: State Cancer Profiles > Incidence Rates Table.

- **What are some ways to prevent childhood cancer?**

  Preventing childhood cancer is challenging as the exact causes of childhood cancers are difficult to identify. However, there are important measures that can potentially reduce the risks, such as these:
  - Reduce exposure to environmental carcinogens such as secondhand smoke, pesticides, and radiation during medical procedures.
  - Teach children about the harmful effects of smoking to reduce future smoking.
  - Encourage a healthy lifestyle including a healthy diet and regular physical activity.
  - Vaccinate children against cancers linked to infectious diseases including hepatitis B and human papillomavirus (HPV).
  - Ensure prenatal care during pregnancy and obtaining genetic counseling for those with a family history of cancer or inherited medical conditions.
  - Educate parents, especially pregnant persons and caregivers, about cancer and their risk factors.

- **Where can I get a copy of the report?**

  This report is available on the DOH website: Demographic, Temporal, and Geographic Variations in Pediatric Cancer Incidence in Pennsylvania

- **Where can I get additional information on the report?**

  Individuals interested in learning more about this report can contact the Bureau of Epidemiology, Division of Community Epidemiology at 717-787-3350.