ROUTE 9 CORRIDOR DATA ANALYSIS WITH DELAWARE CANCER REGISTRY

June 2025

DELAWARE HEALTH AND SOCIAL SERVICES
Division of Public Health
Bureau of Cancer Prevention and Control

Route 9 Corridor Data Analysis with Delaware Cancer Registry
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State of Delaware

Department of Health and Social Services

Division of Public Health

For more information, contact:
Bureau of Cancer Prevention and Control
Health Promotion and Disease Prevention Section
Division of Public Health
Thomas Collins Building
540 S. Dupont Highway, Suite 11
Dover, DE 19901
302-744-1040
https://www.healthydelaware.org/Individuals#healthy-living

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Objective

The purpose of this analysis is to monitor cancer trends around the Route 9 Corridor in New Castle County at the request of the Delaware Department of Natural Resources and Environmental Control (DNREC). The first analysis was completed in April 2022. The results can be found at the following link: https://documents.dnrec.delaware.gov/Air/ethylene-oxide/DPH-Route-9-Data-Analysis-Report.pdf. This second report examines trends from 2007-2021 and geographic clustering of cases around the Route 9 Corridor.

Delaware Cancer Surveillance

This report was compiled using data from the Delaware Cancer Registry (DCR). The Delaware Department of Health and Social Services, Division of Public Health (DPH) maintains the DCR database. This database contains cancer information on individuals who are Delaware residents at the time of diagnosis. After a cancer diagnosis is confirmed, health care professionals are responsible for reporting this information to the registry. Registry data are used for the state cancer monitoring efforts.

Utilizing the DCR, DPH compiles an annual comprehensive report titled, *Cancer Incidence and Mortality in Delaware,* which includes cancer incidence rates. Incidence rates describe the number of new cancer cases diagnosed in a population over a given period; rates are typically expressed as the number of new cancer cases diagnosed per year per 100,000 people. Cancer incidence rates are aggregated over five years. For example, the most recent Delaware report was released in October 2024 and discusses cancer rates from 2017 to 2021. Within the annual report, Delaware cancer rates are also compared to national data to assess for trends and areas for improvement. The compendium titled, *Census Tract-Level Cancer Incidence in Delaware, 2016-2020,* discusses all-site cancer incidence within a census tract.

Ethylene Oxide

In April 2022, there was interest in the "Route 9 Corridor" due to a known ethylene oxide emission from Croda, Inc.'s Atlas Point facility, located at 315 Cherry Lane in New Castle, Del. In response, the Delaware Department of Natural Resources and Environmental Control (DNREC) and the Environmental Protection Agency (EPA) worked together to convene a community meeting to present current information and answer constituent concerns. The Delaware Division of Public Health (DPH) was an active participant at this meeting. Details of the meeting can be found at the following link: https://dnrec.delaware.gov/air/ethylene-oxide/. Cases of female breast, leukemia, and non-Hodgkin lymphoma were chosen by DNREC for this report, as they are more likely associated with ethylene oxide exposure.

Route 9 Corridor Category

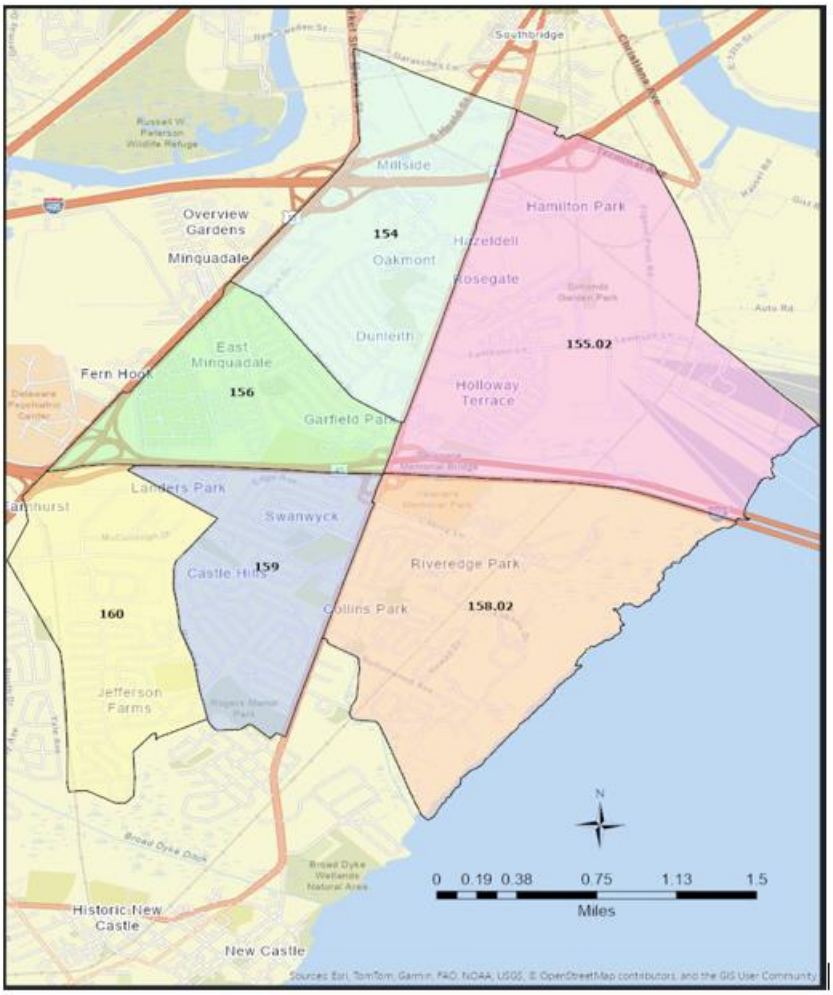
For the purposes of this analysis, the "Route 9 Corridor" is defined by the Wilmington Area Planning Council as north to south from the City of Wilmington line to the City of New Castle line, and west to east from US 13 to the Delaware River. As of the 2010 Census, Delaware is divided into 214 census tracts. A

census tract is an area roughly equivalent to a neighborhood established by the U.S. Census Bureau for analyzing populations. Census tracts generally encompass 2,500 to 8,000 people. The full form for census tracts currently has 11 digits. The first two digits represent state (DE=10), the next three digits are for county (Kent = 001, New Castle = 003, Sussex = 005), and the last six digits represent a unique tract. The U.S. Census Bureau provides this search tool to determine census tracts by ZIP Code: https://geocoding.geo.census.gov/geocoder/geographies/address?form

Census tracts, in the unique form associated with the Route 9 Corridor, are: 154.00, 155.02, 156,.00 158.02, 159.00 and 160.00 (Figure 1). The values used in the calculations for these census tracts were aggregated to create the Route 9 Corridor cancer rate.

A case is defined as an individual who is newly diagnosed with cancer and resides in Delaware at the time of their diagnosis. Cases were included in the analysis of the Route 9 Corridor if the census tract that was geocoded for the case was considered high certainty.

Figure 1: Census Tracts Included in the Route 9 Corridor



Data Source: U.S. Census Bureau, 2010 TIGER/Line Shapefiles (machine-readable data files), Delaware census tract selection.

Age-Adjusted Cancer Incidence Rates

Statistical adjustment, such as age-adjustment, is commonly performed when comparison between groups could be influenced by a confounding variable – which in this case, is age. For example, older age groups tend to be affected more by cancer than younger ones. Age adjustment ultimately allows for more accurate comparisons to be made between age groups and removes the influence of the confounding variable, leading to more accurate conclusions to be made.

Table 1: Five Year Age-Adjusted Cancer Incidence Rates by Area and Cancer Type, Route 9 Corridor, Delaware, 2015-2021

	2015-2019		2016-2020		2017-2021	
	Age-adjusted Incidence Rate with Confidence Intervals	Count of Cases	Age-adjusted Incidence Rate with Confidence Intervals	Count of Cases	Age-adjusted Incidence Rate with Confidence Intervals	Count of Cases
Route 9 Corridor						
All-site	430.1 [390.7, 472.4]	471	404.8 [367.0, 445.6]	451	393.1 [356.2, 433.1]	448
Lymphoma	17.1 [9.9, 27.7]	18	16.1 [9.3, 26.2]	18	17.0 [10.0, 27.4]	19
Leukemia	---	< 16	---	< 16	---	< 16
Female Breast	112.4 [84.5, 146.5]	61	111.7 [84.0, 145.6]	61	132.6 [103.0, 168.4]	76
New Castle County						
All-site	479.3 [471.7, 487]	15,943	462.8 [455.5, 470.3]	15,739	451.8 [444.6, 459.1]	15,653
Lymphoma	22.5 [20.9, 24.3]	728	20.7 [19.2, 22.4]	682	19.8 [18.3, 21.4]	664
Leukemia	12.4 [11.2, 13.7]	396	12.3 [11.1, 13.6]	396	12.4 [11.1, 13.7]	402
Female Breast	142.8 [137, 148.7]	2,480	143.9 [138.2, 149.8]	2,550	146.1 [140.4, 152.0]	2,622
Delaware						
All-site	485.5 [479.9, 491.1]	30,594	473 [467.6, 478.6]	30,678	462.1 [456.7, 467.5]	30,849
Lymphoma	21.9 [20.7, 23.2]	1,320	20.9 [19.7, 22.1]	1,284	19.6 [18.5, 20.8]	1,248
Leukemia	13.2 [12.3, 14.2]	798	13.3 [12.3, 14.2]	813	13.0 [12.1, 13.9]	817
Female Breast	138.2 [133.9, 142.5]	4,422	137.4 [133.2, 141.7]	4,505	139.2 [135.0, 143.5]	4,680

Source: Delaware Health and Social Services, Division of Public Health, Delaware Cancer Registry, April 2025.
Note: Rates are per 100,00 population. All-site refers to all cancer types. Population estimates are from Woods & Poole Economics, Inc. Census Tract Estimates Controlling to Vintage 2022.
'---' indicates suppression of rates and counts for privacy protection with small numbers.
Route 9 Corridor includes tracts 154.00, 155.02, 156.00, 158.02, 159.00 and 160.00.
For Route 9, all cases had high quality CTs and were therefore included in analysis.

The age-adjusted cancer incidence rates described in Table 1 are for the five-year time periods of 2015-2019, 2016-2020, and 2017-2021. The all-site cancer incidence rate, which includes all cancer types, for Route 9 Corridor for the most recent period of 2017-2021 was 393.1 per 100,000 people, which was lower than the rates for Delaware (462.1 per 100,000 people) and New Castle County (451.8 per 100,000 people). The Route 9 Corridor all-site cancer incidence rate was lower compared to the Delaware and New Castle for other time periods. Similarly, the Route 9 Corridor cancer incidence rates for lymphoma, leukemia, and female breast cancer were lower compared to New Castle County and Delaware for the 2017-2021, 2016-2020, and 2015-2019 periods.

Most cancer incidence rates for all-site, leukemia, and lymphoma were lower in 2017-2021 compared to the other two periods in the Route 9 Corridor, New Castle County and Delaware. The cancer incidence for female breast cancer in the Route 9 Corridor did increase in 2017-2021 (132.6 per 100,000 people) compared to both the 2016-2020 (111.7 per 100,000 people) and 2015-2019 (112.4 per 100,000 people) periods. However, female breast cancer incidence rates also increased in New Castle County and Delaware for 2017-2021, compared to the earlier two periods.

Due to data privacy limitations, the cancer rates for leukemia cannot be displayed, but the incidence rates were lower than Delaware and New Castle County for the displayed time periods.

Joinpoint Trend Analysis

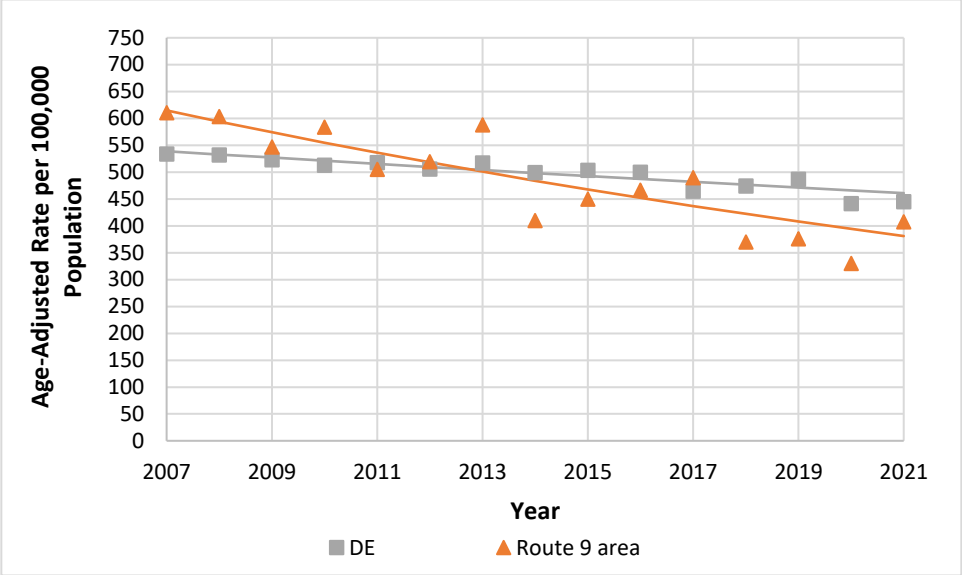
For this report, trend analysis was calculated using Joinpoint statistical software available through the NCI (https://surveillance.cancer.gov/joinpoint/). Briefly, trend data (e.g., cancer incidence rates), are input into the software and the software fits the simplest Joinpoint model that is identified from the data. The model provides information about significant changes in the trend across the years and calculates the annual percent change (APC). An APC can also be calculated to summarize the trend over a pre-specified fixed interval (e.g., 2007-2021) and allows investigators to use a single number to describe the average APCs over a period of multiple years.

Table 2: Joinpoint Trends with Annual Percent Change (APC) and Average Annual Percent Change (AAPC) in Cancer Incidence Rates, Delaware and Route 9 Area, 2007-2021^

	Trend 1		Trend 2		Overall Trend 2007-2021	Overall Trend Interpretation
	Years	Annual Percentage Change (APC)	Years	Annual Percentage Change (APC)	Average Annual Percentage Change (AAPC)	
All-Site						
Delaware	2007-2021	-1.1*			-1.1*	Decrease
Route 9	2007-2021	-3.4*			-3.4*	Decrease
Female Breast						
Delaware	2007-2021	0.9			0.9	Stable
Route 9	2007-2021	0.2			0.2	Stable
Leukemia						
Delaware	2007-2021	-1.4			-1.4	Stable
Route 9	2007-2021	-5.9			-5.9	Stable
Non-Hodgkin Lymphoma						
Delaware	2007-2016	-0.1	2016-2021	-6.4*	-2.4*	Decrease
Route 9	2007-2021	-1.0			-1.0	Stable

Source: Delaware Health and Social Services, Division of Public Health, Delaware Cancer Registry, April 2025.
Note: Rates are per 100,00 population. All-site refers to all cancer types. Population estimates are from Woods & Poole Economics, Inc. Census Tract Estimates Controlling to Vintage 2022.
Route 9 Corridor includes tracts 154.00, 155.02, 156.00, 158.02, 159.00 and 160.00.
For Route 9, all cases had high quality CTs and were therefore included in analysis.
^ Incidence rates for year 2020 are plotted but were not used for the analysis of trends since 2020 was an anomaly and would bias estimates.
*APC/AAPC is significantly different from zero at the alpha = 0.05 level

Figure 2: Age-Adjusted All-Site Cancer Incidence Rate Trend; DE and Route 9 Area, 2007-2021^

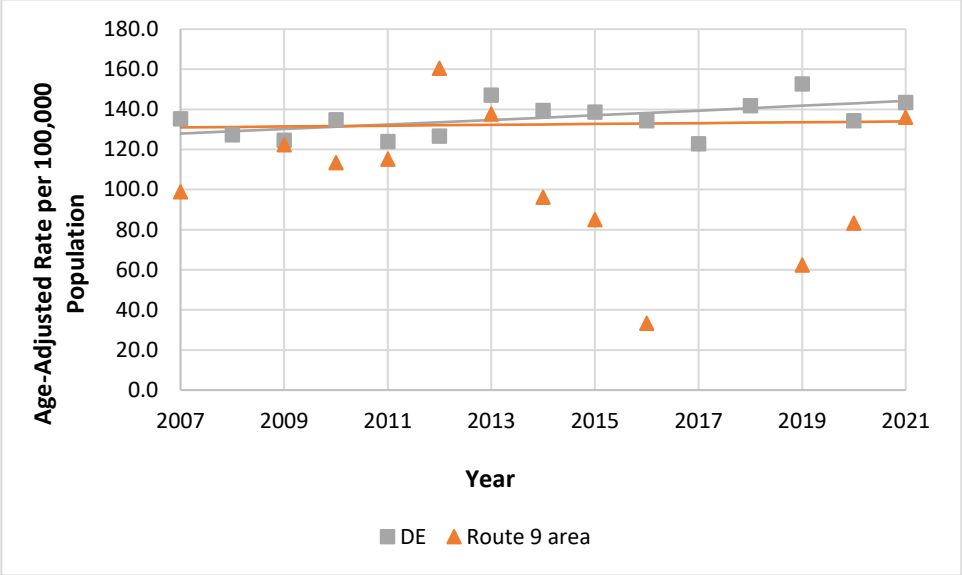


Source: Delaware Health and Social Services, Division of Public Health, Delaware Cancer Registry, April 2025.
Note: Rates are per 100,00 population. All-site refers to all cancer types. Population estimates are from Woods & Poole Economics, Inc. Census Tract Estimates Controlling to Vintage 2022.
Route 9 Corridor includes tracts 154.00, 155.02, 156.00, 158.02, 159.00 and 160.00.
For Route 9, all cases had high quality CTs and were therefore included in analysis.
^ Incidence rates for year 2020 are plotted but were not used for the analysis of trends since 2020 was an anomaly and would bias estimates.
*APC/AAPC is significantly different from zero at the alpha = 0.05 level

- Incidence rates for all-site cancer decreased an average of 1.1% per year in Delaware between 2007 and 2021 and the trend was consistent over this time period.

- Incidence rates for all-site cancer decreased an average of 3.4% per year in the Route 9 area between 2007 and 2021 and the trend was consistent over this time period.

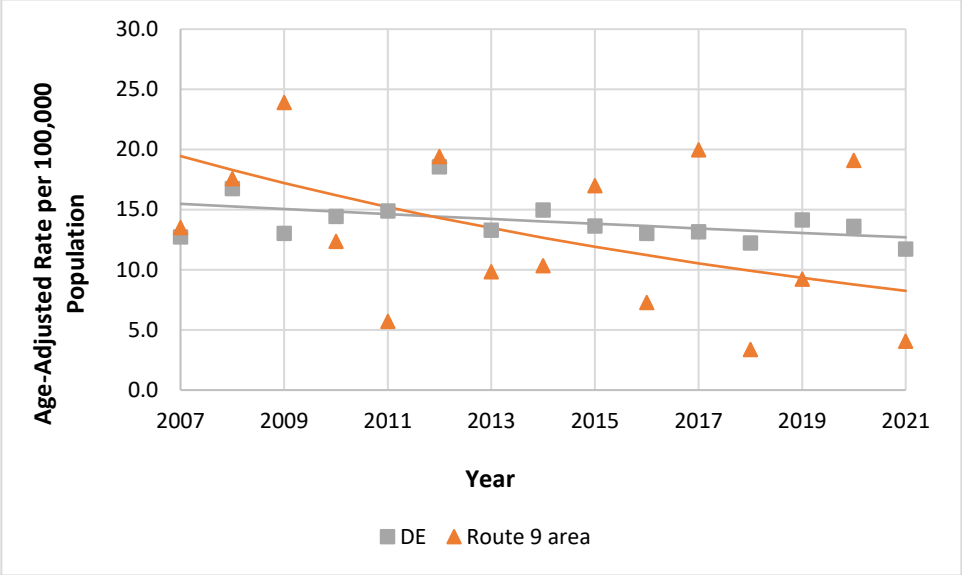
Figure 3: Age-Adjusted Female Breast Cancer Incidence Rate Trend; DE and Route 9 Area, 2007-2021^



Source: Delaware Health and Social Services, Division of Public Health, Delaware Cancer Registry, April 2025.
Note: Rates are per 100,00 population. All-site refers to all cancer types. Population estimates are from Woods & Poole Economics, Inc. Census Tract Estimates Controlling to Vintage 2022.
Route 9 Corridor includes tracts 154.00, 155.02, 156.00, 158.02, 159.00 and 160.00.
For Route 9, all cases had high quality CTs and were therefore included in analysis.
^ Incidence rates for year 2020 are plotted but were not used for the analysis of trends since 2020 was an anomaly and would bias estimates.
*APC/AAPC is significantly different from zero at the alpha = 0.05 level

- Incidence rates for female breast cancer were stable in Delaware between 2007 and 2021.
- Incidence rates for female breast cancer were stable in the Route 9 area between 2007 and 2021.

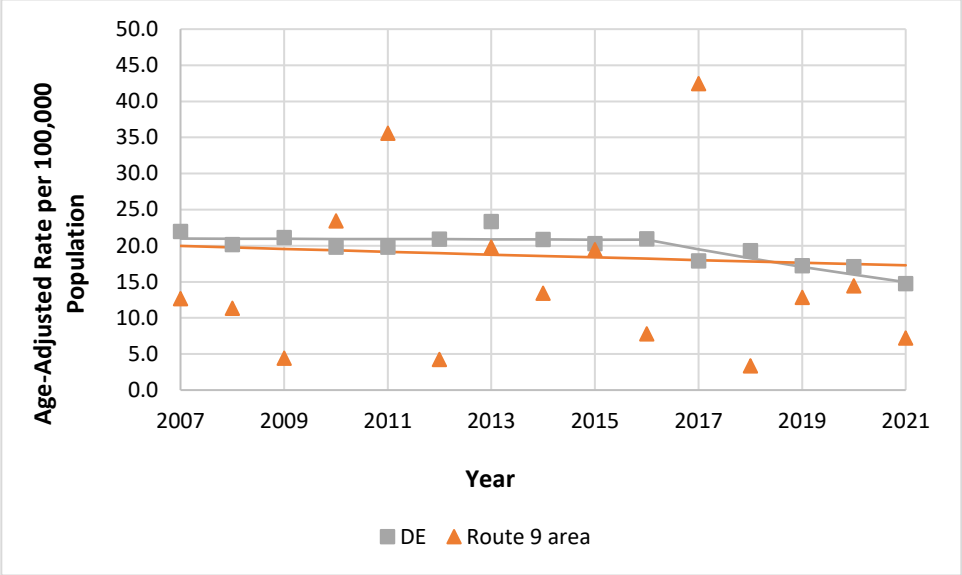
Figure 4: Age-Adjusted Leukemia Incidence Rate Trend; DE and Route 9 Area, 2007-2021^



Source: Delaware Health and Social Services, Division of Public Health, Delaware Cancer Registry, April 2025.
Note: Rates are per 100,00 population. All-site refers to all cancer types. Population estimates are from Woods & Poole Economics, Inc. Census Tract Estimates Controlling to Vintage 2022.
Route 9 Corridor includes tracts 154.00, 155.02, 156.00, 158.02, 159.00 and 160.00.
For Route 9, all cases had high quality CTs and were therefore included in analysis.
^ Incidence rates for year 2020 are plotted but were not used for the analysis of trends since 2020 was an anomaly and would bias estimates.
*APC/AAPC is significantly different from zero at the alpha = 0.05 level

- Incidence rates for leukemia were stable in Delaware between 2007 and 2021.
- Incidence rates for leukemia were stable in the Route 9 area between 2007 and 2021.

Figure 5: Age-Adjusted Non-Hodgkin Lymphoma Incidence Rate Trend; DE and Route 9 Area, 2007-2021^



Source: Delaware Health and Social Services, Division of Public Health, Delaware Cancer Registry, April 2025.
Note: Rates are per 100,00 population. All-site refers to all cancer types. Population estimates are from Woods & Poole Economics, Inc. Census Tract Estimates Controlling to Vintage 2022.
Route 9 Corridor includes tracts 154.00, 155.02, 156.00, 158.02, 159.00 and 160.00.
For Route 9, all cases had high quality CTs and were therefore included in analysis.
^ Incidence rates for year 2020 are plotted but were not used for the analysis of trends since 2020 was an anomaly and would bias estimates.
*APC/AAPC is significantly different from zero at the alpha = 0.05 level

- Incidence rates for non-Hodgkin Lymphoma decreased an average of 2.4% per year in Delaware area between 2007 and 2021. There were two distinct trends during this time period:
    - Stable rates between 2007 and 2016
    - An average 6.4% annual decrease between 2016 and 2021.

- Incidence rates for non-Hodgkin lymphoma were stable in the Route 9 area between 2007 and 2021.

SaTScan Analysis

Analysis was conducted using SaTScan (SaTScan - Software for the spatial, temporal, and space-time scan statistics). The software is used to analyze spatial, temporal, or space-time scan statistics. For the purposes of this analysis, a purely spatial Poisson scan statistic was used to analyze the geographical distribution of all-site, female breast, leukemia, and non-Hodgkin lymphoma cancers to determine if there were any geographical clusters of these cancer types. Geographical clusters are areas that had a higher number of cancer cases than what is expected based on underlying population characteristics (i.e., age and sex). Investigators then reviewed any identified geographical clusters to determine whether any of the census tracts associated with the Route 9 area were in a geographical cluster.

Data for cases diagnosed in 2012-2021 were included for the analysis. Cancer case data was aggregated to 2010 census tract geographies. Since census tract level data were utilized, only cases with high certainty 2010 census tract geocoding were included in the analyses.

None of the census tracts associated with the Route 9 area were found to be a part of any geographical cluster with a higher-than-expected number of cancer cases for any of the cancer types analyzed during the period of 2012-2021.

Conclusion The all-site cancer incidence rate for Route 9 Corridor for the most recent period of 2017-2021 was 393.1 per 100,000 people, which was lower than the rates for Delaware (451.8 per 100,000 people) and New Castle County (462.1 per 100,000 people). Similarly, the Route 9 Corridor cancer incidence rates for lymphoma, leukemia, and female breast cancer were lower compared to New Castle County and Delaware for the 2017-2021, 2016-2020, and 2015-2019 periods. The cancer incidence for female breast cancer in the Route 9 Corridor did increase in 2017-2021 (132.6 per 100,000 people) compared to both the 2016-2020 (111.7 per 100,000 people) and 2015- 2019 (112.4 per 100,000 people) periods. However, female breast cancer incidence rates also increased in New Castle County and Delaware for the 2017-2021 compared to the earlier two periods.

When examining statistical significance of cancer trends in Route 9 area through Joinpoint, incidence rates for all-site cancer decreased an average of 3.4% per year between 2007 and 2021 and the trend was consistent over this time period. Incidence rates for leukemia and non-Hodgkin lymphoma were stable in the Route 9 area between 2007 and 2021. Although an increase in female breast cancer incidence was observed for the 2017-2021 period, when examined over a longer period (2007-2021), the rate was found to be stable with no statistically significant increases.

To examine geographic clustering of cancer cases, SaTScan analysis was utilized for cases from 2012 to 2021. A spatial Poisson scan statistic was used to analyze the geographical distribution of all-site, female breast, leukemia, and non-Hodgkin lymphoma cancers to determine if a higher number of cancer cases than what is expected occurred within the census tracts associated with the Route 9 Corridor. None of the census tracts associated with the Route 9 area were found to be a part of any geographical cluster with a higher-than-expected number of cancer cases.

DPH will continue to monitor cancer rates in the Route 9 Corridor and continue to share new data.

Resources

Delaware's cancer reports: https://www.dhss.delaware.gov/dhss/dph/dpc/cancer.html

Center for Disease Control and Prevention (CDC) cancer data visualization (includes Delaware and United States: USCS Data Visualizations - CDC

Additional information on April 2022 report and public meeting:
https://dnrec.delaware.gov/air/ethylene-oxide/

DNREC, EPA, Croda, discuss cancer rates in Route 9 corridor | Delaware First Media (delawarepublic.org)

Technical Notes

Case: An individual who is newly diagnosed with cancer and resides in Delaware at the time of their diagnosis.

Route 9 case: An individual who is newly diagnosed with cancer and resides within census tracts: 154.00, 155.02, 156.00, 158.02, 159.00 and 160.00 at the time of their diagnosis.

High-certainty census tract: High certainty 2010 census tract geocodes were defined as:

- Census tract based on complete and valid street address of residence
- Census tract based on residence ZIP + 4
- Census tract based on residence city where city has only one census tract, or based on residence ZIP code where ZIP code has only one census tract.

Age-adjusted incidence rate: A cancer incidence rate is the number of new cancers of a specific site/type occurring in a specified population during a year, usually expressed as the number of cancers per 100,000 population at risk. An age-adjusted rate is a weighted average of the age-specific rates, where the weights are the proportions of persons in the corresponding age groups of a standard population. The potential confounding effect of age is reduced when comparing age-adjusted rates computed using the same standard population. For more information: Cancer Incidence Rates - SEER Cancer Statistics

Lymphoma, Leukemia, Female Breast: Inclusion of cases into the Delaware Cancer Registry is defined by the Surveillance Epidemiology and End Results Program (SEER) ICD-O-3/WHO 2008 Definition. For more information on specific ICD-O-3 site codes: Site Recode ICD-O-3/WHO 2008 - SEER Data Reporting Tools (cancer.gov)

All-site: Inclusion of cases from all cancer types.

Interpretation Of Cancer Rates: Cancer incidence rates are estimated values; by nature, all estimated values have some degree of uncertainty. Confidence intervals represent the range of values in which the cancer incidence rate could reasonably fall. The level of uncertainty associated with an incidence rate is reflected in the width of its confidence interval. Very wide confidence intervals mean that the incidence rate is estimated with a large degree of uncertainty. The width of a confidence interval is influenced by two factors: (a) the number of cancer cases in the population under consideration; and (b) the size of the population under consideration.