2019-2020

Sullivan County

Community Health Assessment

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Sullivan County Community Members,

Improving the health of people in Sullivan County begins with a thorough understanding of the population's health as well as the underlying causes of those conditions that adversely affect our health. As such, the Sullivan County Regional Health Department is pleased to share the *2020 Community Health Assessment* (CHA) for Sullivan County, Tennessee. The CHA is a portion of the Mobilizing for Action through Planning and Partnerships (MAPP) process promoted by the Centers for Disease Control and Prevention (CDC) and used with the Collective Impact Model to facilitate organizational actions working to improve community health measures.

This document serves as a snapshot of our community's health and provides data for over 150 health indicators covered in seven sections. Those sections are:

- Demographics and Access to Healthcare
- Behavioral Risk Factors
- Social and Mental Health
- Cancer
- Chronic Diseases
- Maternal and Child Health
- Environmental Health

Each section provides a brief overview of the topic area, relevant morbidity and mortality data, and when applicable comparisons between county, state, and national data. This document addresses four main questions: 1) How healthy are our residents? 2) What does the health status of our community look like? 3) In what areas do we excel? and 4) In what areas do we need to improve?

This document should be used to identify priority health issues in Sullivan County, provide baseline data for programs/services, guide program planning, inform decision makers about Sullivan County residents' health status, and help the community gain a better understanding of health disparities as they relate to health status. The data presented in this document is purely descriptive and intended to promote further questions and consider future ideas and solutions.

It is our sincerest hope that you will find this document useful for analysis, planning, and implementation of programs to continue to improve our county's health.

Sincerely,

Andrew Stephen May, M.D., FAAFP
Regional Medical Director

Executive Summary

The purpose of the Community Health Assessment is to develop a comprehensive health profile of Sullivan County in an effort to determine the health of its residents and inform public health interventions. Healthy People 2030 (HP2030) is a program established by the United States Department of Health and Human Services to provide evidence-based benchmarks for achieving obtainable goals for population health improvement. Throughout this document, measures of health for Sullivan County are compared to the state of Tennessee and to HP2030 goals where applicable to identify strengths and areas for improvement.

Demographics & Access to Healthcare

The Sullivan County Regional Health Department (SCRHD) serves a resident population of 158,163, accounting for 2.3% of Tennessee's population. Annual median income was $29,897, with 15.5% of residents living below the federal poverty level in 2020. Nearly 20% of Sullivan County residents report living with permanent disability. There was a higher ratio of dental (1:1,136) and general medical providers (1:415) compared to the population in Sullivan County than the state (Dentist 1:2,439 and Medical providers 1:556). Similarly, there were too few mental health providers per capita (Sullivan 1:830 vs TN 1:660) to meet the needs of the community.

Behavioral Risk Factors

As with the Appalachian region, Sullivan County continues to have high rates of substance abuse. The proportion of Sullivan County adults who binge drink (12.5%) is lower than both state (14.1%) and national rates (15.7%). Additionally, the rate of alcohol-related deaths (20/100,000 residents) is 10% higher than that of Tennessee (18/100,000 residents). Even higher rates of drug-induced deaths were seen in both Sullivan County (40/100,000) and in Tennessee (46/100,000). Prevalence of adult tobacco smoking is higher in Sullivan County (23%) than the state (21%).

Although Sullivan County is similar in prevalence of overweight and obesity to Tennessee (Sullivan overweight: 38.9% vs TN overweight: 34.4%; Sullivan obese: 34% vs TN obese: 35.6%), 32% of Sullivan County residents reported no leisure time physical activity, 9.8% more than that for the state (29%). Additionally, 14% of Sullivan County adults reported limited access to healthy foods.

Social & Mental Health

Whereas rates of general violent crime in Sullivan County (484/100,000) are lower than the state (621/100,000), child abuse and neglect is more prevalent in Sullivan County (Sullivan: 6.5/1,000 vs TN: 4.5/1,000). Although opioid drug overdose mortality rates have been lower in Northeast Tennessee than the state over the past five years, the rate has increased sharply between 2019 and 2020, corresponding to the overwhelming increase in the abuse of fentanyl and rates of neonatal abstinence syndrome (NAS). Approximately 15% of Sullivan County high school students report marijuana use, while 7% report misuse of prescription drugs within the past 30 days according to surveys taken in 2015. The average age of initial marijuana use and prescription drug misuse was 13 years of age in Sullivan County according to the same survey. The six-year average percent of youth aged 12-17 with alcohol or drug dependence is higher in

Sullivan County (7.6%) than Tennessee (6.0%). Past year nonmedical use of illicit drugs is much more prevalent among 18-25 year-olds than adults aged 26 and older for both the United States and Tennessee.

Cancer

Removing the effect of age, rates of all cancer mortality have declined in the state over the past decade at a greater rate than Sullivan County (Sullivan: -12% vs TN: -13%). Three-year average rates of cancer mortality have declined in Sullivan County since 2010-12 for cancers of the: lung and trachea (-21.5%), colon and rectum (-23.9%), and pancreatic cancer (-27.6%), and prostate cancer (-36.8%). From 2014-16 to 2018-20, rates of trachea and lung cancer were higher in Sullivan County than Tennessee, however the difference was small (see Figure 6.6). While reductions in cancer mortality were observed for most forms reported, a modest increase in female breast cancer was observed (Sullivan & TN: +10.9%).

Chronic Diseases

Three-year average rates of cardiovascular disease mortality have remained steady in Tennessee since 2010-12, but Sullivan County mortality rates increased 14.3% between 2016-2018 and 2018-20. However, rates of fatality attributed to atherosclerosis, acute myocardial infarction, heart failure, and stroke are lower in Sullivan County than the state (see Figures 7.4, 7.6, 7.7, & 7.10). Rates of diabetes mortality are lower in Sullivan County (19.89/100,000) than the state (26.91/100,000).

Maternal & Child Health

Rates of infant and neonatal mortality more than doubled between 2018 and 2019, and rates of neonatal abstinence syndrome (NAS) increased 30.3% in the same time. Rates of infant and neonatal mortality and NAS remained constant in Tennessee since 2015. Rates of adolescent pregnancy were lower in Sullivan County than the state from 2015-2018 (see Figure 8.2). Additionally, the percent of preterm live births was lower in Sullivan County than the state in 2019 and 2020 (Sullivan 2020: 9.3%, TN 2020: 10.9%). The proportion of live births with low birth weight or preterm delivery was considerably higher among African Americans than Caucasian in Tennessee, but there were too few cases of preterm births to report by race for Sullivan County (see Figures 8.11 & 8.13).

Environmental Health

Concentrations of radon, a naturally occurring carcinogenic gas, are categorized by the United States EPA in the highest risk level (average household level > 4 pCi/L) for Sullivan County in 2015. Five-year ambient air concentrations of particulate matter 2.5 (11.34 $\mu g/m^3$) and lead (0.04 $\mu g/m^3$) are lower in Sullivan County than national standards for ambient air quality. Three-year average concentrations of ground level ozone in Sullivan County have decreased overall from 1998-00 to 2018-20(see Figure 9.1).

Contamination for E. Coli was identified in 38 tributary waterways of the Holston River, while litter contamination was identified in three tributaries. From 2016-2020, 5 out of 11 Sullivan County water treatment facilities noted violations. Among children younger than 72 months, there has been a steady decline in blood lead levels for both the state and Sullivan County. Sullivan County had a slightly higher proportion of children younger than 72 months with blood lead levels greater than 10 µg/dL compared to Tennessee during this period, but the difference was minor (see Table 9.3).

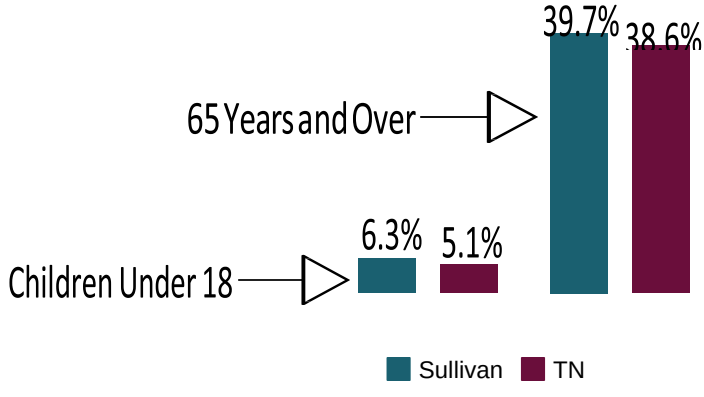
Community Description

An estimated 158,163 people resided in Sullivan County in 2020, accounting for approximately 2.3% of the 6.9 million residents of Tennessee. The average age of residents in Sullivan County is 45 years of age. 21.8% of the population is over age 65, while 49.6% are below 45 years of age. Nearly 91% of Sullivan County is white, while approximately 2% is African American. American Indians and Alaska Natives, Native Hawaiians and Pacific Islanders, and Asians have each accounted for less than one percent of Sullivan County's population. Additionally, unemployment has risen from 5.7% in 2015 to 6.5% in 2020. The annual median income was $29,897 in 2020, with 15.5% of residents living below the federal poverty level as of 2020. 32.2% of residents under 18 years of age are living below the federal poverty level. 34.1% of Sullivan County residents over 25 years of age completed high school and 15.8% completed a bachelor's degree. 19.9% of all Sullivan County residents report living with some sort of disability.

Annual Median Income

TN=$32,800
Sullivan=$29,897

Disability Status



Education

Less than High School		12.5%
High school graduate		34.1%
Some college, no degree		20.0%
Associate's degree		8.8%
Bachelor's degree		15.8%
Graduate or professional degree		8.7%

Sullivan County

TOP 4 FOCUS AREAS

1 Obesity

2 Physical Inactivity

3 Tobacco Use

4 Substance Abuse

Cardiovascular Disease

- Heart Attack.....
- Stroke.....
- Heart Failure.....
- Atherosclerosis.....
- Diabetes.....

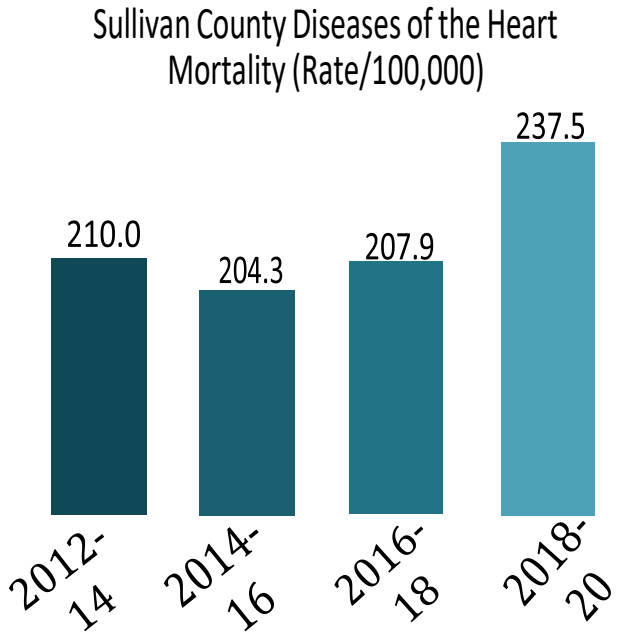
Cancer

- Lung.....
- Colon/Rectum.....
- Breast (female).....
- Prostate.....

Maternal and Child Health

- NAS.....
  Neonatal Abstinence Syndrome
- SIDS.....
  Sudden Infant Death Syndrome

Cardiovascular Disease



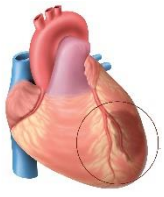
The most common type of heart disease is coronary artery disease, which affects the blood flow to the heart. Decreased blood flow often results in heart attack. Mortality rates in Sullivan County due to heart disease were 45% than the state of Tennessee in 2020. The four most common diseases of the heart in Sullivan County are listed below.

Source: CDC

DISEASES OF THE HEART ARE THE LEADING CAUSE OF DEATH IN SULLIVAN COUNTY

Heart Attack

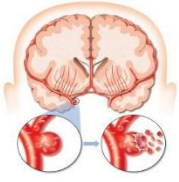
The death of heart tissue due to insufficient supply of oxygen



31 per 100,000

Cerebrovascular Disease

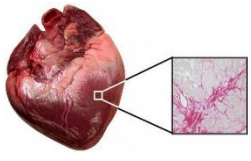
Conditions that cause temporary or permanent damage to the brain due to bleeding or lack of oxygen to the brain's tissue



44 per 100,000

Heart Failure

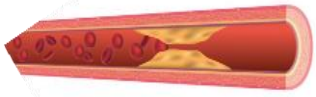
The heart muscle is unable to keep up with the body's demand for blood and oxygen



16 per 100,000

Atherosclerosis

Narrowing of arteries due to buildup of plaque



<4 per 100,000

Source: CDC

Risk Factors

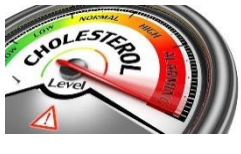
Source: CDC

Tobacco Use

Obesity

Diabetes

High Blood Pressure



High Cholesterol

Prevention

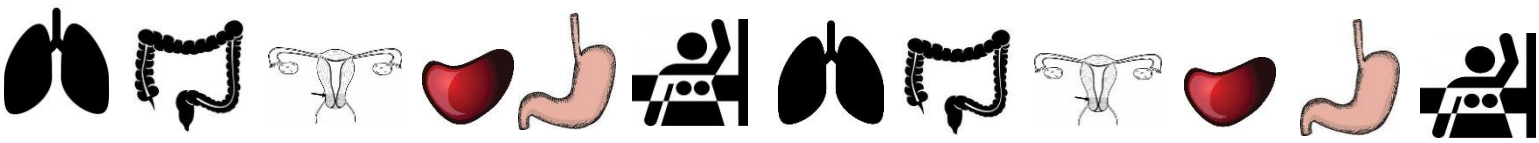
Source: CDC

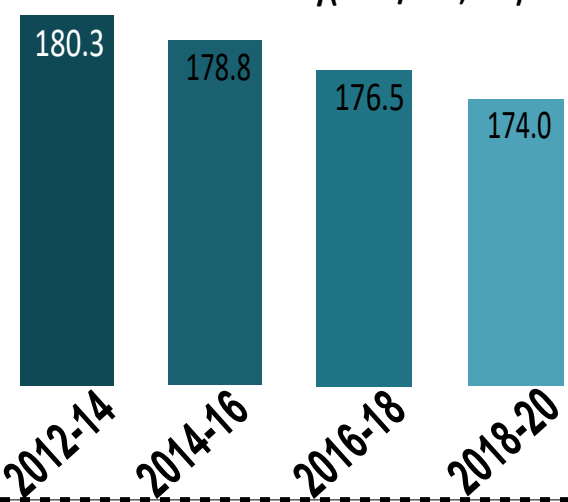
Exercise 30 minutes/day

Eat a well-balanced, healthy diet

Avoid all tobacco products

Cancer





Cancer is a term that broadly applies to diseases that occur when abnormal cells multiply without control and, at times, spread to affect other parts of the body. There are more than 100 different types of cancer. Cancers that occur with high frequency or have a high fatality rate in Sullivan County are shown below.

Source: CDC

Risk Factors

Obesity

Physical Inactivity

Tobacco Use

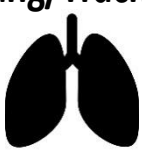
Substance Abuse

Unhealthy Diet

Heavy Alcohol Consumption

Sullivan County Cancer Specific Mortality Rates

Lung/Trachea



49 per 100,000

Breast (female)

14 per 100,000

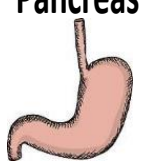
Colon/Rectum

13.3 per 100,000

Prostate

5.2 per 100,000

Pancreas



8.8 per 100,000

Cervical

1 per 100,000

Source: CDC Underlying Cause of Death

Prevention

Physical Activity

Healthy Diet

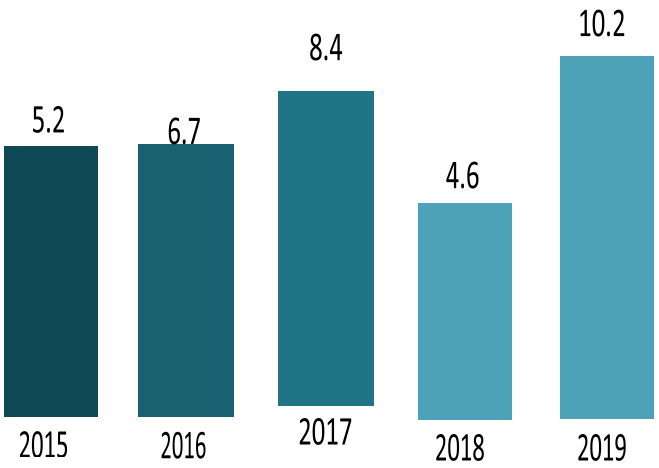
Blood Pressure Screenings

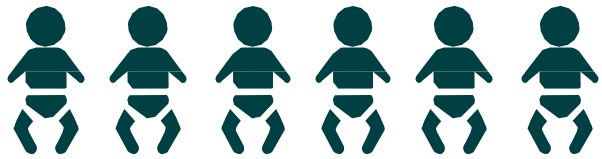
Routine Cancer Screenings

Avoid All Tobacco

Maternal and Child Health

Sullivan County
Infant Mortality (Rate/1,000)





Infant mortality is defined as death occurring to babies younger than one year of age. The rate of death among infants is a well-recognized indicator of the health and well-being of a nation. The five-year average rate of infant mortality in Sullivan County is 7.02/1000. The most common cause of infant mortality is described below.

SUDDEN INFANT DEATH SYNDROME (SIDS) IS THE LEADING CAUSE OF INFANT MORTALITY IN SULLIVAN COUNTY

SIDS is a medical term used to refer to babies whose cause of death remains undetermined. It usually occurs while babies are sleeping. Babies are typically considered healthy prior to their death.

Prevention

A Babies should sleep alone

B Babies should sleep on their back

C Babies should sleep in their crib

&

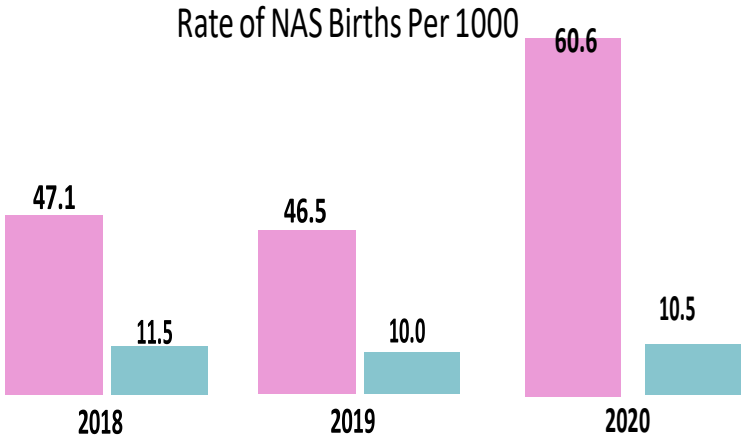
Avoid All Tobacco

Neonatal Abstinence Syndrome

Neonatal Abstinence Syndrome (NAS) occurs when a fetus is exposed to opioid drugs during pregnancy. When opioid drugs are taken during pregnancy they are passed from the mother to the fetus, causing the baby to become dependent on the substance.

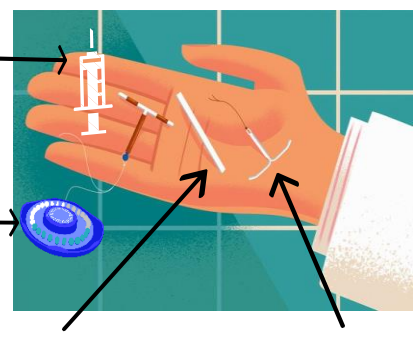
Source: US National Library of Medicine

Rate of NAS Births Per 1000



NAS PREVENTION

Progestin Injection
- 1 injection every 3 months given by health care provider

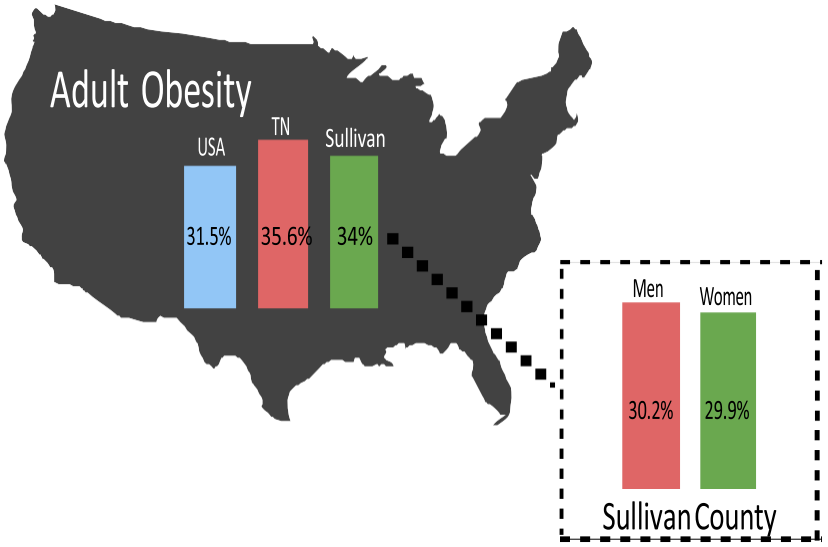


Birth Control Pills
- Prescribed by health care provider
- Take daily

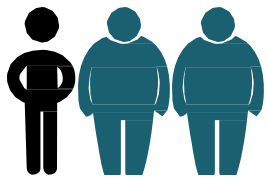
Implant
- Placed by a health care provider
- Lasts up to three years

IUD
- Placed by a healthcare provider
- Progestin IUD lasts 3-5 years
- Copper IUD lasts up to 10 years

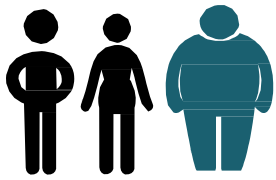
Obesity and Physical Inactivity



Rates of obesity are higher in both Sullivan County and Tennessee than the nation. The proportion of adults in Sullivan County who are obese is slightly less than the state.



Two in three Sullivan County adults are overweight (BMI= 25-29.9)



One in three Sullivan County adults are obese (BMI ≥ 30)

Source: Tennessee Department of Health (BRFSS); CDC

Three of the main causes of obesity are diet, environment, and physical inactivity.

Access to Healthy Food

13% of Sullivan County adults lack adequate access to food.

5.6% of Sullivan County residents report consuming five or more servings of fruits and vegetables daily compared to 8.6% across the state.

Access to Exercise

77% of Sullivan County adults report adequate access to locations for physical activity.

Access to exercise locations is 8% more prevalent in Sullivan County compared to the state.

Physical Inactivity

30% of Sullivan County adults report engaging in no leisure time activity.

78

Improvement is needed to meet the national goal of reducing the proportion of adults who engage in no leisure time physical activity to 21.2%. This is attainable due to the access of physical activity locations.

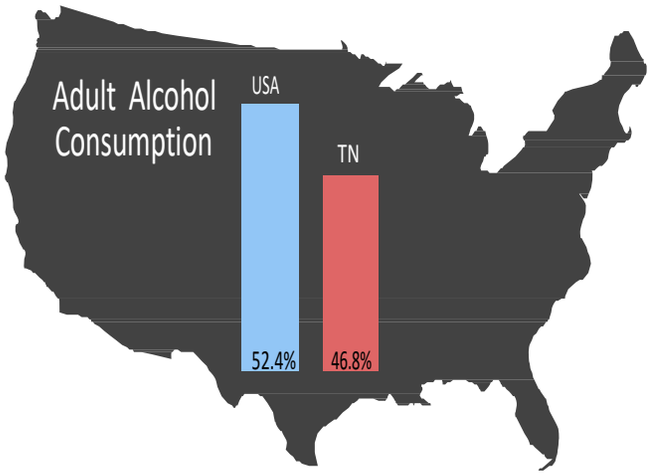
Kingsport Farmer's Market

Kingsport YMCA

Steele Creek Park - Bristol

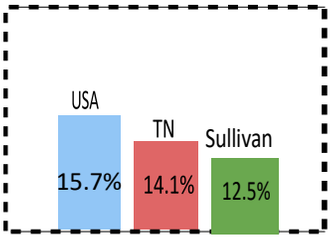
Sources: America's Health Rankings, County Health Rankings, CDC

Substance Abuse



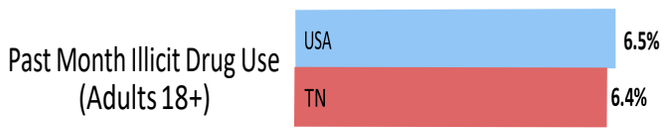
Source: CDC (BRFSS)

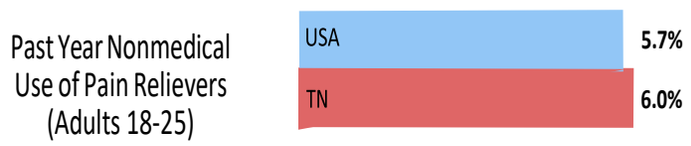
Previous consumption of alcohol was lower in Sullivan County than both the state and the nation. Binge drinking also occurs less in Sullivan County than the state and nation. According to the CDC, binge drinking is defined as 5 or more alcoholic drinks for men, and 4 or more alcoholic drinks for women within approximately 2 hours.

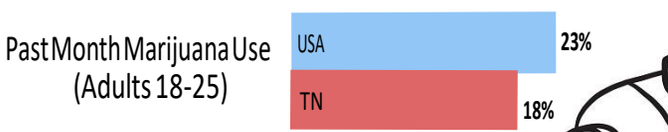


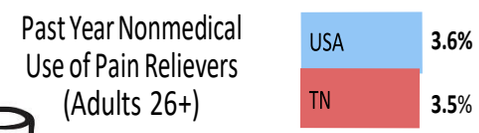
Adult Binge Drinking

Source: CDC (BRFSS)









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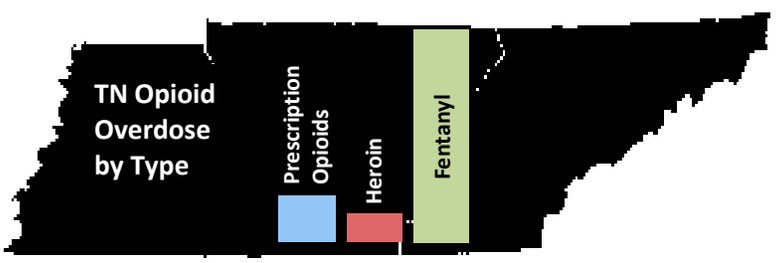
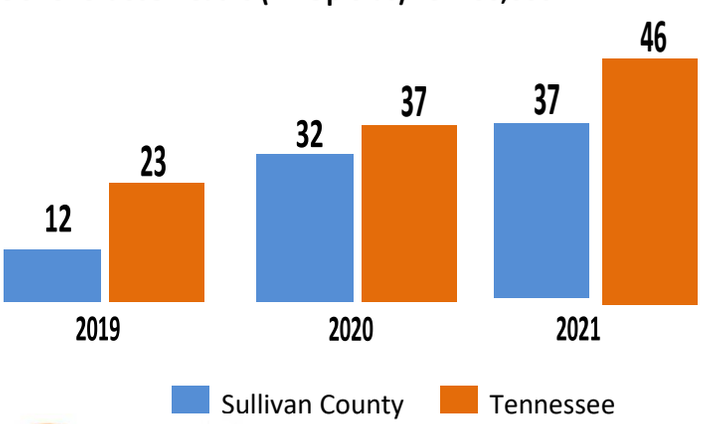
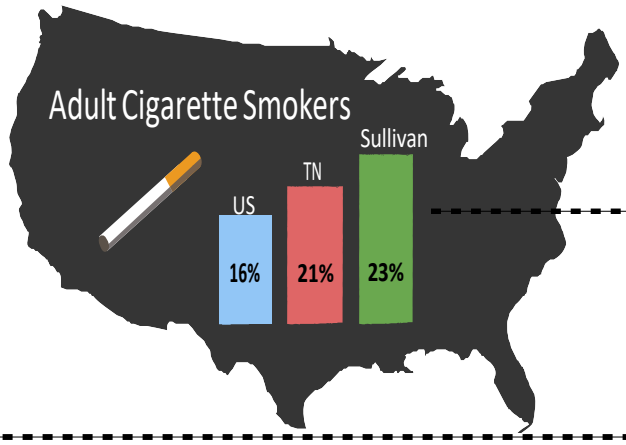


Rate of Overdose Deaths (All Opioids) Per 100,000



Pharmaceutical fentanyl is used for treating severe pain in hospitals, often for advanced cancer pain, as it is 50 to 100 times more potent than morphine. The fentanyl-related harm seen here is linked to illegally made fentanyl, and is often mixed with other drugs with or without the user's knowledge.

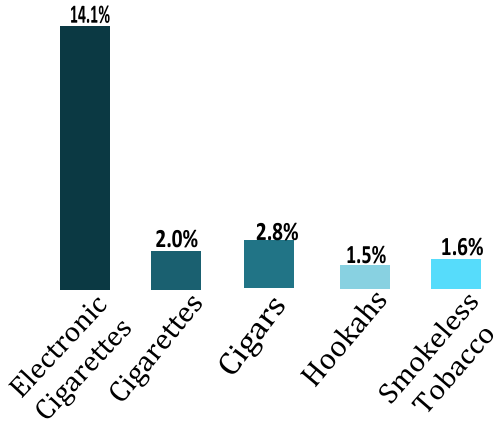
Tobacco Use



Adult smoking rates are higher in Sullivan County than Tennessee and the nation. The national goal is to reduce cigarette smoking among adults to 5%. In 2013, 71.6% of current smokers in Sullivan County reported attempting to quit.

Source: County Health Rankings

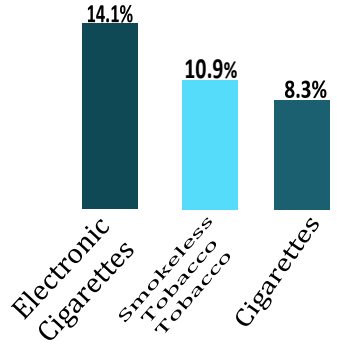
Current Use of Tobacco Products In High School Students in the United States



Source: National Youth Tobacco Survey, CDC 2022

There has been a large decrease in youth cigarette use in the U.S. since 2011. This is largely due to increases in electronic cigarette use. Sullivan County has seen a similar increase in electronic cigarette use.

Current Use of Tobacco Products In High School Students in Sullivan County

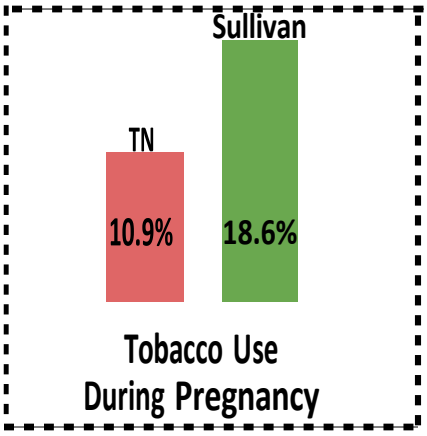


Source: Sullivan County Regional Health Department, 2016

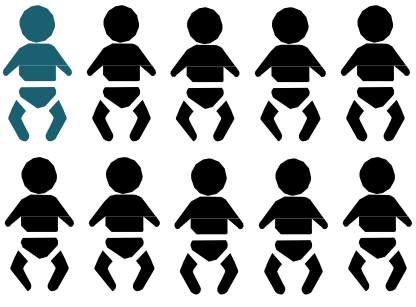
What are Electronic Cigarettes?

Electronic cigarettes are regulated tobacco products and are commonly referred to as e-cigarettes, e-cigs, vapes, and vape pens. These devices come in many shapes and sizes and allow the user to inhale an aerosol usually composed of nicotine, flavorings, and a variety of other ingredients.

Source: U.S. Surgeon Generals Report



Tobacco Use During Pregnancy



10% of all infant deaths are due to smoking

Quitting tobacco is hard. Finding help is easy.

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Sources: The Annie E. Casey Foundation: Kids Count Data Center, American Pregnancy Association

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Methods

The Sullivan County Regional Health Department (SCRHD) conducts a comprehensive population health assessment of the Sullivan County region in four year intervals as part of ongoing strategic planning efforts. The information captured in this assessment informs the development of strategic initiatives to improve the health of Sullivan County's population. SCRHD is proud to present the results of the 2019-2020 Community Health Assessment to community members and professional stakeholders. Narrative discussion is provided along with graphical representation of collected data to aid interpretation.

With the exception of COVID-19 data, only finalized data that has been fully reviewed by data experts for completeness and quality were included in this report. While more recent data is shared among public health professionals for monitoring and observing trends and outbreaks in real time, this data is preliminary and may be significantly different from the final count. Using only finalized data resulted in a two to three year data lag, but the resulting reports are more reliable for observing trends over time and is more consistent with future reports and national comparisons. These lags in data are acceptable to make sure the reported data is accurate and representative of the population; however, shortening this data lag is a goal across public health, achievable through improvements in processing technology and data collection.

Data were collected from federal and state agencies as well as non-profit health advocacy groups where publicly available. Additionally, data were extracted from SCRHD records and were obtained upon request from the Tennessee Department of Health where subjects of specific interest to Sullivan County's health were not publicly reported. Federal data sources commonly used include the US Centers for Disease Control and Prevention's *Wonder* and *AtlasPlus* and the US Census Bureau. Tennessee Department of Health data sources include *Interactive Dashboard for Selected Reportable Diseases*, and *Tennessee Behavioral Risk Factor Surveillance System*. Data from non-profit sources included the Annie E. Casey Foundation's *Kid's Count Datacenter* and the Robert Wood Johnson Foundation's *County Health Rankings & Roadmaps*. The US Office of Disease Prevention and Health Promotion's *Healthy People 2030* is referenced throughout this document where applicable to provide comparative benchmarks for national health goals.

Results were organized into nine overarching domains of health, including: demographics, access to healthcare, behavioral risk factors, social and mental health, communicable diseases, cancer, chronic illness, maternal and child health, and environmental health indicators. Analyses are commonly presented in terms of age-, sex-, and race-specific measures to better understand how the burden of disease in the Sullivan County community varies by these factors. Where annual data was available for more than three recurrent periods, trends are displayed to demonstrate changes over time. Where data for lesser periods of time were available, averages are used to compensate for small changes due largely to anomaly and to present the information in a concise manor. Throughout the document, measures of Sullivan County's health are presented with comparable measures for the state of Tennessee and the United States to provide meaningful context. County Health Rankings data comparisons made in this document are based upon the 2020 and County Health Rankings results, as they were the most recently available at the time of authorship. However, a copy of the 2022 County Health Rankings, which were released prior to publication of this report, are included in the index. Current County Health Rankings data may be obtained at this link, http://www.countyhealthrankings.org.

The Robert Wood Johnson Foundation, a non-profit organization supporting research and programs to improve the health of our nation, in partnership with the University of Wisconsin, Population Health Institute, maintains a program of annual measurement and ranking of health determinants, called the *County Health Rankings*. The purpose of this initiative is to build awareness of factors that influence health, provide data to local communities to identify priority areas for community health improvement, and to engage local leaders to foster a sustainable community of health improvement. The *County Health Rankings* measure factors associated with community health, ranging from socioeconomic indicators, behavioral risk factors, and environmental health determinants.

The County Health Rankings provide a snapshot of the factors that affect health in Sullivan County, and allow health officials and community members to compare the health status of our county to the state of Tennessee. As rankings are updated annually, progress may be tracked and evidence may be obtained to support the effectiveness of health programs in our county. This ranking is included at the beginning of the Sullivan County Community Health Assessment to provide a broad overview of the factors affecting the county's health, relative to the state, before more in depth review is provided for specific health domains. As one can see, Sullivan County is currently ranked 37th out of 95 counties for overall health outcomes in Tennessee. Accordingly, Sullivan County is not far from ranking among the top third healthiest counties in our state. At the time of publication, the 2022 County Health ranking had recently been released and is included in the Appendix of this document.

					2020 County Health Ranking, Tennessee: Sullivan County = 37th
Metric	**Sullivan**	**TN**	**County Health Ranking**	**Year of Data**	**Measurement Definition**
Length of Life	**	**	**27th**		
Premature Death (YPPL/100,000)	9,500	9,300		2016-2018	Years of potential life lost before age 75 per 100,000 population (age-adjusted)
Quality of Life	**	**	**60th**		
Poor or Fair Health	21%	20%		2017	Percentage of adults reporting fair or poor health (age-adjusted)
Poor Physical Health Days	4.9	4.2		2017	Avg. number of physically unhealthy days reported in past 30 days (age-adjusted)
Poor Mental Health Days	5.2	4.4		2017	Avg. number of mentally unhealthy days reported in past 30 days (age-adjusted)
Low Birthweight	8%	9%		2012-2018	Percentage of live births with low birthweight (< 2,500 grams)
Health Behaviors	**	**	**29th**		
Adult Smoking	22%	23%		2017	Percentage of adults who are current smokers
Adult Obesity	34%	33%		2016	Percentage of adults that report a BMI of 30 or more
Food Environment Index	7.2	6.4		2015-2017	Index of factors that contribute to a healthy food environment (0 worst, 10 best)
Physical Inactivity	30%	27%		2016	Percentage of adults aged 20+ reporting no leisure-time physical activity
Access to Exercise Opportunities	78%	70%		2010-2019	Percentage of population with adequate access to locations for physical activity

Excessive Drinking	13%	14%		2017	Percentage of adults reporting binge or heavy drinking
Alcohol-Impaired Driving Deaths	22%	25%		2014-2018	Percentage of driving deaths with alcohol involvement
Sexually Transmitted Infections	276.2	522.4		2017	Number of newly diagnosed chlamydia cases per 100,000 population
Teen Births	33	31		2012-2018	Number of births per 1,000 female population aged 15-19
Clinical Care	**	**	**6th**		
Uninsured	10%	11%		2017	Percentage of population under age 65 without health insurance
Primary Care Physicians	790:1	1,400:1		2017	Ratio of population to primary care physicians
Dentists	1,380:1	1,860:1		2018	Ratio of population to dentists
Mental Health Providers	830:1	660:1		2019	Ratio of population to mental health providers
Preventable Hospital Stays	5,497	5,320		2017	Rate of hospital stays for ambulatory-care conditions per 100,000 Medicare enrollees
Flu Vaccinations	50%	49%		2017	Percentage of fee-for-service Medicare enrollees that had an annual flu vaccination
Mammography Screening	45%	41%		2017	Percentage of female Medicare enrollees aged 67-69 received mammography screening
Social & Economic Factors	**	**	**24th**		
High School Graduation	94.0%	90.0%		2016-2017	Percentage of ninth-grade cohort that graduates in four years
Some College	60%	61%		2014-2018	Percentage of adults age 25-44 with some pose-secondary education
Unemployment	3.7%	3.5%		2018	Percentage of population ages 16 + unemployed but seeking work
Children in Poverty	25.0%	22.0%		2018	Percentage of children under age 18 in poverty
Income Inequality	4.6%	4.8%		2014-2018	Ratio of household income at the 80th percentile to income at the 20th percentile
Children in Single-Parent Household	34.0%	35.0%		2014-2018	Percentage of children living in a household headed by a single parent
Social Associations	14.4	11.3		2017	Number of social associations per 100,000 population
Violent Crime	484	621		2014-2016	Number of reported violent crimes per 100,000 population
Injury Deaths	89	89		2014-2018	Number of deaths due to injury per 100,000 population
Physical Environment	**	**	**27th**		
Air Pollution – Particulate Matter	10.2	10.0		2014	Avg. daily density of fine particulate matter (µg/m^3)
Severe Housing Cost Burden	10%	12%		2014-2018	Percentage of households that spend 50% or more of their household income on housing
Severe Housing Problems	11%	15%		2012-2016	Percentage of households with ≤ 1 of 4 housing problems: overcrowding, high housing costs, lack of kitchen plumbing facilities
Driving Alone to Work	86%	83%		2014-2018	Percentage of work force that drive alone to work
Long Commute – Driving Alone	26%	35%		2014-2018	Percentage of workers commuting alone for more than 30 minutes
*Color Code: Green = Sullivan Co. outcome > 1% better than TN; Yellow = Sullivan Co. within 1% of TN; Red = Sullivan Co. outcome > 1% worse than TN					
Source: Robert Wood Johnson Foundation & University of Wisconsin; County Health Rankings					

Population Snapshot

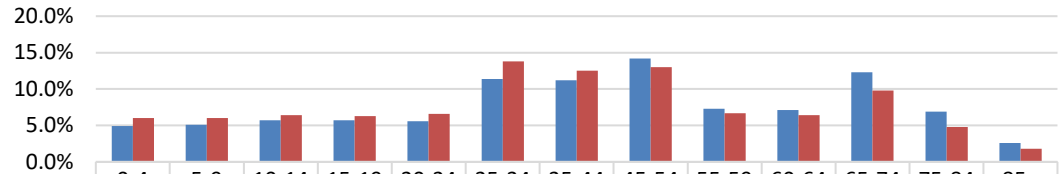
Population Change:

An estimated 158,163 people resided in Sullivan County in 2020, accounting for approximately 2.3% of the 6.9 million residents of Tennessee. While the state's population increased 4.3% between 2015 and 2020, Sullivan County's population remained relatively stable during this period (0.88% increase).[1] The estimated annual growth rate for Tennessee, from 2005 to 2025, is 1.1% per year. As the state's population increases, senior citizens aged 65 and older are expected to represent the greatest projected growth. During this period, the estimated total population growth of Sullivan County is 5.37%, the fourth lowest county growth projection for the state of Tennessee.[2]

Age distribution:

The overall distribution of age in 2020 was similar between Sullivan County and the state of Tennessee. However, Sullivan County has an older population than the state. A greater proportion of Sullivan County's population (22.0%) is comprised of seniors aged 65 or older compared to the State (16.4%), while it has a considerably smaller proportion of persons younger than 45 years of age (49.6%) compared to the state (57.6%).[1] See Figure 1.1.

Figure 1.1: Distribution of Age by Percent of Population (Sullivan County & Tennessee)



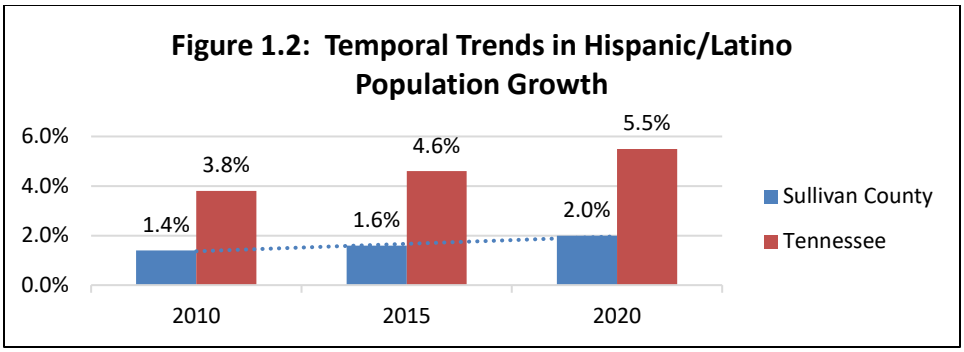
	0-4	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-59	60-64	65-74	75-84	85+
Sullivan County	4.9%	5.1%	5.7%	5.7%	5.6%	11.4%	11.2%	14.2%	7.3%	7.1%	12.3%	6.9%	2.6%
Tennesse	6.0%	6.0%	6.4%	6.3%	6.6%	13.8%	12.5%	13.0%	6.7%	6.4%	9.8%	4.8%	1.8%

Source: US Census Bureau, American Community Survey

Race/Ethnicity:

In 2020, nearly 91% of Sullivan County's population was Caucasian, compared to 72% of Tennessee's population. Two percent of Sullivan County's population is African American and this proportion has remained stable for the past ten years. Since 2010, American Indians and Alaska Natives, Native Hawaiians and Pacific Islanders, and Asians have each accounted for less than one percent of Sullivan County's population. There was little change in the racial composition of Sullivan County from 2010 to 2020.

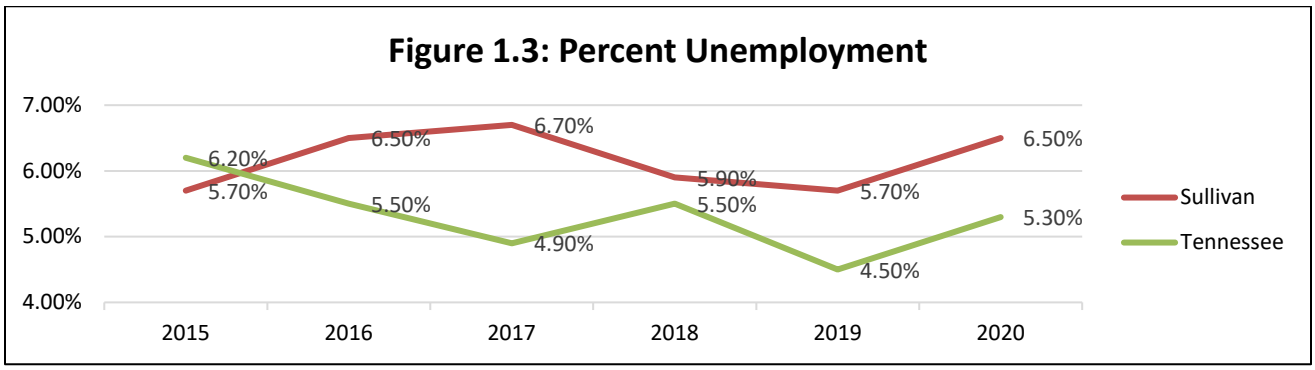
The proportion of Sullivan County's population that is Hispanic or Latino increased steadily from 2010 to 2020, from less than 1.4% to 2.0%. Although the proportion of Hispanic or Latino population in Sullivan County is lower than the state's, the rate of increase is similar.[1] See Figure 1.2.



Source: US Census Bureau, American Community Survey

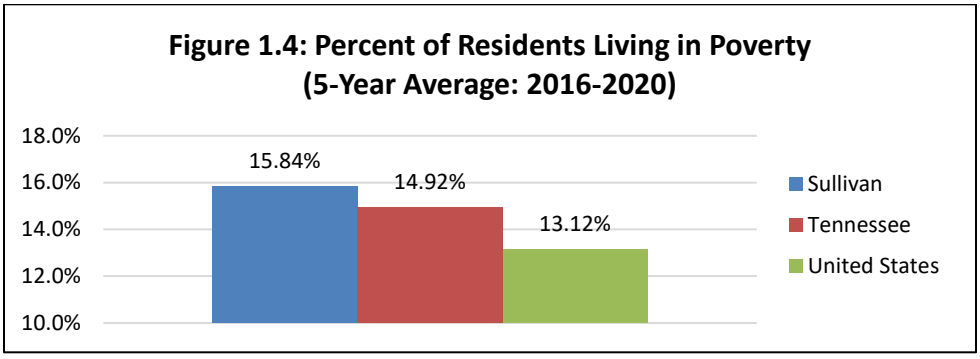
Economic Indicators:

Unemployment has risen in Sullivan County, from 5.7% in 2015 to 6.5% in 2020, though the variation of rates across the years has been consistent. However, the proportion of unemployed population during this period was notably higher in Sullivan County than Tennessee.[1] See Figure 1.3.



Source: US Census Bureau, American Community Survey

Over the five-year period from 2016 to 2020, the percent of all residents living below the federal **poverty** level decreased 8.6% across the United States from 14.0% to 12.8%. A lower rate of decrease in poverty (7.6%) was observed in Tennessee during this period, from 15.8% to 14.6%, although poverty levels were consistently higher in Tennessee than the Nation. However, the change in percentage of people living in poverty in Sullivan County (4.3%) was lower than both the state and the nation during this period despite higher levels of poverty, from 16.2% to 15.5%. The 5-year average poverty levels are reported below (See Figure 1.4).[1]



Source: US Census Bureau, American Community Survey

The average proportion of women living in poverty in Sullivan County (56.2%) exceeded that for men (43.8%) from 2016-2020 (Figures 1.5-1.6). With consistency in the proportion of males to females, there was an average of 22% more females in poverty than males in that time period. Additionally, the 10-year average proportion of youth aged 18 or younger living in poverty (31.2%) was substantially higher than that observed for seniors aged 65 and older (11.2%). There was little change in the percent of Sullivan County's total population living in poverty during the previous decade. The proportion of youths and seniors living in poverty also remained stable in Sullivan County over this period (Fig. 1.7-1.8).[1]

Figure 1.5: Percent of Population Living in Poverty by Sex (Sullivan Co.)

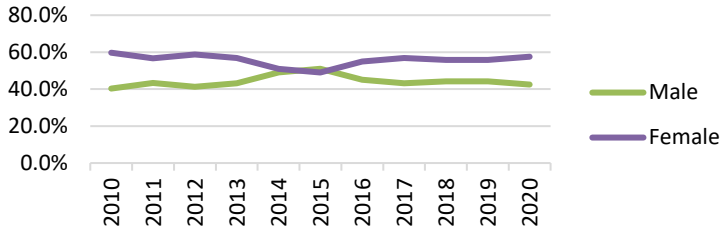


Figure 1.6: Percent of Sullivan Co. Population Living in Poverty by Sex (5-Year Average: 2016-2020)

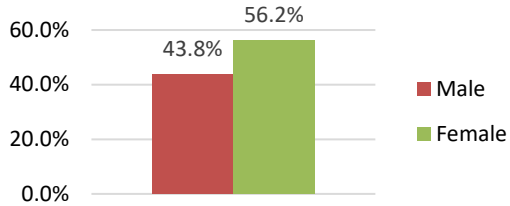


Figure 1.7: Percent of Population Living in Poverty by Age Group (Sullivan Co.)

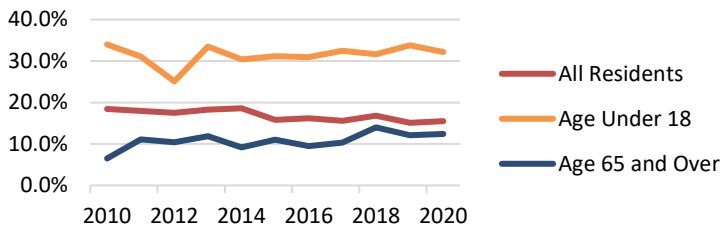
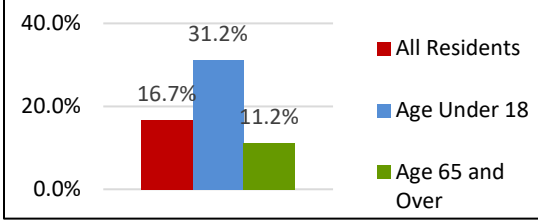


Figure 1.8: Percent of Sullivan Co. Population Living in Poverty by AGe(5-Year Average: 2016-2020)



Source: US Census Bureau, American Community Survey

Between 2016 and 2020, average per capita **income** was less in Tennessee ($29,446) than the nation ($33,682), and lower in Sullivan County ($28,060) than the state (See Figure 1.9). While per capita income increased for each geographic region during this period, the percent increase in income was higher in Sullivan County (17.4%) than the state (14.0%). Similar stratification was observed for median income in 2020 (Sullivan County: $ 29,897, Tennessee: $32,800, US: $36,378) (See Figure 1.10).[1]

Figure 1.9: Per Capita Income

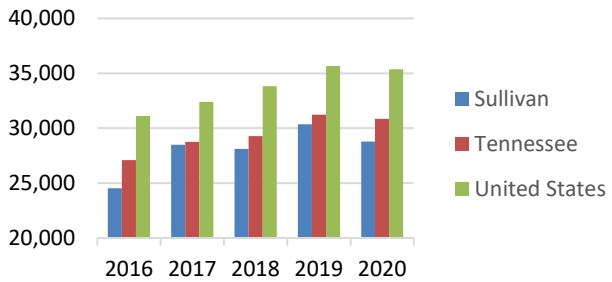
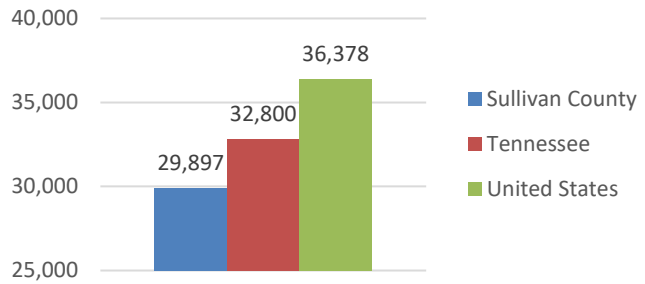


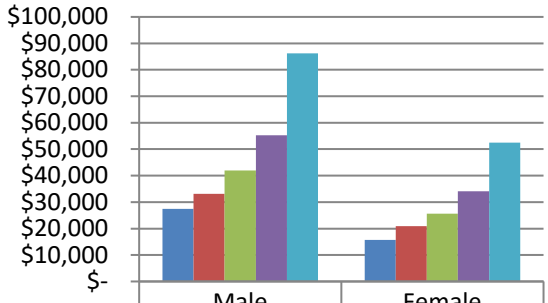
Figure 1.10: Median Income (2020)



Source: US Census Bureau, American Community Survey

Income gap exists in Sullivan County whereby men earn, on average, nearly $19,000 per year more than women. This income difference persists for all levels of education and increases with educational attainment. In 2020, women in Sullivan County with less than a high school education earned $11,650 per year less than male contemporaries, while women attaining a graduate or professional degree earned $33,717 per year less than men with comparable education. For each level of education, this income gap increases similarly at the state and national levels (see Figure 1.11).[1]

Figure 1.11: Median Annual Income (Sullivan Co. 2020) by Education and Gender



	Male	Female
Less than high school	27,409	15,759
High School or GED	33,096	20,875
Associate's Degree	41,922	25,613
Bachelor's Degree	55,204	34,076
Graduate Degree	86,188	52,471

Source: US Census Bureau, American Community Survey

Education levels are lower in Tennessee than the nation and lower still in Sullivan County for most levels of higher education attainment. Levels are similar between Sullivan County and the state for the proportion of persons with less than a high school education and for those graduating from high school. The proportion of Sullivan County's population who attended college, but did not graduate, is equal to that of both the state and nation. While attainment of an associate's degree is modestly higher in Sullivan County than the state, completion of a bachelor's or graduate degree is lower in Sullivan County compared to Tennessee. Completion of college, for all levels of college education, is more prevalent throughout the United States than in Tennessee (see Table 1.1).[1]

Table 1.1: Educational Attainment for Individuals Ages 25 and Older (2020) (Percent of Population			
Educational Attainment	**Sullivan**	**TN**	**US**
Less than High School, no Diploma	12.5%	11.8%	11.5%
High school graduate (Includes equivalent)	34.1%	31.8%	26.7%
Some college, no degree	20.0%	20.7%	20.3%
Associate's degree	8.8%	7.5%	8.6%
Bachelor's degree	15.8%	17.8%	20.2%
Graduate or professional degree	8.7%	10.4%	12.7%

Source: US Census Bureau, American Community Survey

Disability:

Report of any disability was higher in 2020 for the total population of Sullivan County (19.9%) than the state of Tennessee (15.5%). The percent of Sullivan County's employed population reporting any disability increased slightly from 18.7% in 2018 to 18.9% in 2020. The proportion of disabled persons in Sullivan County was 39.7% among seniors aged 65 or older and 6.3% among children younger than 18.[3] Childhood disability prevalence varied by head of household characteristics. Among Sullivan County children in married-couple households, 4.1% had a reported disability, whereas 6.4% of children in single male householder and 8.6% of children in single female householder families had a reported disability. Similar stratification by householder composition was observed at the state and national levels, but with lower proportions of childhood disability (married-couple: TN = 3.6%, US = 3.2%; male householder: TN = 5.1%, US = 4.0%; female householder: TN = 6.6%, US = 6.1%).[1] The higher prevalence of disability among female head-of-household families may be related to the income disparity referenced above.

Data for regional and state distribution of disability claims by age group and type of disability is displayed in Table 1.2. The percentage of the population with each disability was comparable between the county, state, and nation; with the exception of hearing and vision difficulties, where Sullivan County had nearly twice the percentage than that of nation.[3]

Table 1.2: Percent of Population with Disability by Age and Type of Disability (2020)			
Type/Age	Sullivan County	Tennessee	United States
Hearing Difficulty	6.1%	4.4%	3.6%
Population <18	1%	0.6%	0.5%
Population 18 to 64	3.2%	2.6%	2%
Population >65	18.4%	16.4%	14.1%
Vision Difficulty	4.1%	3.1%	2.4%
Population <18	1.1%	1.1%	0.8%
Population 18 to 64	3.4%	2.7%	1.9%
Population >65	8.4%	7.6%	6.2%
Cognitive Difficulty	8.2%	6.4%	5.1%
Population <18	6%	5.1%	4.4%
Population 18 to 64	8%	5.7%	4.5%
Population >65	10.2%	10%	8.4%
Ambulatory Difficulty	11%	8.7%	6.8%
Population <18	0.6%	0.7%	0.6%
Population 18 to 64	8.6%	6.6%	4.7%
Population >65	24.4%	25.1%	21.5%
Self-care Difficulty	3.6%	3%	2.6%
Population <18	1%	1%	1%
Population 18 to 64	2.4%	2.2%	1.7%
Population >65	8.5%	8.3%	7.7%
Independent Living Difficulty	8.8%	7%	5.8%
Population 18 to 64	5.7%	4.7%	3.7%
Population >65	17.3%	15.7%	14%

Source: US Census Bureau, American Community Survey

The national distribution of claimants by body system of morbidity (Table 1.3) and leading primary diagnoses by body system (Table 1.4) were obtained from a 2013 report of findings from a longitudinal study of Social Security Disability claims and benefit outcomes from 1997-2006, released by the US Social

Security Administration.[4] The greatest proportion of disability claims during the period of study were those related to disorders of the musculoskeletal system (34.1%), mental disorders (16.8%), circulatory system (11.8%), and malignant neoplasms (10.0%).[4] While updated leading diagnosis data was not available, 2015 data for Sullivan County was added to Table 1.3.[5]

More than 75% of disability claims related to musculoskeletal impairment were attributed to dysfunction of the back (discogenic and degenerative) or disorders related to osteoarthritis. Affective and mood disorders comprised nearly 56% of all mental health-related disability claims. Four types of cancers (lung, breast, colon, and genital organs) represented over half of all neoplasm-related claims. Although less than one percent of claims were related to infectious diseases nationally, and more than half of those claims (53%) were resultant from symptomatic HIV infection. See Table 1.3 for body system-specific representation or leading claimant categories.[4]

Table 1.3: United States, Percent of Social Security Disability Claimants by Body System

Body System	United States (1997-2006)	Sullivan (2015)
Musculoskeletal	34.11%	21.05%
Mental Disorders	16.76%	17.7%
Circulatory	11.68%	10.3%
Neoplasms	9.97%	2.6%
Nervous System	8.48%	8.5%
Injuries	5.82%	7.45%
Respiratory	4.12%	5.55%
Endocrine	3.88%	7.9%
Digestive	2.17%	3.15%
Genitourinary	1.6%	1.55%
Infectious	0.92%	2.9%
Diseases of the Blood	0.23%	0.7%
Skin	0.21%	0.45%
Congenital	0.06%	1.8%
Other	-	8.4%

Source: US Social Security Administration

Table 1.4: Leading Diagnoses of Social Security Disability Claimants by Body System Category (Cohort: 1997-2006)

Musculoskeletal	
Disorders of the back (discogenic/ degenerative)	55.70%
Osteoarthrosis and allied disorders	20.80%
Mental	
Affective/mood disorders	55.70%
Neoplastic, Malignant cancers of the:	
Trachea, bronchus, or lung	19.00%
Breast	15.50%
Colon, rectum, or anus	10.00%
Genital organs: uterus, cervix, ovaries, prostate, testes, penis, or male/female other	9.20%
Respiratory	
Chronic pulmonary insufficiency	66.70%
Endocrine, Nutritional, and Metabolic	
Diabetes	62.60%
Obesity and other hyperalimentation disorders	30.70%
Digestive	
Chronic liver diseases and cirrhosis	55.70%
Genitourinary	
Chronic renal failure	84.90%
Infectious and parasitic	
Symptomatic HIV infections	52.80%

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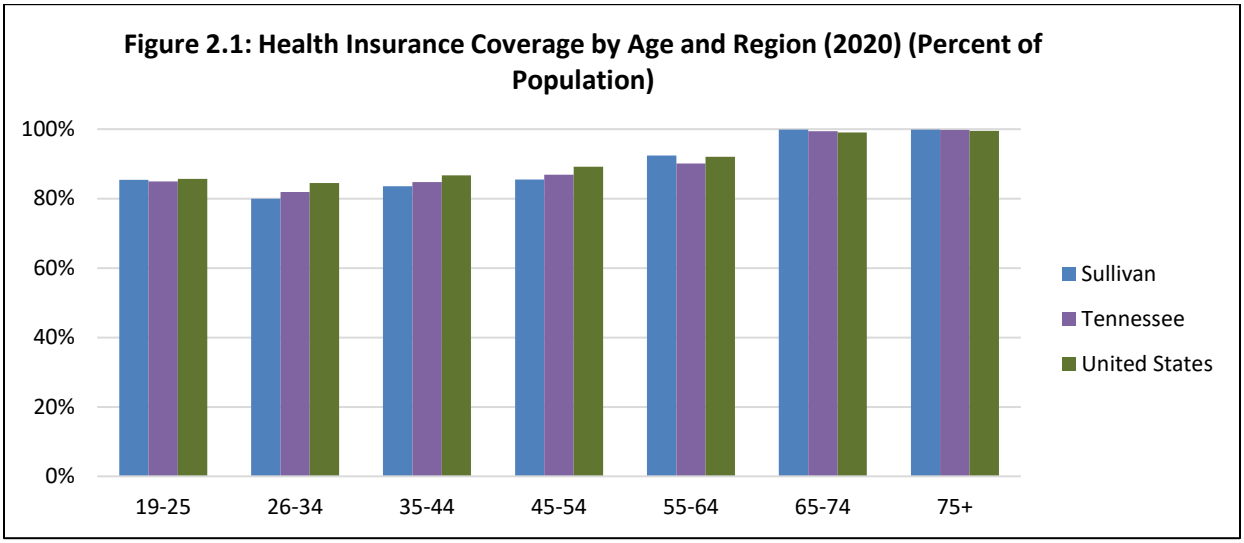
Health Insurance Coverage:

Healthy People 2030 (HP2030) set an ambitious goal of achieving 92.4% medical insurance coverage among American citizens by the year 2030. Although Sullivan County currently falls short of this goal among adults aged 18 to 64, medical insurance coverage among seniors aged 65 and older in Sullivan County met this goal and slightly exceeded that observed for the state of Tennessee. The US Census Bureau estimates that 99.89% of Sullivan County seniors aged 65 to 74 and 99.94% of seniors aged 75 and older had medical insurance in 2020. In both Sullivan County and Tennessee, medical insurance coverage was slightly more prevalent among females than males. This coverage dissimilarity was more pronounced among persons aged 19 to 44. Among adults aged 25 and younger, coverage dissimilarity between regions was negligible. However, insurance coverage was more prevalent nationally than in Sullivan County among persons aged 26 and older (Table 2.1 and Figures 2.1).[1]

Table 2.1: Health Insurance Coverage by Age and Sex (2020) (Percent of Population)

Age Group	Sullivan			TN			United States		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
19-25	82.5%	88.4%	85.4%	82.5%	87.3%	84.9%	84.0%	87.4%	85.7%
26-34	76.5%	83.5%	80.0%	77.3%	86.3%	81.9%	84.8%	87.6%	84.5%
35-44	78.1%	88.8%	83.6%	81.7%	87.6%	84.8%	84.8%	88.4%	86.7%
45-54	86.6%	84.4%	85.5%	85.5%	88.1%	86.9%	88.2%	90.1%	89.2%
55-64	89.6%	91.4%	92.4%	89.4%	90.7%	90.1%	91.6%	92.3%	92.0%
65-74	99.9%	99.9%	99.9%	99.3%	99.5%	99.4%	99.1%	99.0%	99.0%
75+	99.9%	100%	99.9%	99.9%	99.7%	99.8%	99.5%	99.4%	99.5%
Avg.	**87.6%**	**90.9%**	**89.5%**	**87.9%**	**91.3%**	**89.7%**	**90.3%**	**92.0%**	**90.9%**

Source: US Census Bureau, American Community Survey



Source: US Census Bureau, American Community Survey

Health insurance coverage was more prevalent among Caucasian than African American persons in 2020 for both Sullivan County and the state. However, the racial disparity in health insurance coverage between Caucasian and African American persons was more pronounced in Sullivan County than that observed at the state level (see Figure 2.2). Additionally, health insurance coverage was more prevalent among non-Hispanic Caucasians compared to Hispanic or Latino persons for both Sullivan County and the State (see Figure 2.3). Although Hispanic and Latino persons accounted for two percent of Sullivan County's population in 2020, this population is growing rapidly, increasing 70% since 2010. Thus, Hispanic and Latino persons represent an important population for health insurance coverage expansion efforts.[1]

Figure 2.2: Health Insurance Prevalence by Race (2020)

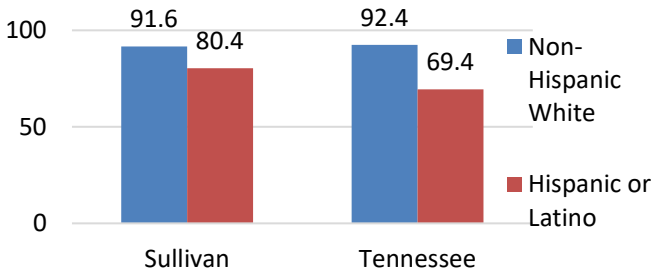
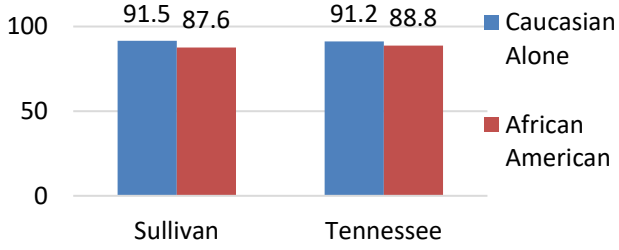


Figure 2.3: Health Insurance Prevalence by Race (2020)



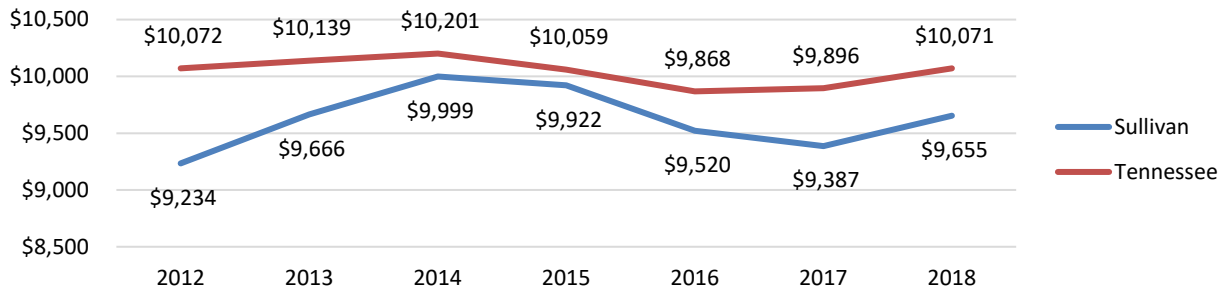
Source: US Census Bureau, American Community Survey

Healthcare Access and Utilization:

Cost of Care:

The cost of health care, estimated as price-adjusted Medicare reimbursements per enrollee, peaked in 2014, an increase of $765 per enrollee from 2012-2014 in Sullivan County, while increasing $129 from 2012-2014 at the state level. Healthcare costs decreased for both the county and state between 2014-2017, but costs increased again in 2018. The cost of care per enrollee was less in Sullivan County than the state during the entire period (see Figure 2.4).[6]

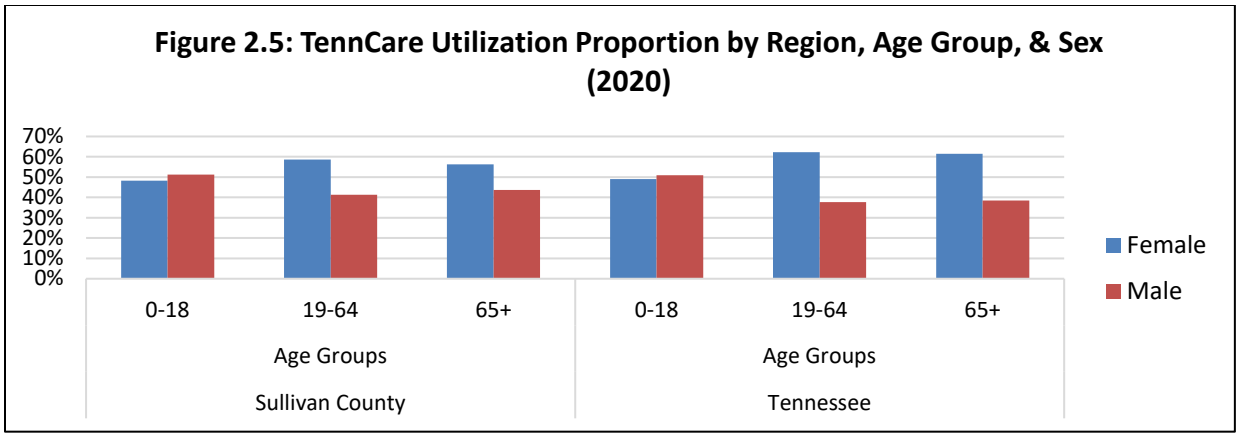
Figure 2.4: Cost of Healthcare Based on Price-adjusted Medicare Reimbursements per Enrollee



Source: The Robert Wood Johnson Foundation, County Health Rankings and Roadmaps

TennCare Utilization

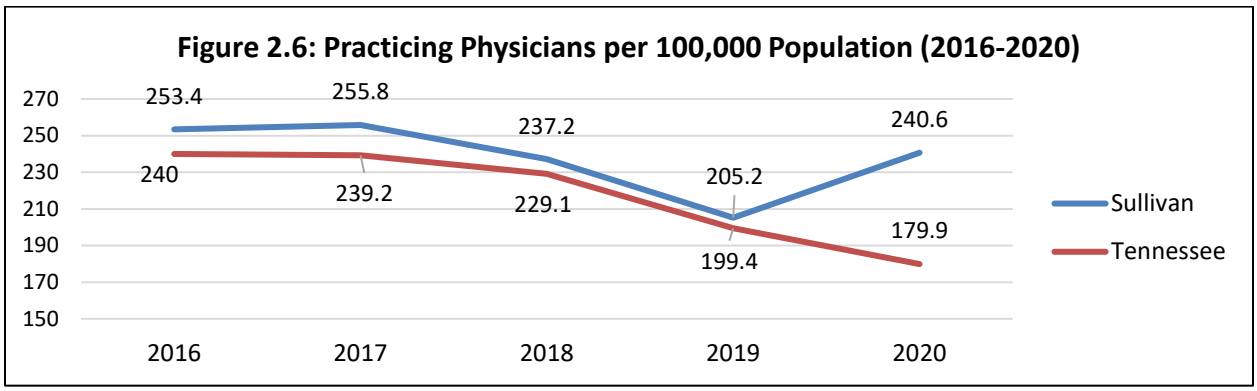
TennCare is Tennessee's government-operated medical assistance program for people who are eligible for Medicaid, as well as for some children who do not have health insurance. TennCare covers approximately 1.3 million Tennesseans and operates with an annual budget of nearly $14 billion. The proportion of TennCare enrollees by sex was similar in 2020 between Sullivan County and the State for each age group (see Figure 2.5). Among youth younger than 18 years, slightly more males than females utilized TennCare services. For all other age groups, a greater proportion of enrollees were female. The difference in TennCare enrollment between males and females increased with age. Overall, for both Sullivan County and the State, more females than males were enrolled in the TennCare program.[1] In 2020, 22.9% of Sullivan County residents were enrolled in TennCare, while 19.6% of Tennessee residents were enrolled. The total service expenditure for Sullivan County amounted to $202,045,042 in 2020, averaging $6,159 per enrollee, modestly greater than the state average of $5,204 per enrollee.[7]



Source: US Census Bureau, American Community Survey

Physician Care:

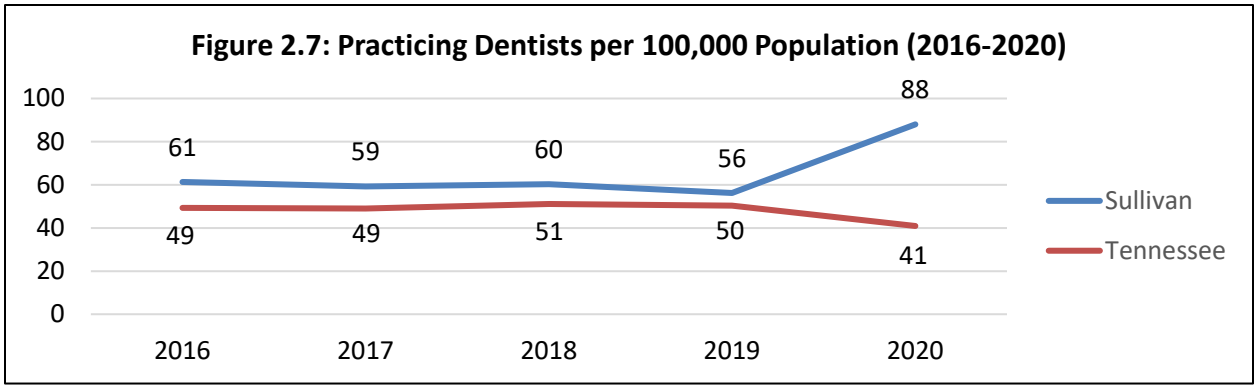
From 2016 to 2020, the total number of licensed practicing medical doctors per 100,000 population decreased in both Sullivan County and Tennessee, though Sullivan County had an increase in doctors that was not observed on the state level (see Figure 2.6).[8]



Source: Annie E. Casey Foundation, Kids County Data Center

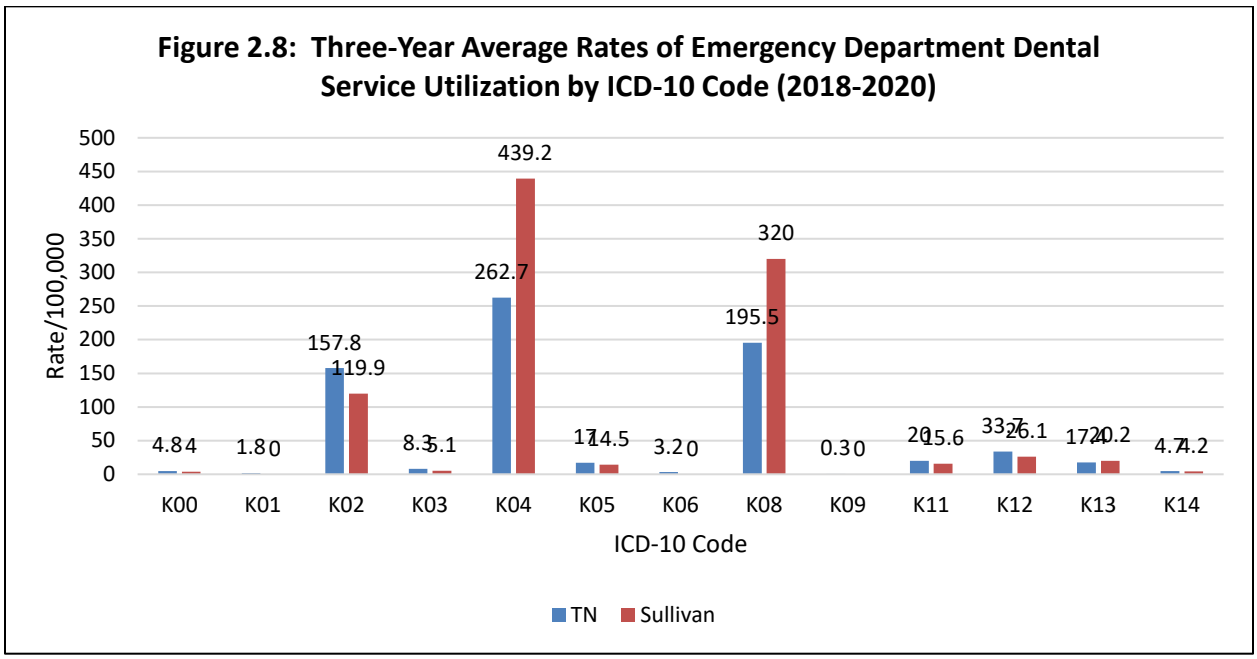
Dental Care:

In Tennessee, 59.7% of adults have visited a dentist, dental hygienist, or dental clinic in the year of 2020.[9] Corresponding data for Sullivan County is unavailable, but has historically closely compared to the state in previous County Health Assessments. From 2016 to 2019, the number of practicing dentists per 100,000 residents remained stable in both the county and state. The ratio of dentists to population in Sullivan County was consistently higher than that reported for the state from 2016 to 2020. However, in 2020, Sullivan County had a sharp increase in dentists, similar to the increase in medical doctors for the same year, while Tennessee had a decline in dentists overall (see Figure 2.7).[10]



Source: Annie E. Casey Foundation, Kids County Data Center

Data for emergency department utilization of dental services for both Sullivan County and the State were obtained upon request from the Tennessee Department of Health for 2018-2020. Figure 2.8 below illustrates the three-year average rate of emergency department utilization of dental services by ICD-10 code from 2018-2020. Of the thirteen ICD-10 codes, rates for three codes were suppressed (K01, K06, K09) where counts were less than eleven. Many individuals who were seen in the ER for dental service utilization had multiple dental diagnoses; therefore, the rates represent primary diagnoses code only. The highest rates of service utilization for both Sullivan County and Tennessee were for ICD-10 codes: K04 (diseases of pulp and periapical tissues), K08 (other disorders of teeth and supporting structures), and K02 (dental caries). For each of these condition categories, with the exception of dental caries, Sullivan County greatly exceeded the state for rates of utilization (see Figure 2.8).



Source: Tennessee Department of Health

International Classification of Diseases – 10th edition (ICD-10) Codes

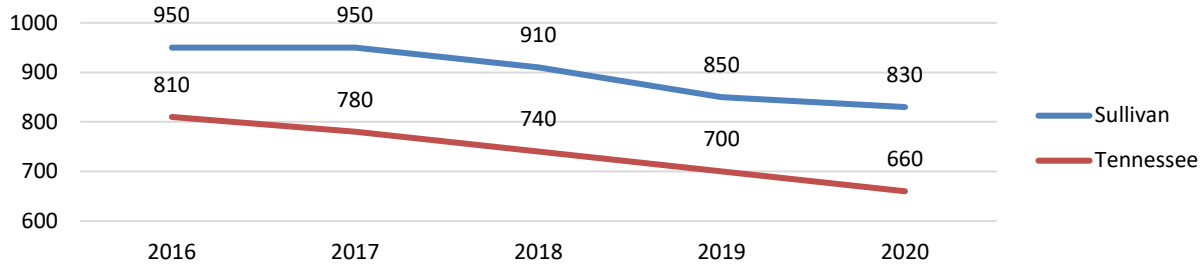
K00: Disorders of tooth development and eruption

K01: Embedded and impacted teeth
K02: Dental Caries
K03: Other disease of hard tissues of teeth
K04: Diseases of pulp and periapical tissues
K05: Gingivitis and periodontal diseases
K06: Other disorders of gingiva and edentulous alveolar ridge
K08: Other disorders of teeth and supporting structures
K09: Cysts of oral region, not elsewhere classified
K11: Diseases of salivary glands
K12: Stomatitis and related lesions
K13: Other diseases of lip and oral mucosa
K14: Disease of tongue

Mental Health Care:

In 2020, there were fewer mental health care providers in Sullivan County than the State. This included psychiatrists, psychologists, licensed clinical social workers, counselors, marriage and family therapists, and advanced practice nurses specializing in mental health care. Reported as a ratio of the count of population for each mental health care provider, the ratio was higher for Sullivan County (830:1) than the state (660:1), indicating that there are fewer providers per population in Sullivan County.[11]

Figure 2.8: Ratio of Population to One Mental Health Provider (2016-2020)



Source: The Robert Wood Johnson Foundation, County Health Rankings and Roadmaps

Sullivan County Healthcare Infrastructure:

There are six hospitals located in Sullivan County: three medical centers, two rehabilitative or specialty long term care hospitals, and one behavioral health hospital. The tables below represent the most recent data available for health service capacities and utilization in Sullivan County at the time of this report's authorship.

Table 2.1: Hospital Services, Sullivan County, 2020	
Measure	**Measure**
Licensed Beds	1211
Staffed Beds	748
Average Daily Census	532
Licensed Beds Percent Occupancy	44.0%
Staffed Beds Percent Occupancy	71.2%
Average Length of Stay in Days	10.9
Total Expenses	$713,125,051
Total Net Revenue	$733,682,080
Charity Care	$46,920,398

Source: Tennessee Department of Health, Office of Healthcare Statistics, *Summary Reports from the Joint Annual Reports of Hospitals for 2020*.[12]

Table 2.2: Nursing Home Facilities, Sullivan County, 2020	
Measure	**Count**
Number of Facilities	7
Total Number of Patients	2,171
Licensed Number of Beds	1,010
Total Beds Setup & Staffed	996
Admissions	2,605
Discharges (Including Deaths)	2,337
Average Length of Stay	75

Source: Tennessee Department of Health, Office of Healthcare Statistics, *Joint Annual Reports of Nursing Homes for 2020*.[13]

Table 2.3 Home Health Agencies, Sullivan County, 2020	
Measure	**Value**
Number of Agencies	2
Total Number of Patients Served	2,476
Number of TennCare Patients	16
Number of Medicare Patients	1,542
Total Revenue	$9,597,812
Percent Revenue Medicare	66.89%
Percent Revenue TennCare	0.23%
Charity Care as Percent Revenue	0.33%

Source: Tennessee Department of Health, Office of Healthcare Statistics, *Joint Annual Report of Home Health Agencies for 2020*.[14]

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1. United States Census Bureau. Accessed August 15, 2022. https://data.census.gov/cedsci/table?t=Populations%20and%20People&g=0400000US47_0500000US47163&y=2020&tid=ACSST5Y2020.S0101

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8. Medical doctors by county of practice | KIDS COUNT Data Center. Accessed August 30, 2022. https://datacenter.kidscount.org/data/tables/3037-medical-doctors-by-county-of-practice?loc=44&loct=5#detailed/5/6501/true/2048,574,1729,37,871,870,573,869,36,868/any/10151,13281

9. TENNESSEE 2020 Calculated Variables Report Behavioral Risk Factor Surveillance System. Published online 2021.

10. Dentists by county of practice | KIDS COUNT Data Center. Accessed August 30, 2022. https://datacenter.kidscount.org/data/tables/3039-dentists-by-county-of-practice?loc=44&loct=5#detailed/5/6501/true/2048,574,1729,37,871,870,573,869,36,868/any/10147,13279

11. Sullivan County, Tennessee | County Health Rankings & Roadmaps. Accessed August 30, 2022. https://www.countyhealthrankings.org/app/tennessee/2020/rankings/sullivan/county/outcomes/2/snapshot

12. *TDH Public Joint Annual Report Summary of Hospitals*.; 2020. Accessed August 31, 2022. https://apps.health.tn.gov/publicjars/default.aspx

13. *TDH Public Joint Annual Reports of Nursing Homes*.; 2020. Accessed August 31, 2022. https://apps.health.tn.gov/publicjars/default.aspx

14. TDH Public Joint Annual Reports of Home Health Agencies. Published 2020. Accessed August 31, 2022. https://apps.health.tn.gov/publicjars/default.aspx

Mental health is a broad term that refers to one's state of emotional, psychological, and social well-being, and is integrally related to how individuals think, feel, and behave.[15] Only 17% of US adults are estimated to be in a state of optimum mental health.[16] Positive mental health is associated with better overall health and improved relationships, life satisfaction, and ability to cope with stress.[17] This section evaluates indicators of social and mental health in terms of health-related quality of life, rates of preventable death, indicators of crime, and prevalence of mental illness and persons seeking treatment for substance used disorders.

The concept of health-related quality of life (HRQL) is multidimensional and subjective, encompassing both positive and negative aspects of overall quality of life that impact individuals' physical or mental health. HRQL is considered a valid method of assessing unmet needs and intervention outcomes, and is purported to be a more powerful predictor of morbidity and mortality than many observable measures of health outcomes.[18]

Health-Related Quality of Life

Sullivan County was similar to Tennessee in subjective measures of overall health-related quality of life. Where County Health Rankings reports as the year 2022, the years of data used was 2019, and this is the most updated data at the time of authorship of this assessment. There was little difference in the age-adjusted proportion of residents reporting their health as "poor or fair" between Sullivan County (23%) and Tennessee (20%). Although both were considerably higher than the nation's top performing county (12%). Similarly, the average number of days in the past month that Sullivan County residents reported feeling physically unhealthy (4.9 days) and mentally unhealthy (5.6 days) were comparable to that of the state for days both physically unhealthy (4.5 days) and mentally unhealthy (5.1 days).[11]

The percent of adults reporting frequent physical distress during the same time frame, defined as reporting more than 14 days of poor physical health per month, was higher in Sullivan County (16%) than the state (14%). The best performing county in the US had 10% of its population reporting frequent physical distress.[11] Frequent mental distress, defined as 14 or more poor mental health days in the last 30 days, was 17% higher in Sullivan County (19%) than Tennessee (16%), and 30% higher than the nation (14%). Defined as the percentage of adults who reported fewer than 7 hours of sleep on average, insufficient sleep was the same in the county and state (41%), but was higher than the United States (35%).[6]

Preventable Death

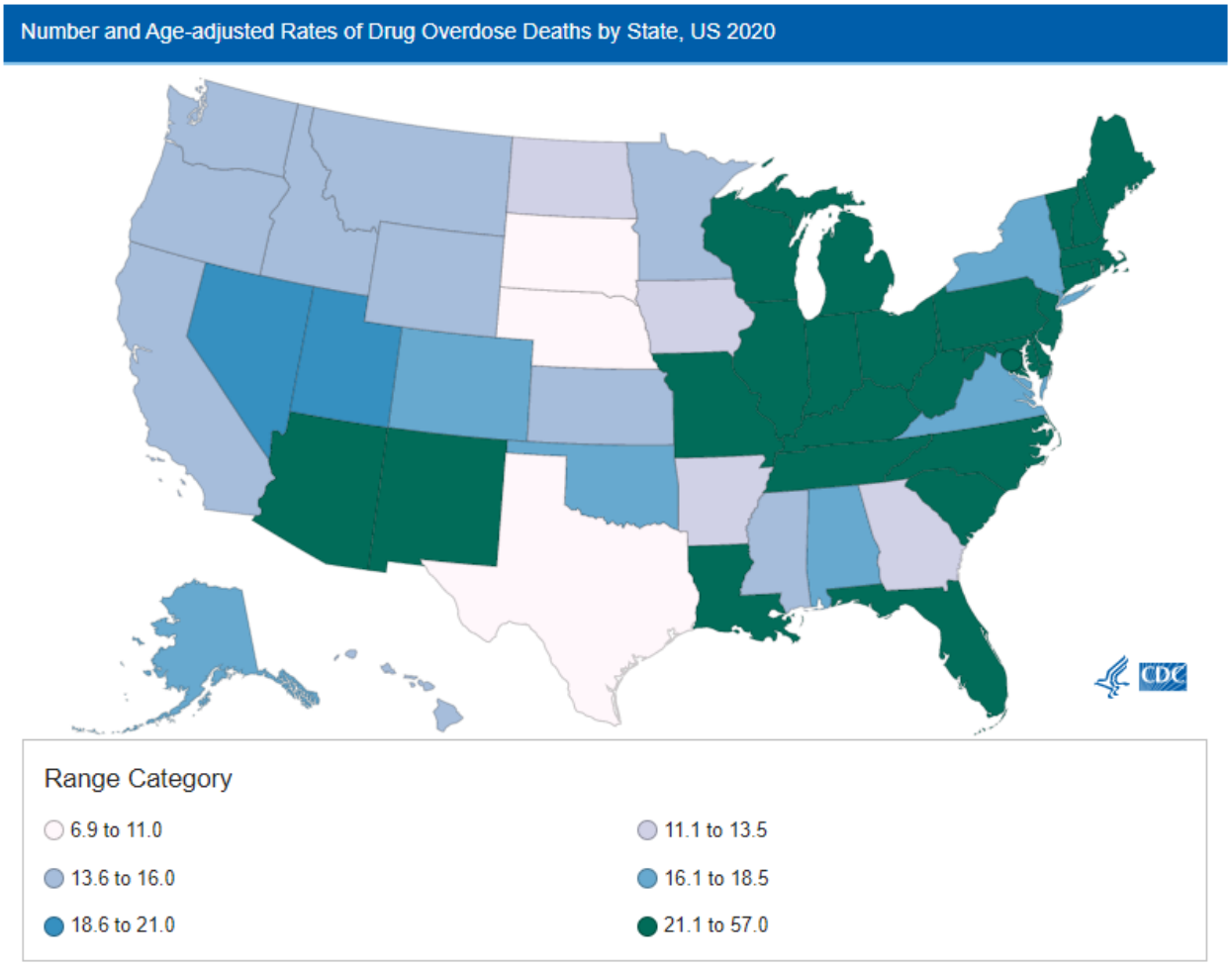
Years of Potential Life Lost & Injury-related Deaths:

Premature death in a population is commonly measured in years of potential life lost (YPLL). This conceptual measure is based upon the assumption that the age of 75 is a reasonable life expectancy in the United States. For each death that occurs among persons younger than 75 years, their age at death is subtracted from 75 and represents the years of potential life lost by that individual. As before, Sullivan County (9,500 YPLL/100,000) was similar to Tennessee (9,300 YPLL /100,000) for this measure in 2020.[11]

Further, the rate of preventable death due to injury is 10% higher in Sullivan County (99.5/100,000) than Tennessee (88.6/100,000).[19]

Drug Overdose Deaths:

In 2020, the average rate of drug poisoning death in Sullivan County was 40/100,000, over double the rate in 2014 (17/100,000). This was lower than that of the state (46/100,000).[11] Although the rate of drug-related mortality has increased steadily across the US since 1999, Tennessee has ranked 16th in highest age-adjusted rate increase in drug overdose deaths between 2013-2017.[20] Currently, both Sullivan County and the state of Tennessee fall short of the HP2030 goal of reducing the rate of drug-induced deaths to 20.7/100,000.

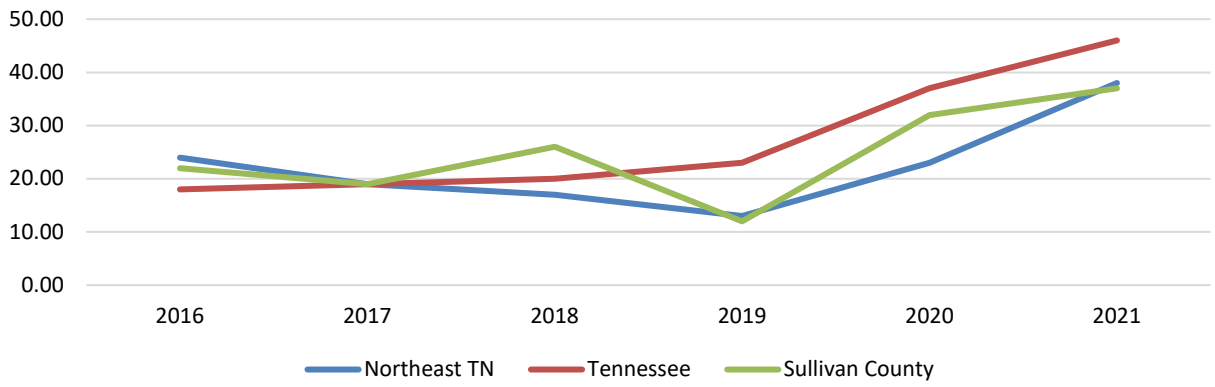


Source: CDC/NCHS, National Vital Statistics System, Mortality. CDC WONDER, Atlanta, GA: US Department of Health and Human Services, CDC; 2021. https://wonder.cdc.gov/.

As of 2018, southern states had the most painkiller prescriptions per person, and Tennessee was one of the top 3 states.[21] Higher rates of prescriptions are associated with increased diversion of opioid drugs and higher rates of abuse. Over the past decade, opioid drug overdose mortality has increased across the state of Tennessee and the Northeast Tennessee Region. Although the mortality rate has been higher for

the state during this period, there has been a greater rate of increase in Sullivan County between 2019 and 2021, as the rate in Sullivan County more than doubled (see Figure 3.1).[22]

Figure 3.1: Drug Overdose Deaths Involving All Opioids (Rate/100,000)



Tennessee Department of Health, Office of Healthcare Statistics

The Tennessee Department of Health documents the frequency of opioid deaths by year and type of opioid overdosed on; however, due to low counts for some categories and regions, counts and rates are not displayed in this report for reliability and anonymity purposes. For both the Northeast Region and Tennessee, overdose fatality attributed to consumption of prescription opioids including natural, semisynthetic, and synthetic opioids combined were steadily decreasing from 2016-2019; however, all three regions had a sharp increase in prescription opioid deaths in 2020. While the number of heroin overdose deaths in Sullivan County and the Northeast Region were similar in 2016-2020, higher case numbers of fatality from heroin overdose in Sullivan County indicates a higher fatality rate during this period. Fentanyl overdose deaths have increased for each region, with the highest increases being between years 2019-2020. Fentanyl deaths in Tennessee nearly doubled during this time, while the deaths in the Northeast Region and Sullivan county tripled.[22]

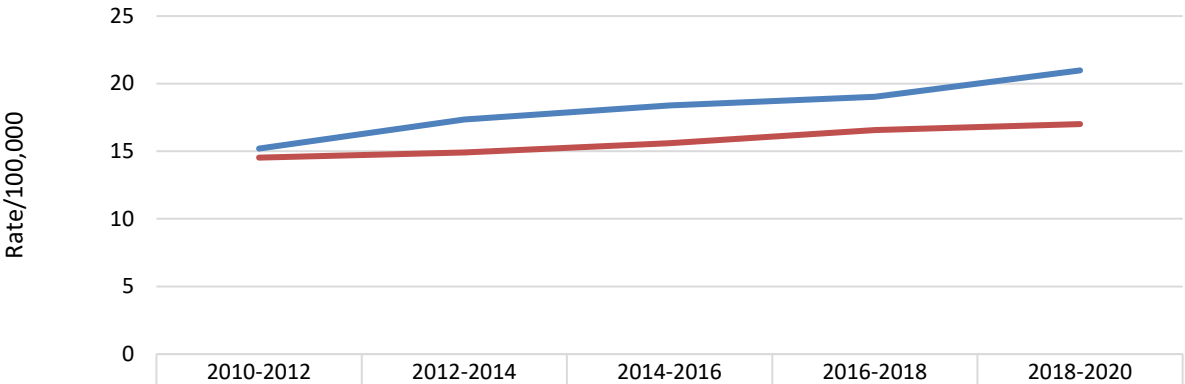
Suicide:

Incidence rates of suicide largely underestimate the need for suicide prevention in communities, as many who are considering or have attempted suicide in the past do not seek professional help. Risk factors for suicide include many other indicators of health-related quality of life, including: history of depression or other mental illness, substance abuse, previous suicide attempts, family history of suicide or domestic violence, physical illness, or feeling of loneliness. Effective coping and problem-solving skills, healthy relationships and support, and availability of consistent high-quality health care all function as protective factors, helping protect against suicidal thoughts and behaviors.[23]

Three-year average rates of suicide have increased steadily in Sullivan County and Tennessee from 2010-2012 to 2018-2020. However, the percent increase during this period was greater in Sullivan County (38%) than Tennessee (17%) (see Figure 3.2). Over the past decade, three-year average incidence of suicide has been similar between Sullivan County and Tennessee for both men and women, with men committing

suicide at three (In Sullivan County) to four (Tennessee) times higher than the rate of women (see Figure 3.3).[24] Statewide, suicide was the 3rd leading cause of death among young people aged 15-24 and 2nd among those aged 25-34, but was no longer ranked in the top 10 leading cause of death overall for the county, state, or nation in 2020. Historically, the ranking reduced with age, as other causes of death, such as heart disease and cancer, bear a heavier burden on older age groups. Despite this trend, at the time of authorship in 2022, people aged 85 and older had the highest crude rates of suicide (20.9/100,000) compared to other age groups, followed closely by age groups 75-84 and 25-34 (both 18.4/100,000).[25]

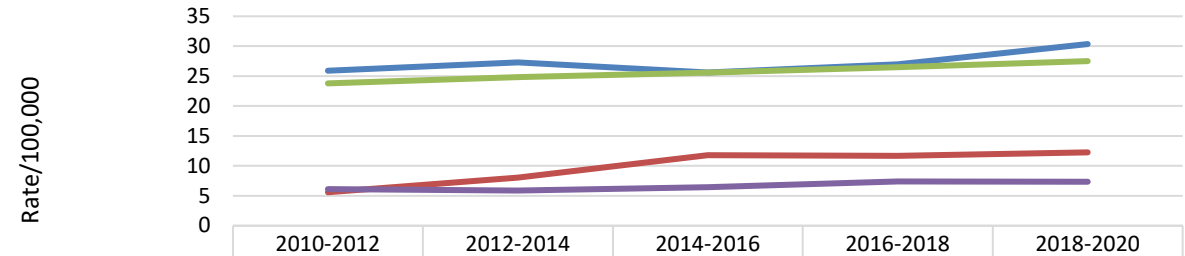
Figure 3.2: Age-Adjusted Suicide Rates



	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	15.2	17.35	18.39	19.04	20.98
TN	14.53	14.9	15.59	16.56	17.01

Source: Centers for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Figure 3.3: Age-Asjusted Suicide Rates by Sex



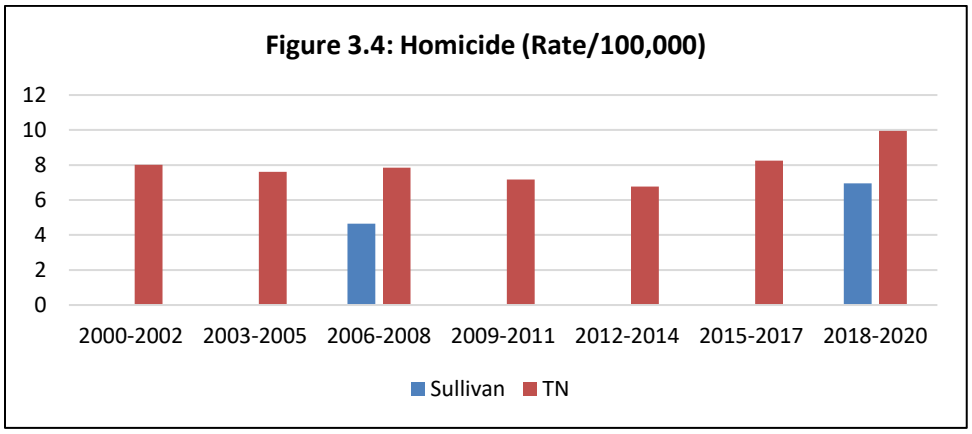
	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan Male	25.9	27.28	25.61	26.96	30.36
Sullivan Female	5.6	8.05	11.78	11.69	12.26
TN Male	23.79	24.85	25.6	26.52	27.51
TN Female	6.12	5.88	6.46	7.4	7.37

Source: Centers for Disease Control and Prevention, Underlying Cause of Death 1999-2020

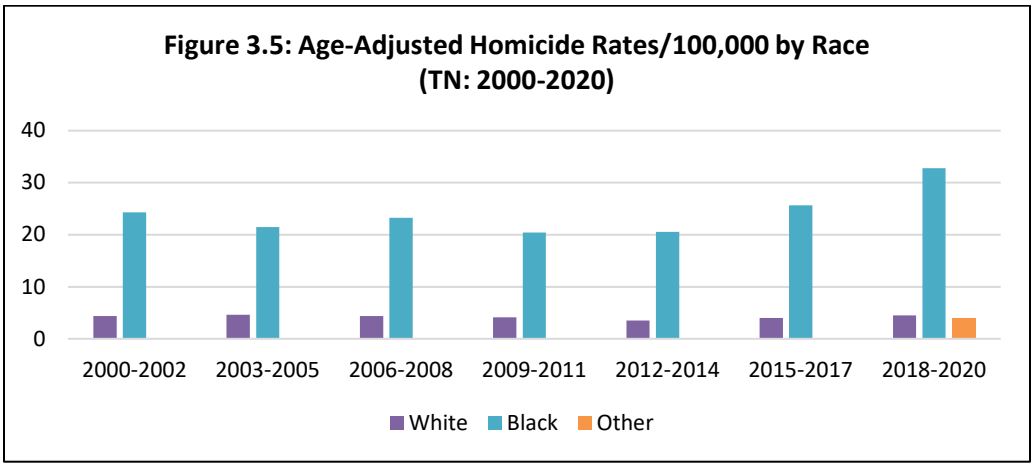
Homicide

Over the past two decades, three-year average rates of homicide have remained steady Tennessee, with a recent 20.7% increase in 2018-2020(9.96) from 2015-2017(8.25). Because counts of homicide are so low in Sullivan County, there are concerns for statistical significance with counts lower than 20 homicide

cases per time range; therefore, rates for Sullivan County are only displayed for years that collectively had at least 20 homicides. On average for these years, Sullivan County's homicide rates are 43.5% less than those of Tennessee's (see Figure 3.4). Across the state, homicide rates were highest among African Americans (see Figure 3.5); however, this trend is not seen in Sullivan County where the highest percentage of homicides were among the Caucasian population.[26]



Source: Centers for Disease Control and Prevention, Underlying Cause of Death 1999-2020

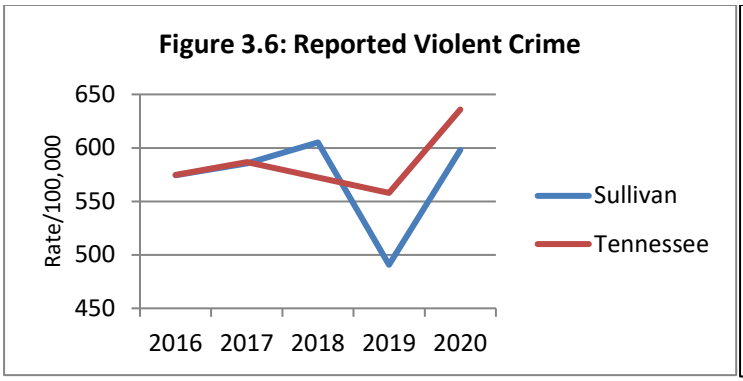


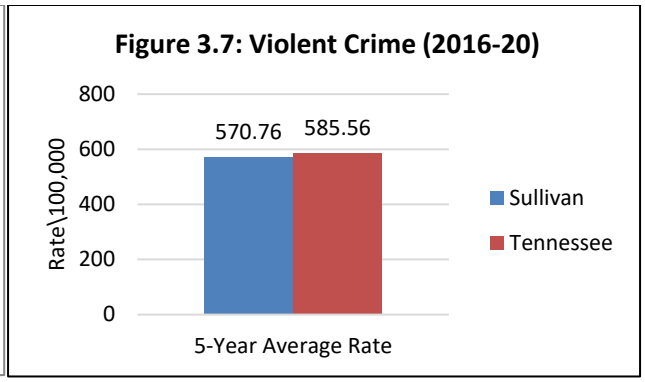
Source: Centers for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Crime:

Violent Crime:

Rates of reported violent crime, including homicide, sex offenses, and aggravated assault, have increased (10.6%) across the state in the past five years (2016-2020). Sullivan County's crime rate also increased during this period, but the percentage increase was less than half of that of the state (4.1%, see Figure 3.7). Throughout the duration of this period, the violent crime rates of Sullivan County closely follow Tennessee's rates (see Figure 3.8).[27]

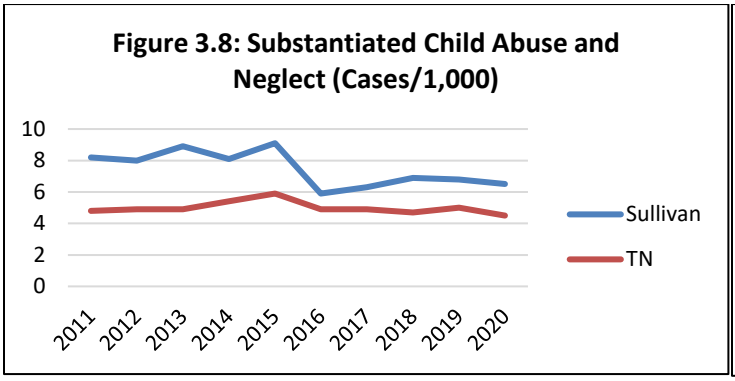


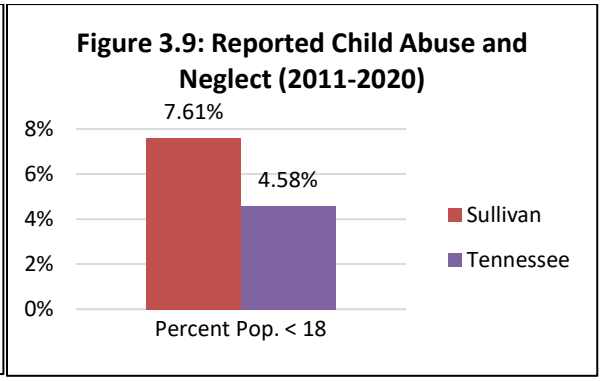


Source: Tennessee Bureau of Investigation, CrimeInsight: Violent Crime

Child Abuse & Neglect:

While reported violent crime rates in the general population are lower in Sullivan County than the state, rates of substantiated child abuse and neglect cases have consistently been higher in Sullivan County compared to the rest of the state. However, rates of child abuse and neglect have stayed consistent in Tennessee while Sullivan County's rate increased by 10% over the last decade (2011-2020) (see Figure 3.8). Over the past five years (2016-2020), the average frequency of *reported* (not substantiated) child abuse or neglect cases represented an estimated 7.9% of Sullivan County's population younger than 18 years. During this time, the frequency enumerated across Tennessee represented an estimated 4.8% of the state's youth population during this period (see Figure 3.9).[28]





Source: Annie E. Casey Foundation, Kids Count Data Center

Drug-related Crimes:

The three-year average rate of drug-related offenses among youth younger than 18 years was slightly higher in Sullivan County (3.11/1,000) than Tennessee (2.49/1,000) (see Table 3.1). The three-year average drug-related arrests among adults, reported as a percentage, was comparable in Sullivan County (0.91%) to the state (0.82%) (see Table 3.2).[29]

Table 3.1: Drug Related Arrests for Youth < 18 (Number and Rate/1,000)				
Year	Sullivan		Tennessee	
	Freq	Rate	Freq	Rate
2018	91	2.96	4,399	2.91
2019	129	4.32	4,011	2.65
2020	63	2.07	2,888	1.92
3-Year Avg.	94	3.11	3,766	2.49

Table 3.2: Drug Related Arrests for All Ages (Number and Percent of Population)				
Year	Sullivan		Tennessee	
	Freq	Percent	Freq	Percent
2018	1428	0.91	59,609	0.88
2019	1517	0.96	56,776	0.83
2020	1393	0.88	50,208	0.74
3-Year Avg.	1446	0.91	55,531	0.82

Source: Tennessee Bureau of Investigation, CrimeInsight: Drug

Mental Health

Mental Health-Related Quality of Life

The percent of adult population reporting any mental illness in the previous year, defined as having any mental, behavioral, or emotional disorder meeting diagnostic criteria for mental illness, was nearly the same in Sullivan County from 2019-2020 (18.79%) and the state (18.51%) (see Table 3.3). During the same period, the proportion of population reporting serious mental illness, defined as any mental, behavioral, or emotional disorder that substantially interfered with or limited one or more major life activities, was also very similar in Sullivan County (5.75%) and Tennessee (5.66%) (see Table 3.4).[30] Another subjective measure of health-related quality of life, the age-adjusted average number of poor mental health days, defined as the number of "mentally unhealthy days" reported in the past month, was also similar between Sullivan County (5.6 days/month) and Tennessee (5.1 days/month) in 2020.[6]

Table 3.3: Population Aged 18+ with Any Mental Illness in Past Year				
Year	Sullivan		Tennessee	
	Freq.	%	Freq.	%
2008-10	27,982	22.47	1,074,326	22.15
2010-12	27,534	22.11	997,181	20.56
2019-2020	29,630	18.79	1,253,750	18.51

Table 3.4: Population Aged 18+ with Serious Mental Illness in Past Year				
Year	Sullivan		Tennessee	
	Freq	%	Freq	%
2008-10	6,550	5.26	250,831	5.18
2010-12	5,492	4.41	251,235	5.18
2019-2020	9,070	5.75	383,610	5.66

Source: Tennessee Department of Mental Health and Substance Abuse Services

Drug Dependence & Treatment

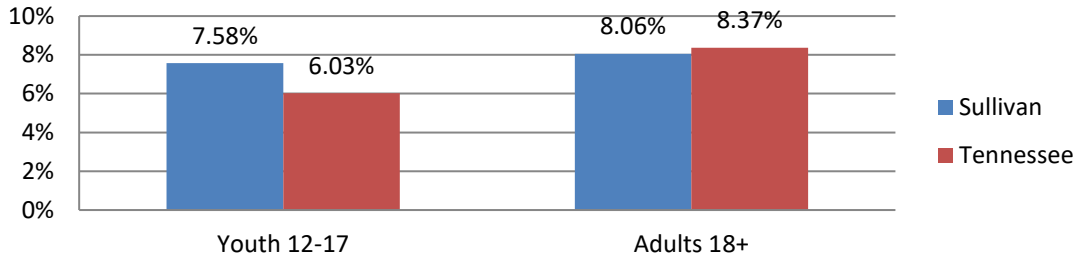
From 2006-2008 to 2010-2012, as this is the most updated data available for this age group, there has been a 33% decrease in youth aged 12-17 dependent on or abusing illicit drugs or alcohol across Tennessee. The decrease in prevalence has been less notable in Sullivan County (16% decrease) during this time period, and prevalence was consistently higher throughout compared to the state (see Table 3.5). Among adults aged 18 and older, prevalence of substance abuse and dependence did not change notably during this period and prevalence was similar between regions (see Table 3.6 & Figure 3.11).[13]

Table 3.5: Youth Aged 12-17 with Dependence / Abuse of Illicit Drugs or Alcohol in Past Year				
Year	Sullivan		Tennessee	
	Freq	%	Freq	%
2006-08	986	8.53	37,486	7.41
2008-10	814	7.04	29,108	5.75
2010-12	829	7.17	24,991	4.94
Period Avg.	876	7.58	30,528	6.03

Table 3.6: Adults Aged 18+ with Dependence / Abuse of Illicit Drugs or Alcohol in Past Year				
Year	Sullivan		Tennessee	
	Freq	%	Freq	%
2006-08	10,603	8.59	422,237	8.86
2008-10	9,863	7.92	390,153	8.04
2010-12	9,551	7.67	397,709	8.20
Period Avg.	10,006	8.06	403,366	8.37

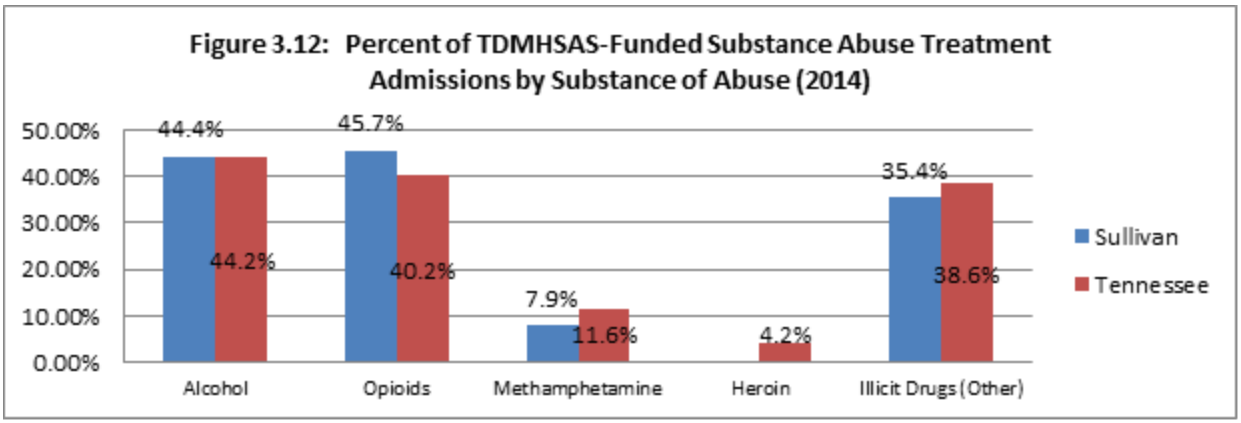
Source: Tennessee Department of Mental Health and Substance Abuse Services

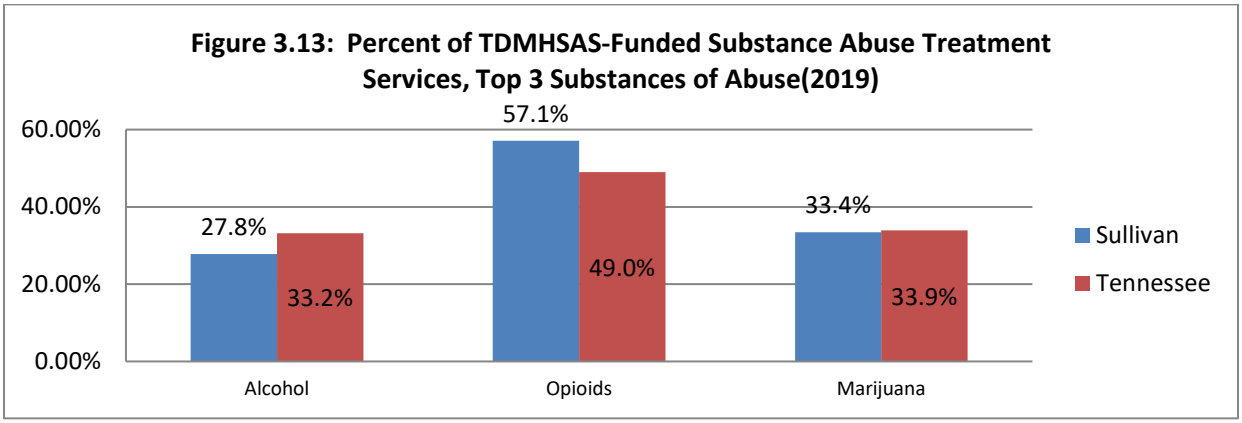
Figure 3.11: Percent of Population Dependent on or Abusing Drugs or Alcohol, by Region and Age Group (2006-2012)



Source: Tennessee Department of Mental Health and Substance Abuse Services

From 2012 to 2014, the average rate of youth aged 6-18 participating in Tennessee Department of Mental Health and Substance Abuse Services (TDMHSAS)-funded substance abuse prevention programs in Sullivan County was 10.37/1,000 youth. This was considerably higher than that for the state (7.07/1,000) during this period. Additionally, a greater proportion of Sullivan County residents dependent on or abusing alcohol or illicit drugs during this time period received treatment from a TDMHSAS-funded program (6.53%) than did those throughout the state (3.67%). Alcohol and opioid drugs, followed by unspecified illicit drugs, were the most common types of substances abused by persons seeking substance abuse treatment. Of note, the frequency of individuals in Sullivan County seeking treatment for heroin in 2014 was too sparse for the Tennessee Department of Health to report a percentage (see Figure 3.12). The Top 3 Substances of Abuse treated by TDMHSAS in 2019 is included below to demonstrate the changing field of substance abuse, as it can be seen that treatment of alcohol abuse has diminished, while treatment of opioid abuse has increased (See Table 3.13).





Source: Tennessee Department of Health

From 2014-2016 in Sullivan County, Narcan, a drug that reverses the effects of opioid drugs and is used to treat opioid drug overdose, was administered in the prehospital setting 188 times. On 23 occasions (12.2% of the time) during this period, patients who received Narcan in the prehospital setting were transported emergency traffic by ambulance to a definitive care facility. On 162 occasions (86.2% of the time), patients receiving Narcan were transported routine traffic to a definitive care facility; meaning that they were transported by an ambulance, but without use of emergency lights and sirens to expedite transport. It is important to note that Narcan is not used to treat overdoses from some types of drugs, and that it is unknown from available data for what percentage of incidents involving report of drug overdose administration of Narcan was indicated. Additionally, Narcan is sometimes administered by emergency medical personnel in the prehospital setting to rule out the possibility of opioid drug overdose for persons presenting with compatible signs and symptoms for which the cause of illness is not known. For this reason, it may not be inferred from this information that 188 incidents necessarily occurred in which opioid drug overdose was the cause of illness.

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Tobacco and Electronic Cigarette Use:

Cigarette Smoking:

Smoking among adults is slightly more prevalent in Sullivan County than Tennessee, with 23% of Sullivan County adults reporting current smoking in 2019, compared to 19.9% of adults throughout the state. This falls short of the HP2030 goal to reduce cigarette smoking among adults to 5% (see Figure 4.1). For the three years of available state data and two years available for Sullivan County, smoking in Sullivan County decreased modestly, following the slight decline throughout the state.[6] In 2013, more adults in Sullivan County (71.6%) who were current smokers reported attempting to quit smoking in the past year than those throughout the state (62.6%). Unfortunately, that is the most current available data on smoking cessation. At that time, however, there was an upward trend in the proportion of current smokers attempting to quit for both Sullivan County and the state (see Figure 4.2).[31]

Figure 4.1: Proportion of Population Reporting Current Cigarette Smoking

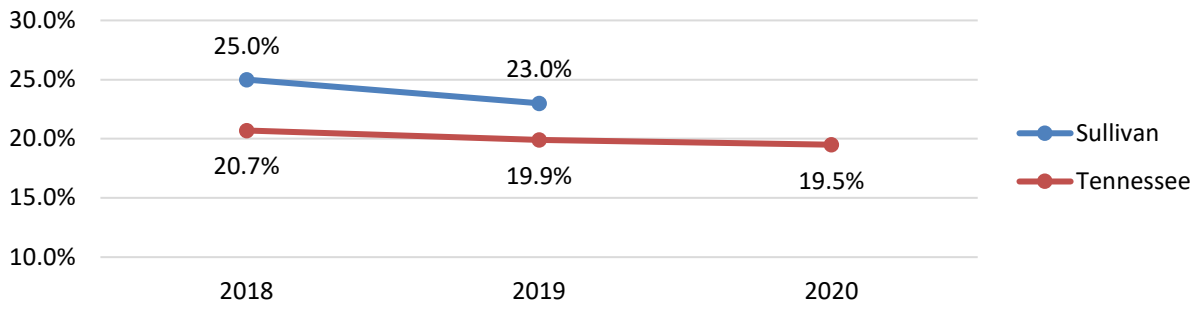
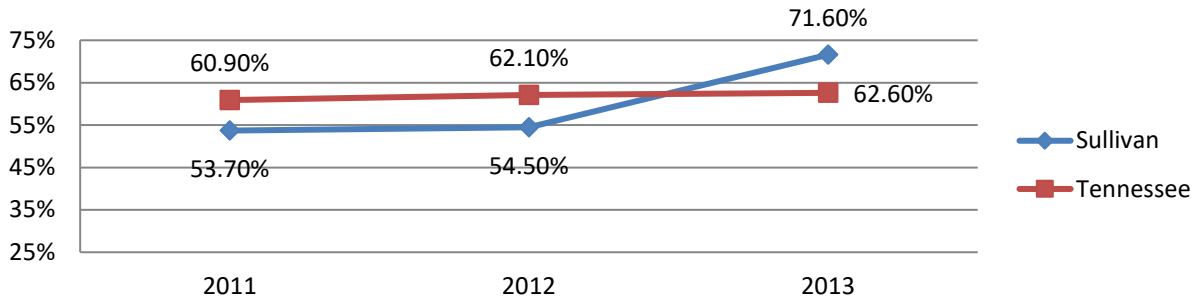


Figure 4.2: Proportion of Current Smokers Who Attempted Smoking Cessation within the Past Year



Source: Tennessee Department of Health, Tennessee Behavioral Risk Factor Surveillance System; County Health Rankings

Smoking during pregnancy is attributed to 10% of all infant deaths, and babies born to mothers who smoked during pregnancy are more likely to die of sudden infant death syndrome (SIDS) than those born to mothers who did not smoke. Additionally, smoking during pregnancy increases the risk of preterm birth or low birth weight.[32] Nearly one fifth (19%) of Sullivan County mothers smoked during pregnancy in 2019. This is much higher than the percentage of pregnant women in Tennessee (12%) who smoked at some point during their pregnancy.[33] There is no available national data for 2019; however, these

percentages are considerably higher than the national prevalence of maternal smoking during pregnancy three years earlier in 2016 (7.2%). Throughout the US during this time, smoking during pregnancy was most common among ages 20-24, and women with a high school education or less.[34]

A survey conducted by the Sullivan County Regional Health Department in four Sullivan County high schools found that 29% (see Figure 4.3) of high school students in 2016 had experimented with cigarette smoking and that 8.3% currently smoke. The average age of reported initiation of smoking was 13. Of the youth who currently smoke, 49% reported smoking between one and nine cigarettes per week while another 32% reported smoking 40 or more cigarettes per week (see Figure 4.4). More than half (53%) of the youth currently smoking reported having considered smoking cessation (see Figure 4.5).

Smokeless Tobacco:

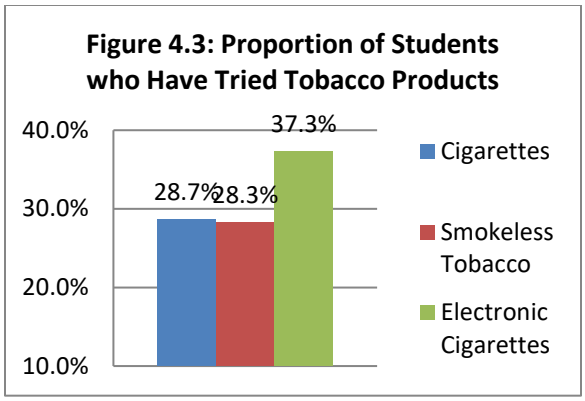
About 6.5% of Tennessee residents used smokeless tobacco products in 2020. The percentage is much higher among men (11.2%) than women (2.4%).[35] Regional estimates are not available for adult smokeless tobacco use.

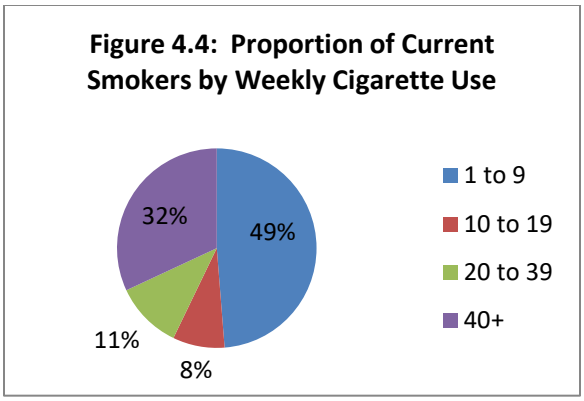
The proportion of Sullivan County high school students reporting having tried smokeless tobacco (28.3%) was similar in 2016 to the proportion having tried cigarettes (28.7%) (see Figure 4.3). Similar to cigarette smoking, the average age at first experience with smokeless tobacco was 13. Nine percent of students currently use smokeless tobacco and the majority of these students (77.5%) report consuming a whole can or more of tobacco per week. Whereas more than half of students currently smoking cigarettes had considered quitting, only 25.8% of students using smokeless tobacco had considered quitting (see Figure 4.5).

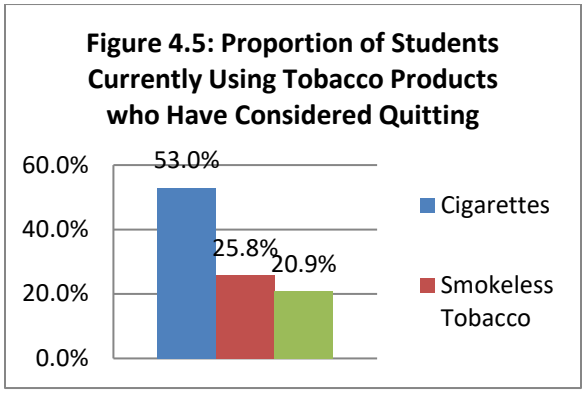
Electronic Cigarettes:

About 14.9% of the total US population has tried electronic cigarettes (e-cigarettes), and the proportion was greater among people who smoked (25.2%) in 2018.[36] The CDC reports that one out of every 35 middle school students (2.8%), and one of every 9 high school students (11.3), have used e-cigs nationally in the past 30 days. As the number one form of tobacco use among high school students, there is evidence increased e-cig use among youth will result in higher smoking rates in upcoming years, as nicotine addiction at a young age is associated with life-time use.[37] As e-cigarettes have been commercially available for only 10 years, longitudinal data is not available to assess the health risks of e-cigarette use. Accordingly, it is currently unknown whether e-cigarettes are less harmful than traditional cigarettes, or if they pose additional health risks other than those observed with traditional cigarettes. However, there is evidence that e-cigarette use promotes the use or continuation of cigarette smoking.[36] Data is not available for state- or region-specific estimates of adult e-cigarette use.

In 2016, 37.3% of Sullivan County high school students reported having tried electronic cigarettes and 14% currently used them (see Figure 4.3). Similar to cigarette smoking and smokeless tobacco use, the average age at first experience with e-cigarettes was 13. Fifty-six percent of current users reported using e-cigarettes at their home and 21% reported having considered quitting e-cigarettes (see Figure 4.5).





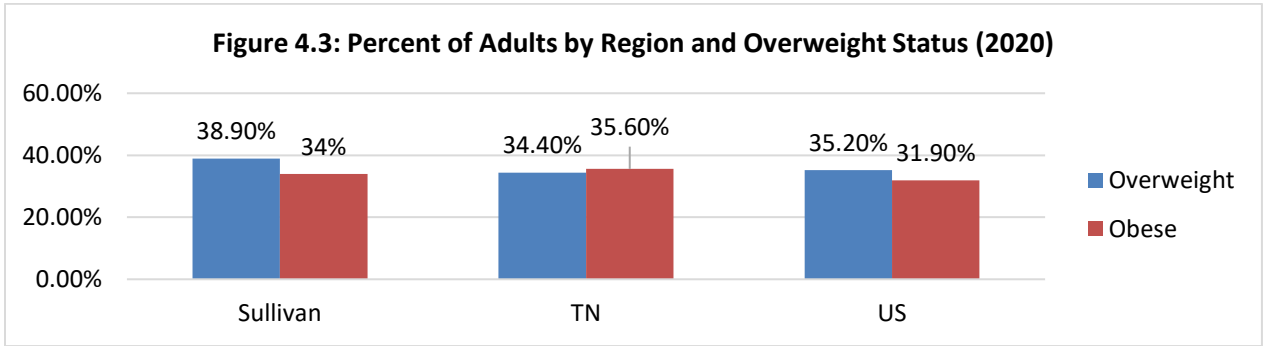


Source: Sullivan County Regional Health Department, Report of Lunch & Learn Tobacco Use Survey

Overweight and Sedentary Behaviors:

Overweight/Obesity:

Rates of overweight and obesity are consistent across Sullivan County, Tennessee, and the nation (See Figure 4.6). Two in five Sullivan County adults are overweight and little more than three in ten are obese. There is little difference in percentage of adults who are overweight between Sullivan County (38.9%), state (34.4%), and the nation (35.2%). The proportion of adults in Sullivan County who are obese (34.0%) is slightly less than that observed for the state (35.6%).[38,39] All three regions meet the HP2030 goal of reducing the proportion of adults who are obese to 36.0%.[40] As all three levels met the goal by less than 5%, work is needed to ensure our county, state, and nation remain within this goal.



Source: The Robert Wood Johnson Foundation, County Health Rankings and Roadmaps; Centers for Disease Control and Prevention, BRFSS Prevalence & Trends Data

Physical Inactivity:
In 2019, more Sullivan County residents (32%) reported engaging in no physical activity outside of work than did residents across Tennessee (29%).[6] In the same year, 68% of Sullivan County residents reported having adequate access to locations for physical activity, more than the proportion of other Tennesseans reporting adequate access (62%).[6] Improvement is needed in Sullivan County to meet the HP2030 Goal of reducing the proportion of adults who engage in no leisure-time physical activity to 21.8%.[41] This is an attainable goal for Sullivan County, as access to physical activity locations is more prevalent in Sullivan County than the state. Despite not reaching HP2030 Goal, the HP2020 Goal (32.6%) was met by both county and state in 2019.

Dietary Intake:

In 2013, fewer Sullivan County residents (5.6%) reported consuming five or more servings of fruits and vegetables per day than that reported for residents across the state (9.2%) in the same year.[42] This is not surprising, as 14% of Sullivan County residents reported having limited access to healthy foods, compared to 8% of Tennesseans. The same year, 62% of restaurants in Sullivan County were classified as fast food establishments, higher than that observed throughout Tennessee (52%).[6] While there is not more current data for Sullivan County, in 2019, percentages of residents consuming five or more servings of fruit and vegetables per day have decreased in the state (8.6%) and nation (8.0%).[43]

Drug and Alcohol Consumption:

Alcohol Use and Misuse
Current consumption of alcohol, defined as consumption of one alcoholic drink within the past 30 days, was less prevalent in Sullivan County (33.7%) than both the State (37.5%) and nation (median = 54.4%) in 2013. Unfortunately, there is not updated data on current alcohol consumption. Binge drinking within the past 30 days, defined as consuming five or more alcoholic beverages on one occasion for men or having four or more beverages on one occasion for women, was less prevalent in Sullivan County than both the state and nation in 2019-2020. Binge drinking was reported by 12.5% of Sullivan County residents surveyed, slightly lower than that reported for the state (14.1%) and almost half the median prevalence reported for the nation (median – 15.7%).[42,44] Sullivan County, Tennessee, and The United States all meet the HP2020 goal (24.4%) and HP2030 goal (25.4%) of reducing the proportion of adults aged 18 and older who report binge drinking during the past 30 days to 24.4% (see Figure 4.8). There was no recent data reported on current and heavy alcohol consumption for Sullivan County.

A survey of Sullivan County high school students, conducted in 2015, by the Sullivan County Antidrug Coalition (SCAD) found that nearly one in five Sullivan County high school students (19%) reported consumption of alcohol within the past 30 days.[10] In the Northeast Tennessee Region, from 2010-2012, 6.6% of youth aged 12 – 17 reporting binge drinking within the past month, while 31.8% of young adults aged 18

– 25 engaged in binge drinking during the same period. The prevalence of alcohol dependence or abuse is lower in Northeast Tennessee than the state and nation for all age groups, and peaks at 12.5% of the population between ages 18 and 25. The proportion of residents aged 12 to 25 who needed treatment for alcohol use but reported not receiving the services they needed was greater Northeast Tennessee than the state. Among adults aged 26 and older, there was a smaller proportion of persons in need of treatment reporting insufficient access than both the state and nation (Figs 4.8 – 4.10).[45]

Figure 4.8: Prevalence of Past Month Binge Drinking (2010-12)

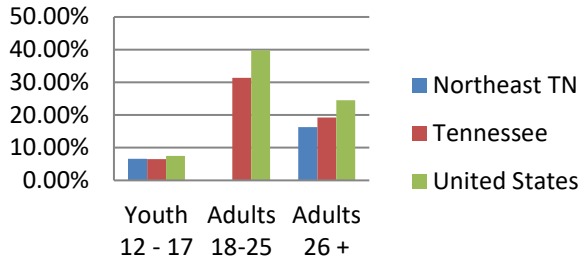


Figure 4.9: Prevalence of Alcohol Dependence or Abuse (2010-12)

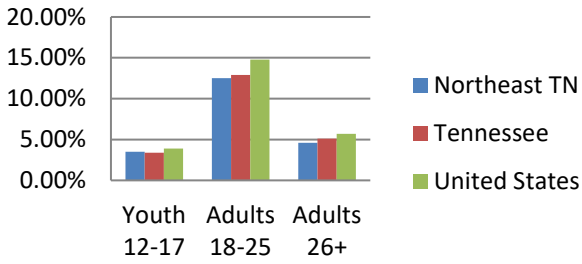
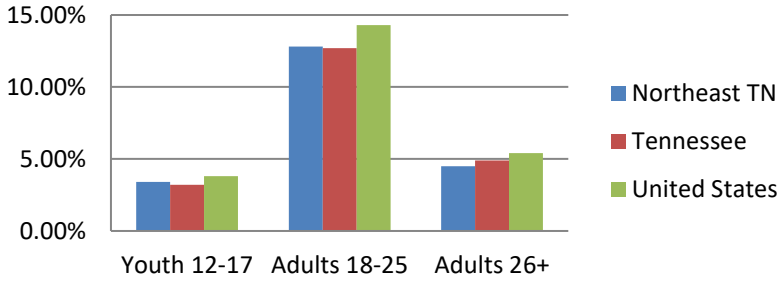


Figure 4.10: Percent Needing Treatment for Alcohol Use who Did Not Receive it (2010-12)



Source: Tennessee Department of Health, Department of Mental Health & Substance Abuse

Intoxicated Driving

In 2016 to 2020, Sullivan County had a lesser proportion of motor vehicle fatalities with alcohol intoxication implicated as a contributing factor (18%) than the state (23%).[46] In 2015, The Sullivan County Antidrug Coalition reports that 23% of high school students reported having ridden as a passenger in a vehicle driven by a drug- or alcohol-intoxicated person. This was more common among females (25.5%) than males (21.1%).

Marijuana

In previous years, report of past year marijuana use was highest among young adults aged 18-25. However, past month marijuana use in young adults aged 18-25 is consistent with the percentage of all adults self-reporting marijuana use in the past year for the state and nation (See Figures 4.11 and 4.12). Marijuana use has increased steadily from 2019-2021, where higher percentages are seen nationally

(22.3%, 2021) compared to the state level (18.1, 2021).[47] Marijuana use among youths aged 12-17 has remained 6% since 2010, though there has been a 29% increase in ages 18-25 from 2010 to 2019.[48]

Figure 4.11: Percent of Adult Population Reporting Past Year Marijuana Use (2019-2021)

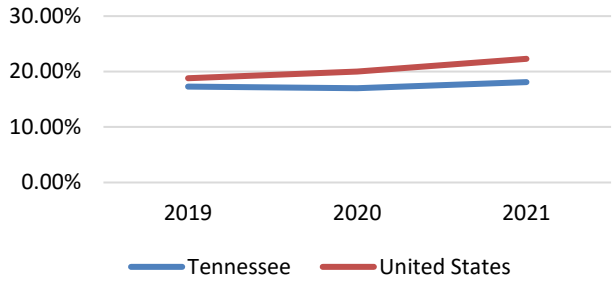
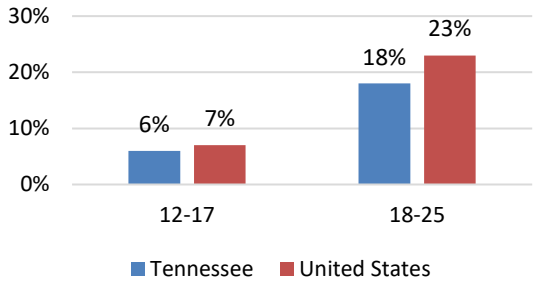


Figure 4.12: Percent of Population Reporting Past Month Marijuana Use by Age (2018-2019)



Source: United Health Foundation, America's Health Rankings; Annie E. Casey Foundation, Kids Count Data Center

Prescription Drug Misuse

Misuse of prescription drugs is the second most common form of drug abuse in Tennessee, after recreational use of marijuana.[49] Tennessee ranks 3rd in the United States for the rate of opioid pain relievers sold per 100 population in 2020. Sullivan County has the 4th highest rate of opioid dispensing in Tennessee for the same year (126.4 / 100 persons).[50] Further, prescription opioids are the most commonly abused substance among persons receiving treatment from Tennessee Department of Mental Health and Substance Abuse programs.[51]

Unfortunately, data on non-medical use of prescription drugs is unavailable for Sullivan County; however, the percentage of adults in Tennessee (6%) using drugs for non-medical purposes was similar to that of the United States (5.7%) in the year 2020. Furthermore, the percentage of adult males who reported non-medical drug use was the same in the state and the nation (13.7%), while the percentage of women was slightly lower in Tennessee (11.8%) (See Figure 4.13). When distributed by race, there was a slightly higher prevalence of non-medical drug use among the Caucasian population, although when excluding reported drug use by the congregate "Other" races, non-medical drug use was consistent across all race categories (Figure 4.14). [49]

Figure 4.13: Non-medical Drug Use by Gender (Adults 2020)

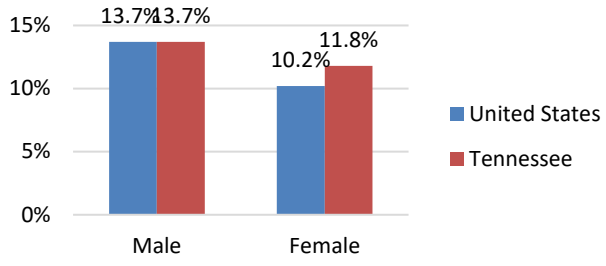
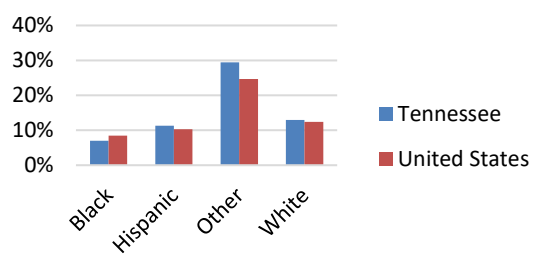


Figure 4.14: Non-medical Drug Use by Race/Ethnicity (Adults 2020)



Source: United Health Foundation, America's Health Rankings

Illicit Drug Abuse

Use of illicit drugs, including: marijuana or hashish, cocaine or crack, heroin, hallucinogens, inhalants, or any prescription psychotherapeutics used nonmedically, again is highest among young adults aged 18 – 25 throughout the state and the nation. An estimate for this age group was not available for Northeast Tennessee due to concern for reliability of the estimate. Among youth younger than 26, prevalence of illicit drug use was higher in the nation (7%, 23%) than the state (6%, 18%) (Figure 4.16).[52] Using congregate adult data over time, there was an 81% increase in illicit drug use in Tennessee from 2019 to 2021, much higher than the percent increase for the nation (32%) during the same time period (see Figure 4.15).[53] In the years leading up to 2019, there were steady decreases in the number of youths and young adults aged 12 to 25 each year from 2015 to 2019 (See Figure 4.17).[52]

Figure 4.15: Illicit Drug Use (Excluding Opioids and Cannabis) in Adults

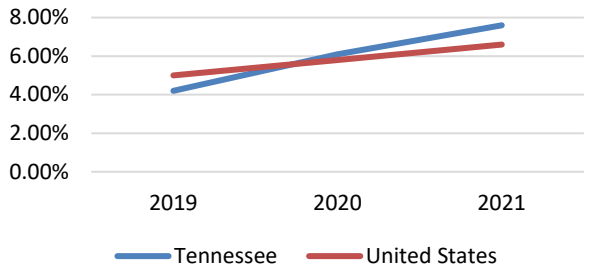
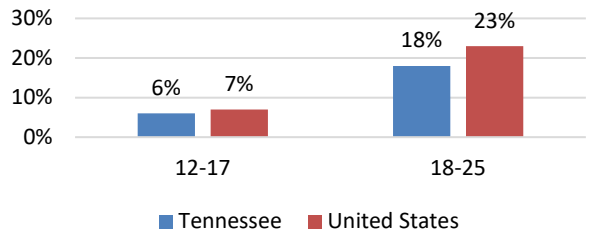
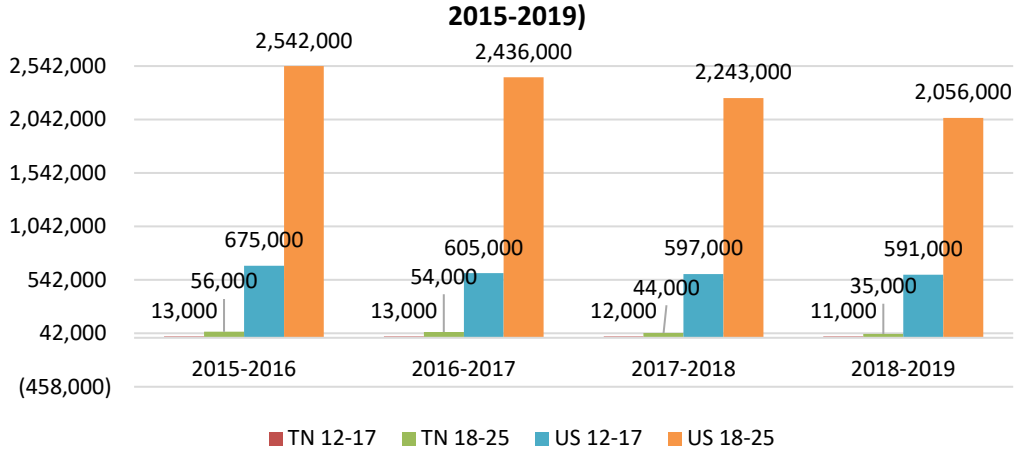


Figure 4.16: Illicit Drug Use (Excluding Cannabis) Among Youth and Young Adults (2018-2019)



Source: United Health Foundation, America's Health Rankings; Annie E. Casey Foundation, Kids Count Data Center

Figure 4.17: Illicit Drug Use Among Youth and Young Adults (Count, 2015-2019)



Source: Annie E. Casey Foundation, Kids Count Data Center

Opioid drug overdoses are also used to monitor drug abuse. The distribution of overdose fatalities involving opioids varies by region, but has changed rapidly from 2016-2020 (Figures 4.18-4.20). Due to the

small count of deaths for some opioid types, some numeric values have been removed for anonymity purposes, leaving the upper bound limits to inform the difference between populations and regions. A large decrease in prescription opioid deaths can be seen in the Northeast Tennessee region, but is not observed in the state or Sullivan County consistently. Fentanyl overdose fatalities, however, are seen to be rapidly increasing across all regions. Pharmaceutical fentanyl is used carefully for treating severe pain in hospitals, often for advanced cancer pain, as it is 50 to 100 times more potent than morphine. The fentanyl-related harm observed here is linked to illegally made fentanyl, and is often mixed with other drugs with or without the user's knowledge.[54] Fentanyl is not only dangerous to drug users, but also law enforcement, laboratory personnel, and any others who may come in contact with fentanyl because it is extremely toxic and readily absorbed through the skin.[55]

Figure 4.18: Number of Opioid Drug Overdose Fatalities by Type and Year (Tennessee)

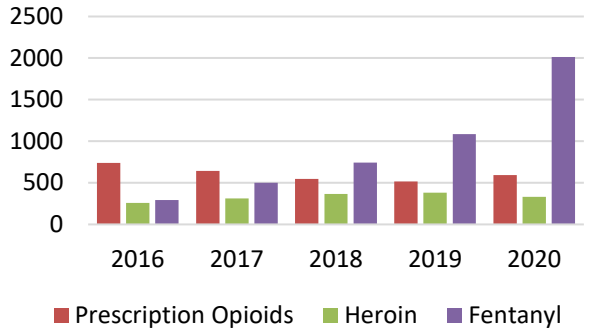


Figure 4.19: Number of Opioid Drug Overdose Fatalities by Type and Year (Northeast TN)

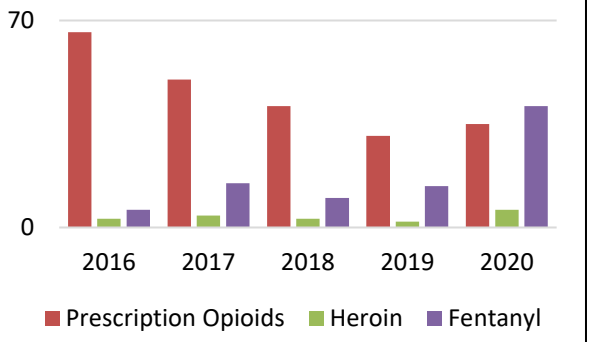
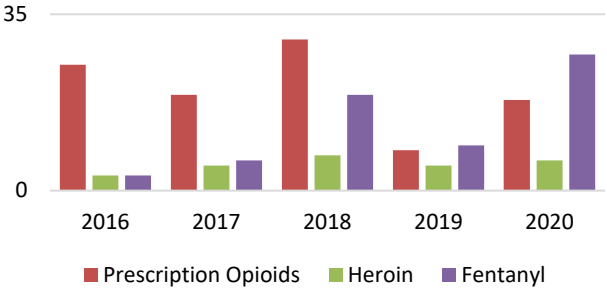


Figure 4.20: Number of Opioid Drug Overdose Fatalities by Type and Year (Sullivan County)



Source: Tennessee Department of Health, Tennessee Drug Overdose Dashboard

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Reportable Diseases (Low Incidence Pathogens)

This section contains 10-year trends in communicable disease incidence for all nationally notifiable diseases, as well as those reportable to the state of Tennessee. Throughout, incidence rates in Sullivan County are contrasted to those of the state to allow for comparison of the burden of disease. Additionally, mortality data are provided for Human Immunodeficiency Virus (HIV) and for viral hepatitis (mortality rates non-specified by type), and prevalence data are provided for vaccination and HIV testing as publicly available data permits. Pathogenic infections reported in this section are divided into the following categories: bacterial, viral, toxin-mediated, HIV/AIDS. The section begins with a table listing all reportable or notifiable pathogens or associated pathogenic infections in which incidence of infection in Sullivan County remained less than 1/100,000 each year for the past decade. Occurrence of these pathogens is too low to warrant detailed examination (see table 5.1).[56]

Table 5.1: Pathogens and Associated Conditions for Sullivan County (10-Year Average Rates < 1/100,000)

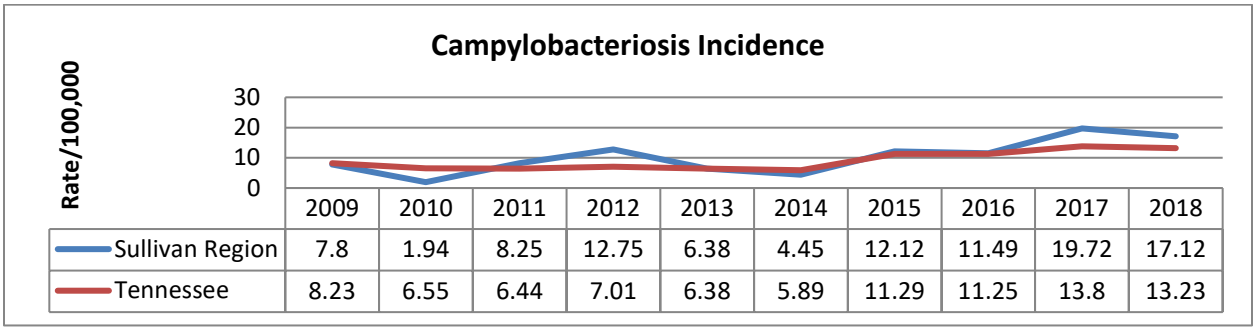
Bacterial Infections	Rate/ 100,000	Viral Infections and Associated Conditions	Rate/ 100,000
Anaplasma Phacocytophilum	0.00	Congenital Rubella Syndrome	0.00
Anthrax	0.00	Dengue Fever	0.00
Cholera (Vibrio Cholerae)	0.00	Encephalitis (Eastern Equine, Western Equine, St. Louis)	0.00
Diptheria	0.00		
Ehrlichiosis (Ewingii, Human Monocytic, Anaplasmosis)	0.00	Measles	0.00
		Mumps	0.13
Listeriosis	0.38	Rubella	0.00
Lyme Disease	0.70	Rabies (Human)	0.00
Bacterial Meningitidis	0.70	**Parasitic Infections**	**Rate/ 100,000**
Meningitis (other)	0.00		
Rocky Mountain Spotted Fever	0.96	Cyclosporiasis	0.00
Typhoid Fever (S. Typhi)	0.00	**Toxin Mediated Infections**	**Rate/ 100,000**
Tetanus	0.00		
Vibriosis	0.89	Botulism (Foodborne)	0.00
Yersiniosis	0.06		

Source: Tennessee Department of Health

Reportable Diseases (Bacterial Infections)

Campylobacteriosis:[56]

10-Year Average Incidence/100,000: Sullivan County = 10.20; Tennessee = 9.01

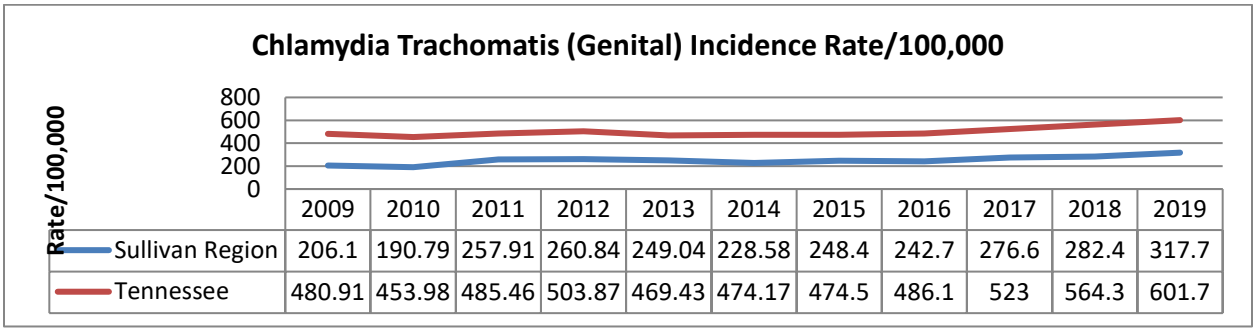


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	7.8	1.94	8.25	12.75	6.38	4.45	12.12	11.49	19.72	17.12
Tennessee	8.23	6.55	6.44	7.01	6.38	5.89	11.29	11.25	13.8	13.23

Source: Tennessee Department of Health

Chlamydia Trachomatis (Genital):[57]

10-Year Average Incidence/100,000: Sullivan County = 255.50; Tennessee = 503.65

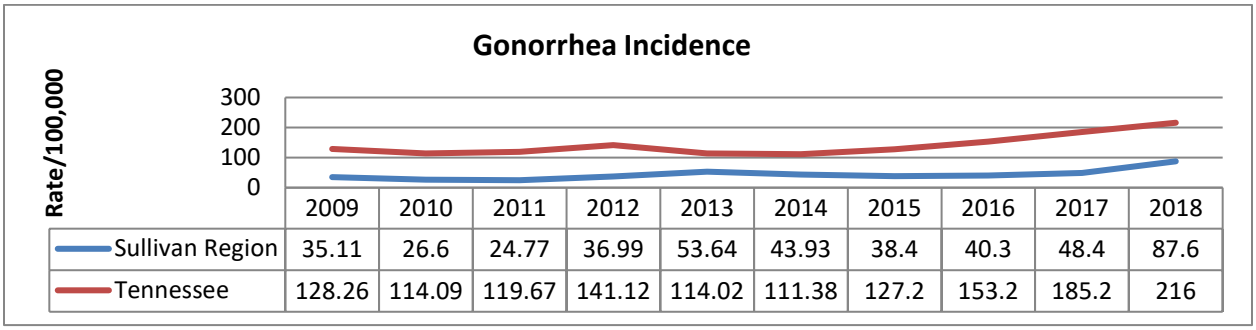


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sullivan Region	206.1	190.79	257.91	260.84	249.04	228.58	248.4	242.7	276.6	282.4	317.7
Tennessee	480.91	453.98	485.46	503.87	469.43	474.17	474.5	486.1	523	564.3	601.7

Source: Centers for Disease Control and Prevention (CDC), AtlasPlus

Gonorrhea – Genital (Neisseria Gonorrhoeae):[57]

10-Year Average Incidence/100,000: Sullivan County = 43.57; Tennessee = 141.01

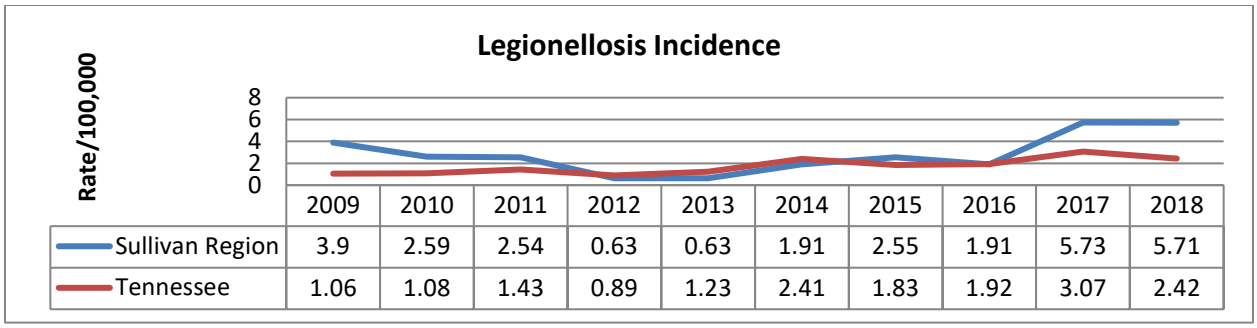


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	35.11	26.6	24.77	36.99	53.64	43.93	38.4	40.3	48.4	87.6
Tennessee	128.26	114.09	119.67	141.12	114.02	111.38	127.2	153.2	185.2	216

Source: Centers for Disease Control and Prevention (CDC), AtlasPlus

Legionellosis:[56]

10-Year Average Incidence/100,000: Sullivan County = 2.81; Tennessee = 1.73

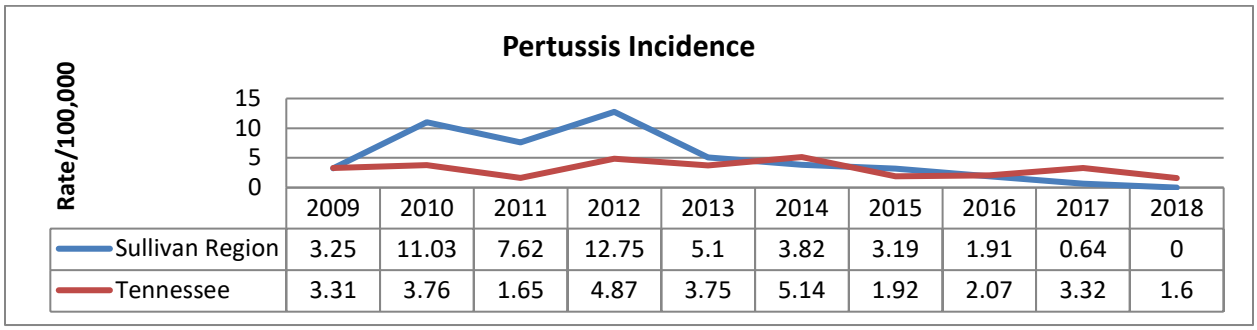


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	3.9	2.59	2.54	0.63	0.63	1.91	2.55	1.91	5.73	5.71
Tennessee	1.06	1.08	1.43	0.89	1.23	2.41	1.83	1.92	3.07	2.42

Source: Tennessee Department of Health

Pertussis:[56]

10-Year Average Incidence/100,000: Sullivan County = 4.93; Tennessee = 3.14

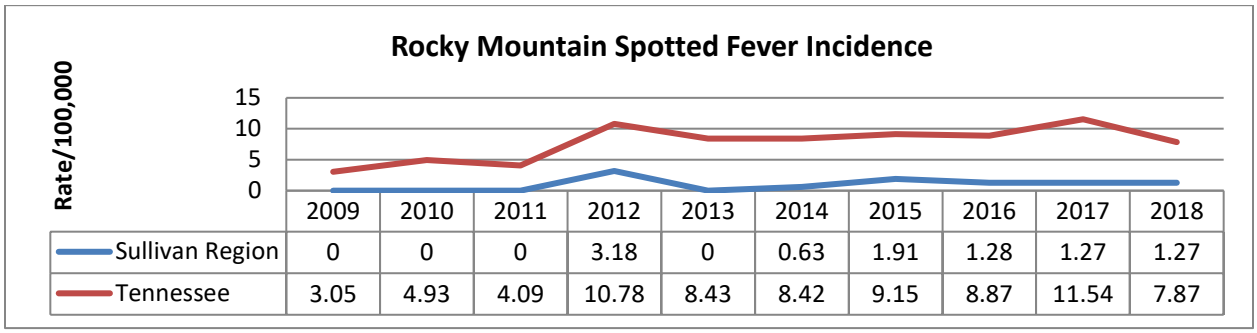


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	3.25	11.03	7.62	12.75	5.1	3.82	3.19	1.91	0.64	0
Tennessee	3.31	3.76	1.65	4.87	3.75	5.14	1.92	2.07	3.32	1.6

Source: Tennessee Department of Health

Rocky Mountain Spotted Fever:[56]

10-Year Average Incidence/100,000: Sullivan County = 0.95; Tennessee = 7.71

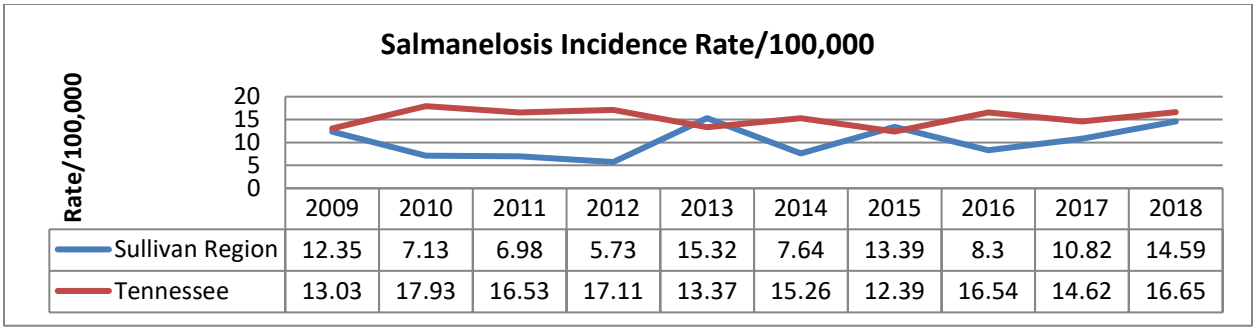


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	0	0	0	3.18	0	0.63	1.91	1.28	1.27	1.27
Tennessee	3.05	4.93	4.09	10.78	8.43	8.42	9.15	8.87	11.54	7.87

Source: Tennessee Department of Health

Salmanelosis:[56]

10-Year Average Incidence/100,000: Sullivan County = 10.23; Tennessee = 15.34

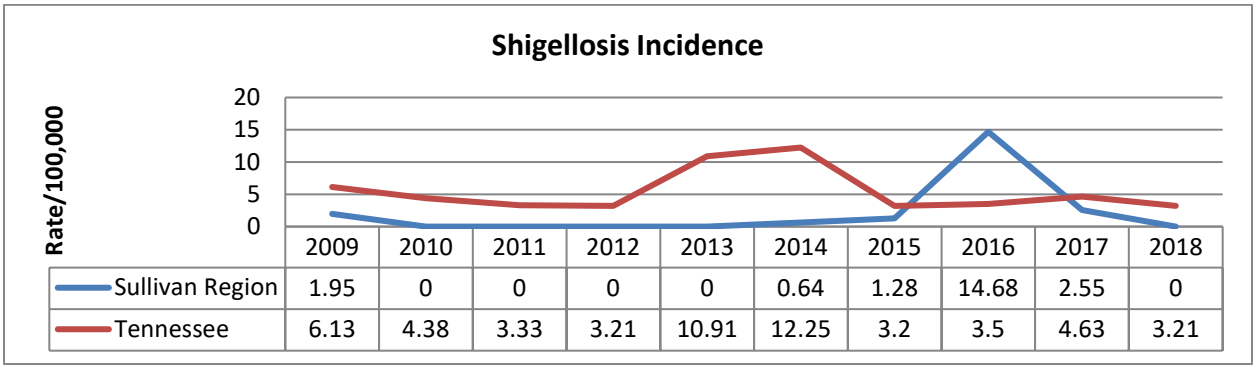


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	12.35	7.13	6.98	5.73	15.32	7.64	13.39	8.3	10.82	14.59
Tennessee	13.03	17.93	16.53	17.11	13.37	15.26	12.39	16.54	14.62	16.65

Source: Tennessee Department of Health

Shigellosis:[56]

10-Year Average Incidence/100,000: Sullivan County = 2.11; Tennessee = 5.48

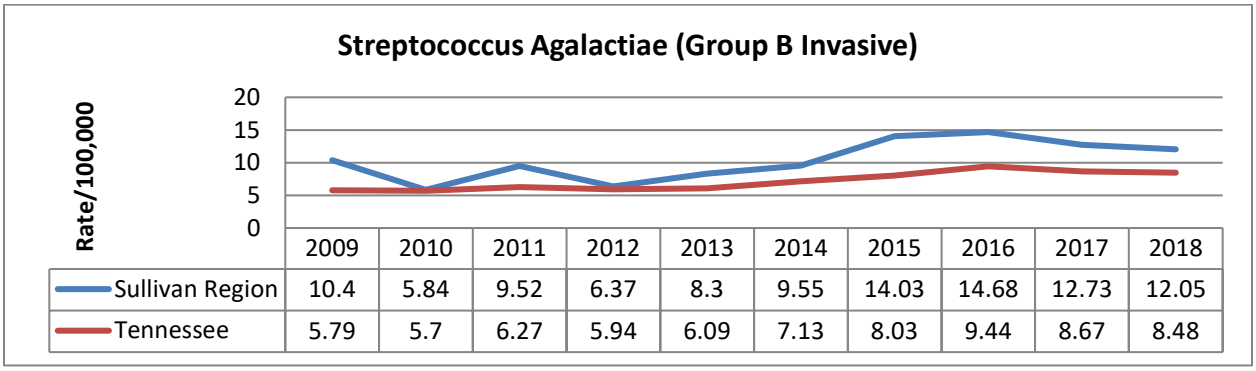


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	1.95	0	0	0	0	0.64	1.28	14.68	2.55	0
Tennessee	6.13	4.38	3.33	3.21	10.91	12.25	3.2	3.5	4.63	3.21

Source: Tennessee Department of Health

Streptococcus Agalactiae (Group B Invasive):[56]

10-Year Average Incidence/100,000: Sullivan County = 10.35; Tennessee = 7.15

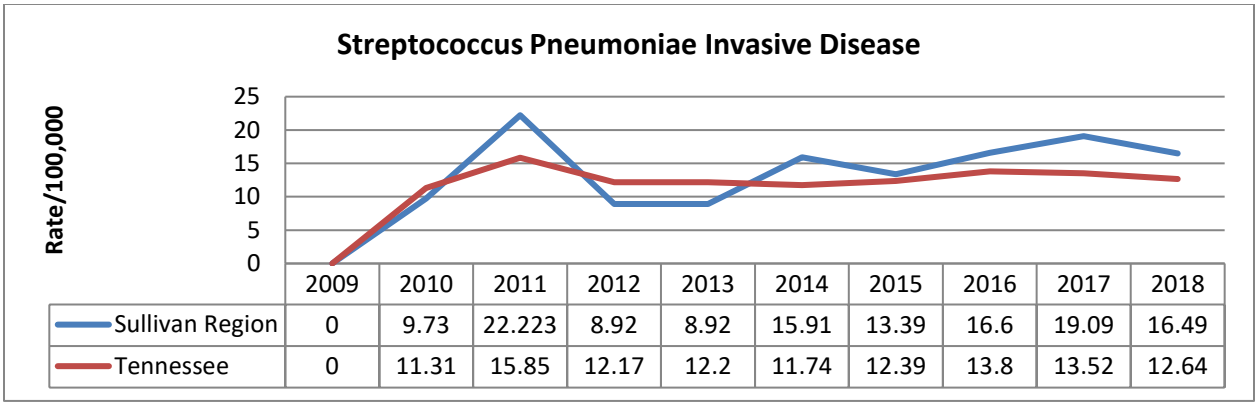


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	10.4	5.84	9.52	6.37	8.3	9.55	14.03	14.68	12.73	12.05
Tennessee	5.79	5.7	6.27	5.94	6.09	7.13	8.03	9.44	8.67	8.48

Source: Tennessee Department of Health

Streptococcus Pneumoniae Invasive Disease:[56]

10-Year Average Incidence/100,000: Sullivan County = 13.13; Tennessee = 11.56

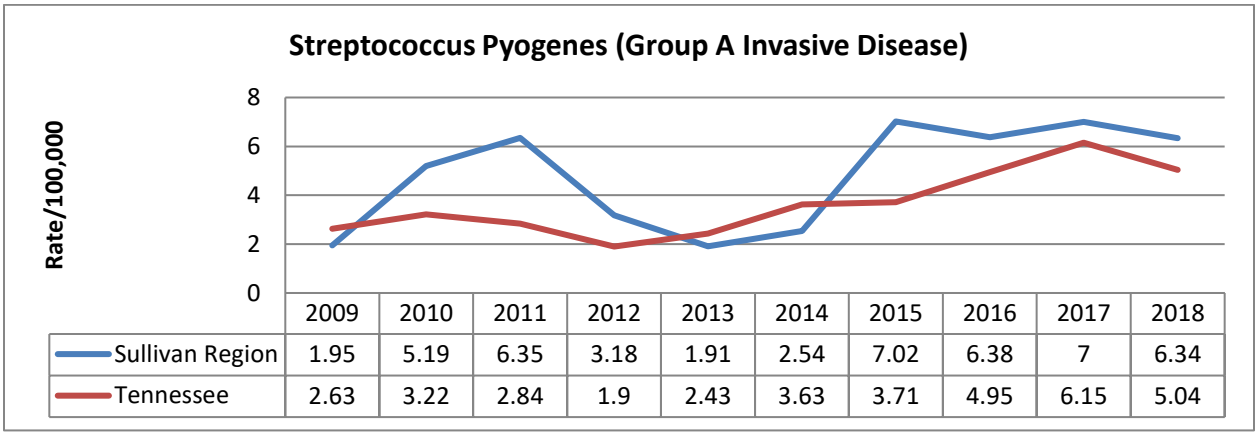


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	0	9.73	22.223	8.92	8.92	15.91	13.39	16.6	19.09	16.49
Tennessee	0	11.31	15.85	12.17	12.2	11.74	12.39	13.8	13.52	12.64

Source: Tennessee Department of Health

Streptococcus Pyogenes (Group A Invasive):[56]

10-Year Average Incidence/100,000: Sullivan County = 4.79; Tennessee = 3.65

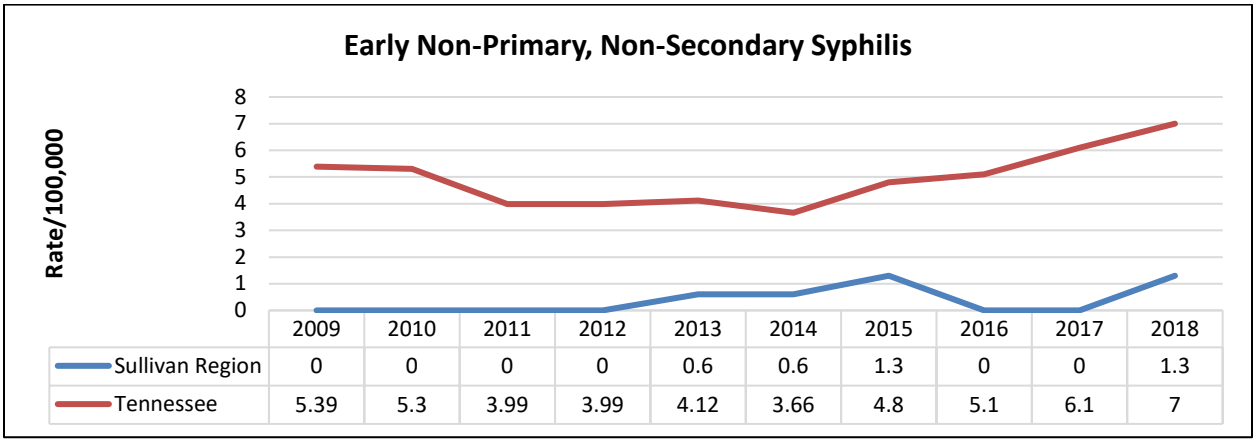


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	1.95	5.19	6.35	3.18	1.91	2.54	7.02	6.38	7	6.34
Tennessee	2.63	3.22	2.84	1.9	2.43	3.63	3.71	4.95	6.15	5.04

Source: Tennessee Department of Health

Syphilis (Early Non-Primary, Non-Secondary):[57]

10-Year Average Incidence/100,000: Sullivan County = 0.63; Tennessee = 5.36

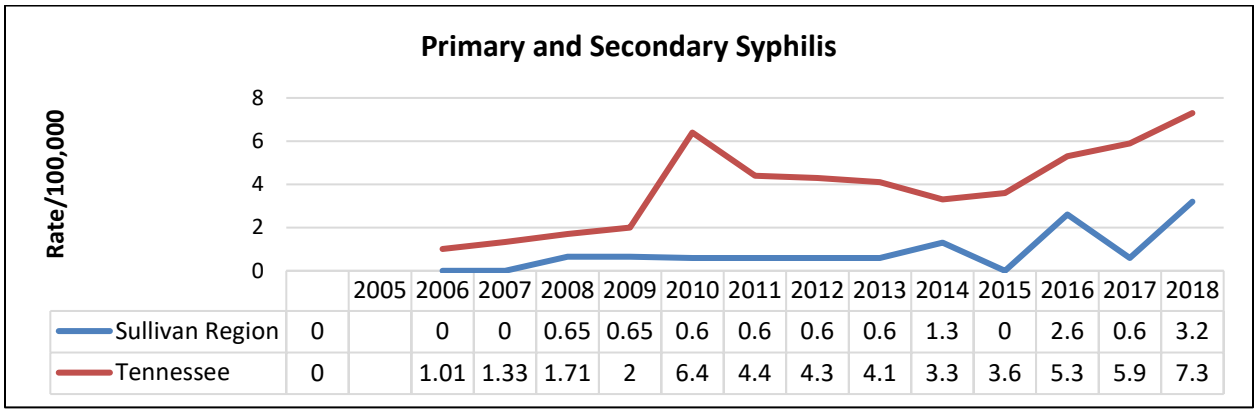


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	0	0	0	0	0.6	0.6	1.3	0	0	1.3
Tennessee	5.39	5.3	3.99	3.99	4.12	3.66	4.8	5.1	6.1	7

Source: Centers for Disease Control and Prevention (CDC), AtlasPlus

Syphilis (Primary and Secondary):[57]

10-Year Average Incidence/100,000: Sullivan County = 1.71; Tennessee = 5.63

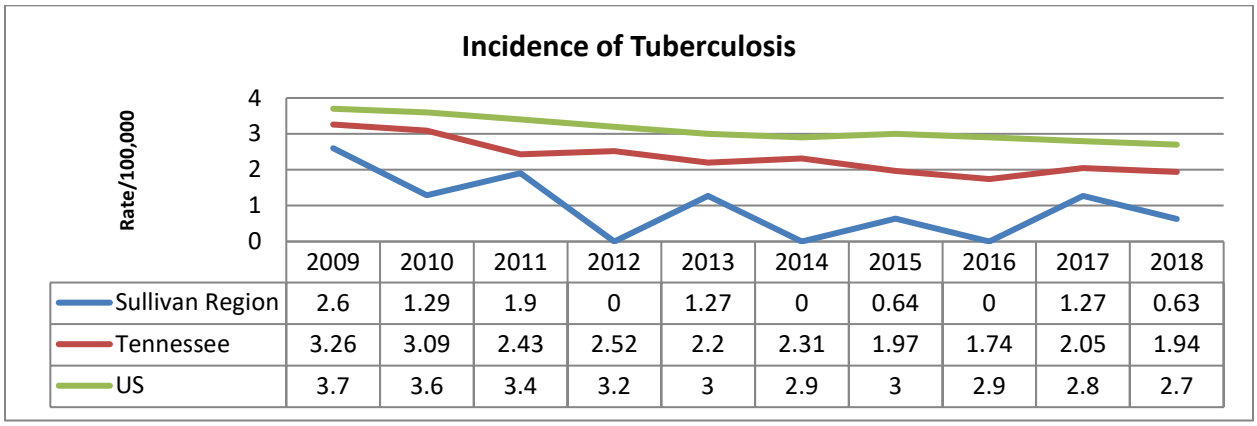


	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	0		0	0	0.65	0.65	0.6	0.6	0.6	0.6	1.3	0	2.6	0.6	3.2
Tennessee	0		1.01	1.33	1.71	2	6.4	4.4	4.3	4.1	3.3	3.6	5.3	5.9	7.3

Source: Centers for Disease Control and Prevention (CDC), AtlasPlus

Tuberculosis <u>Incidence</u> (Mycobacterium Tuberculosis Complex):[56,58]

10-Year Average Incidence/100,000: Sullivan County = 0.96; Tennessee = 2.35; US = 3.12

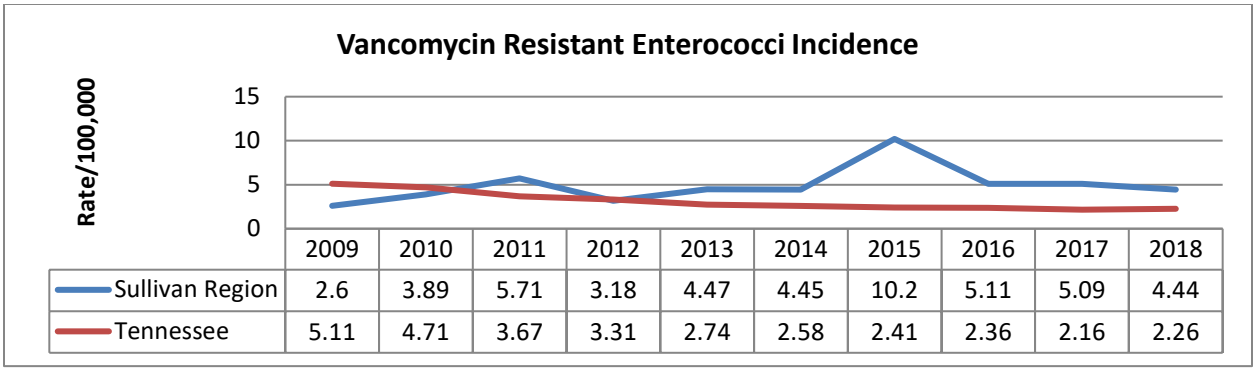


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	2.6	1.29	1.9	0	1.27	0	0.64	0	1.27	0.63
Tennessee	3.26	3.09	2.43	2.52	2.2	2.31	1.97	1.74	2.05	1.94
US	3.7	3.6	3.4	3.2	3	2.9	3	2.9	2.8	2.7

Source: Tennessee Department of Health, Centers for Disease Control and Prevention

Vancomycin Resistant Enterococci Incidence:[56]

10-Year Average Incidence/100,000: Sullivan County = 4.91; Tennessee = 3.13;



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	2.6	3.89	5.71	3.18	4.47	4.45	10.2	5.11	5.09	4.44
Tennessee	5.11	4.71	3.67	3.31	2.74	2.58	2.41	2.36	2.16	2.26

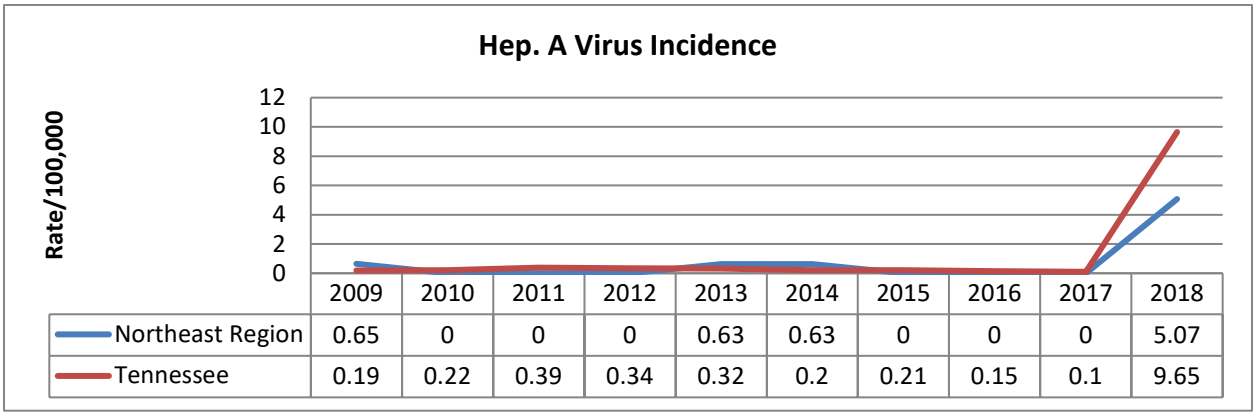
Source: Tennessee Department of Health

Reportable Diseases (Viral Infections)

For some following diseases and cancers, there were not enough cases in Sullivan County to report. In some cases, there were too few persons afflicted to report anonymously. In other cases, there were too few people per the population for the rate to be statistically significant, and these calculations are therefore unreliable. In both of these cases, neither rates nor counts were reported. These values were left blank in charts and figures for these years.

Hepatitis A Virus (Acute):[57]

10-Year Average Incidence/100,000: Sullivan County = 0.70; Tennessee = 1.18

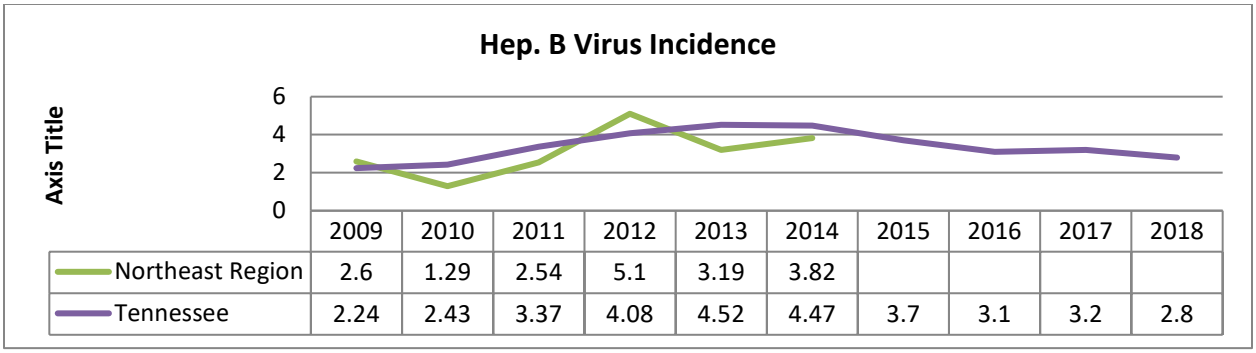


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Northeast Region	0.65	0	0	0	0.63	0.63	0	0	0	5.07
Tennessee	0.19	0.22	0.39	0.34	0.32	0.2	0.21	0.15	0.1	9.65

Source: Centers for Disease Control and Prevention, AtlasPlus

Hepatitis B Virus (Acute):[57]

10-Year Average Incidence/100,000: Sullivan County = 2.63 (2005-2014); Tennessee = 3.47

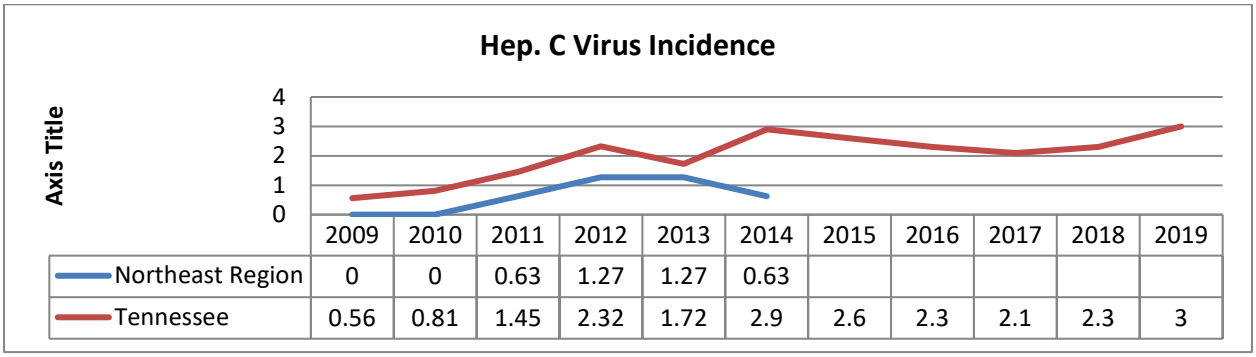


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Northeast Region	2.6	1.29	2.54	5.1	3.19	3.82				
Tennessee	2.24	2.43	3.37	4.08	4.52	4.47	3.7	3.1	3.2	2.8

Source: Centers for Disease Control and Prevention, AtlasPlus

Hepatitis C Virus (Acute):[57]

10-Year Average Incidence/100,000: Sullivan County = 0.71 (2005-2014); Tennessee = 2.15



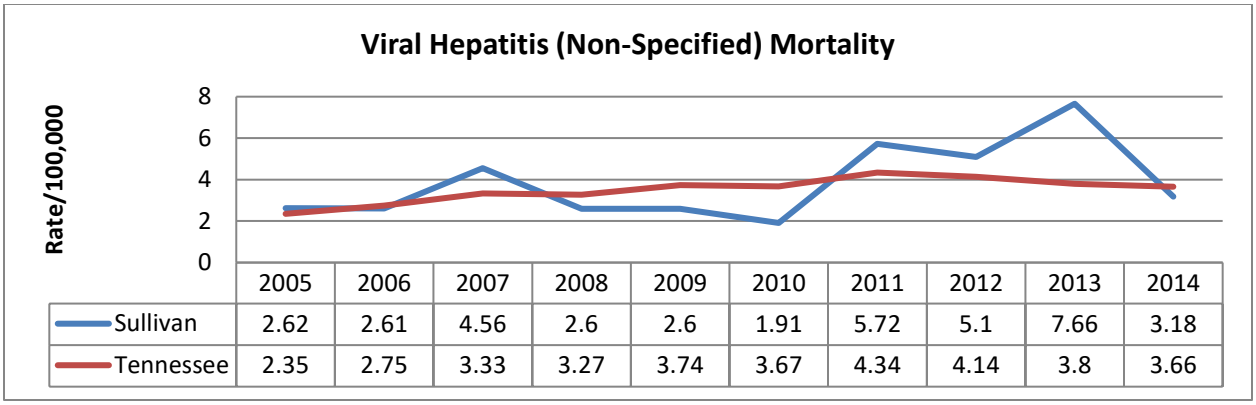
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Northeast Region	0	0	0.63	1.27	1.27	0.63					
Tennessee	0.56	0.81	1.45	2.32	1.72	2.9	2.6	2.3	2.1	2.3	3

Source: Centers for Disease Control and Prevention, AtlasPlus

In March 2016, the Centers for Disease Control and Prevention and the National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention conducted an analysis entitled "County-level Vulnerability to Rapid Dissemination of HIV/HCV Infection Among Persons who Inject Drugs". The purpose of this study was to identify counties in the United States that are potentially vulnerable to rapid dissemination of HIV/HCV infection among persons who inject drugs. Out of the 95 counties within the state of Tennessee, 41 counties, including Sullivan County, were identified within the study as being vulnerable to rapid dissemination of HIV/HCV Infection among persons who inject drugs. The results of this assessment provide a planning tool to help states detect and prevent the introduction and spread of HCV and avert HIV outbreaks like that which occurred in Scott County, Indiana in 2014.[59]

Viral Hepatitis Mortality (Non-Specified):[26]

10-Year Average Mortality/100,000: Sullivan County = 3.04 (2016-2020); Tennessee= 2.67(2016-2020)



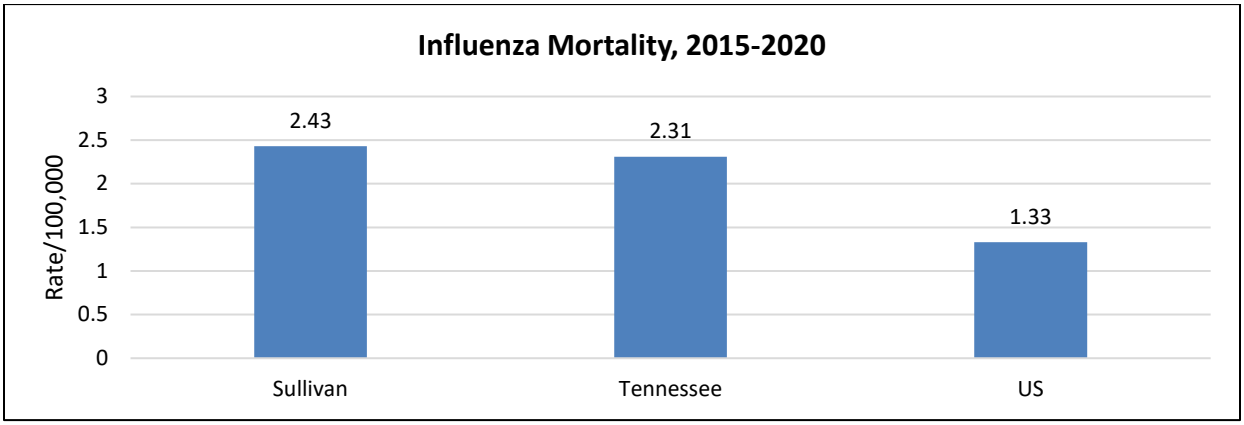
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Sullivan	2.62	2.61	4.56	2.6	2.6	1.91	5.72	5.1	7.66	3.18
Tennessee	2.35	2.75	3.33	3.27	3.74	3.67	4.34	4.14	3.8	3.66

Source: Tennessee Department of Health

Rates could not be reported by year for non-specified viral hepatitis mortality after 2014. Average rates for years 2016-2020 are reported above for both Sullivan County and Tennessee.

Influenza Mortality:[26]

10-Year Average Fatality/100,000: Sullivan County = 0.65; Tennessee = 0.65



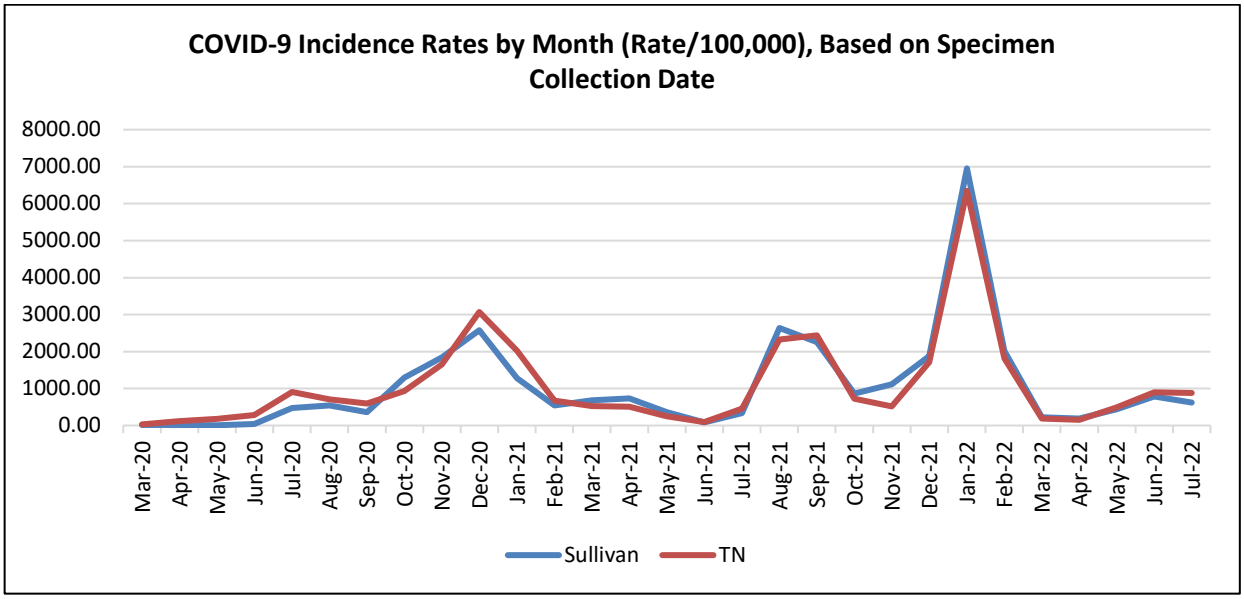
Source: CDC Wonder, Underlying Cause of Death Database

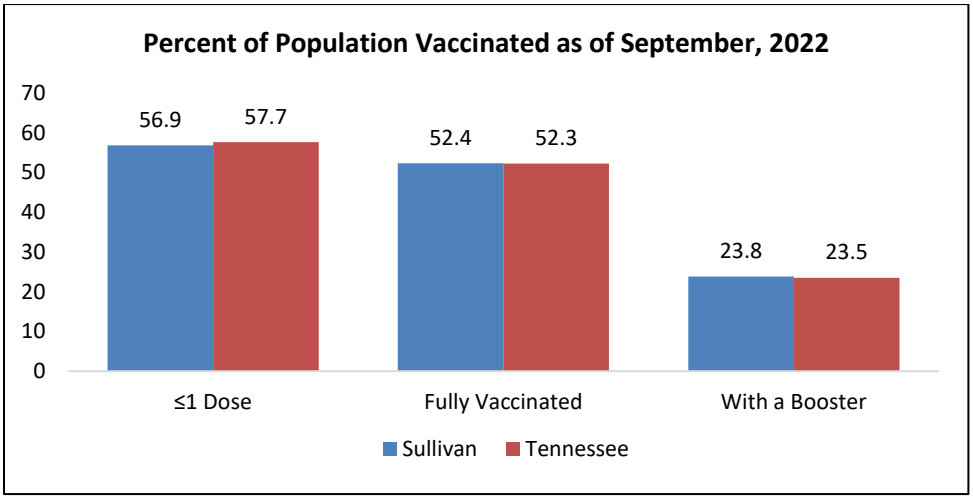
COVID-19:

In response to COVID-19, new data collection and analysis tools and programs were developed and utilized across the nation to allow for real-time tracking and reporting of incidence counts and rates for public health officials and the public alike. However, there are still some instances where reporting systems or facilities sometimes lag as the months change, and some cases have to be moved from one state to another or one county to another, all resulting in changing figures over time. The current monthly incidence rates and vaccination percentages at the time of authorship for Sullivan and Tennessee are displayed below.

Sullivan County incidence rates are are similar to those of the state from March of 2020 through the summer of 2022. Both Tennessee and Sullivan county saw their highest incidence rates in January of

2022, with over twice the incidence of previous December, 2020 and August-September, 2021 peaks. The percent of the population vaccinated against COVID-19 was also very similar between the county and state. While most of those who received at least one dose did finish the main series (fully vaccinated), less than half received a booster at the time of publication.[56]



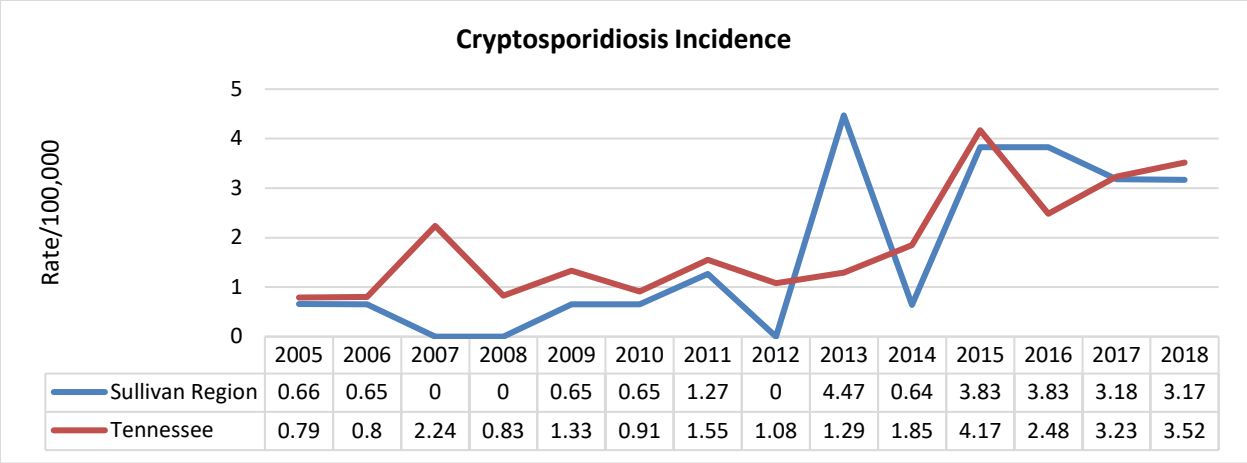


Source: Tennessee Department of Health, Sullivan County Regional Health Department

Reportable Diseases (Parasitic Infections)

Cryptosporidium:[56]

10-Year Average Fatality/100,000: Sullivan County = 2.17; Tennessee = 2.14



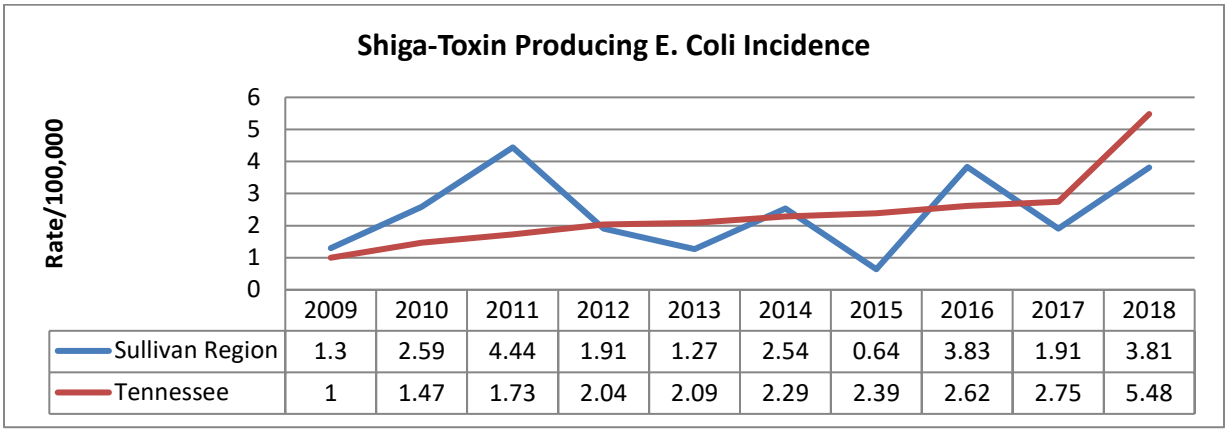
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	0.66	0.65	0	0	0.65	0.65	1.27	0	4.47	0.64	3.83	3.83	3.18	3.17
Tennessee	0.79	0.8	2.24	0.83	1.33	0.91	1.55	1.08	1.29	1.85	4.17	2.48	3.23	3.52

Source: Tennessee Department of Health

Reportable Diseases (Toxin-Mediated Infections):

Shiga-Toxin Producing E. Coli:[56]

10-Year Average Incidence/100,000: Sullivan County = 2.42; Tennessee = 2.39



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sullivan Region	1.3	2.59	4.44	1.91	1.27	2.54	0.64	3.83	1.91	3.81
Tennessee	1	1.47	1.73	2.04	2.09	2.29	2.39	2.62	2.75	5.48

Source: Tennessee Department of Health

HIV/AIDS:

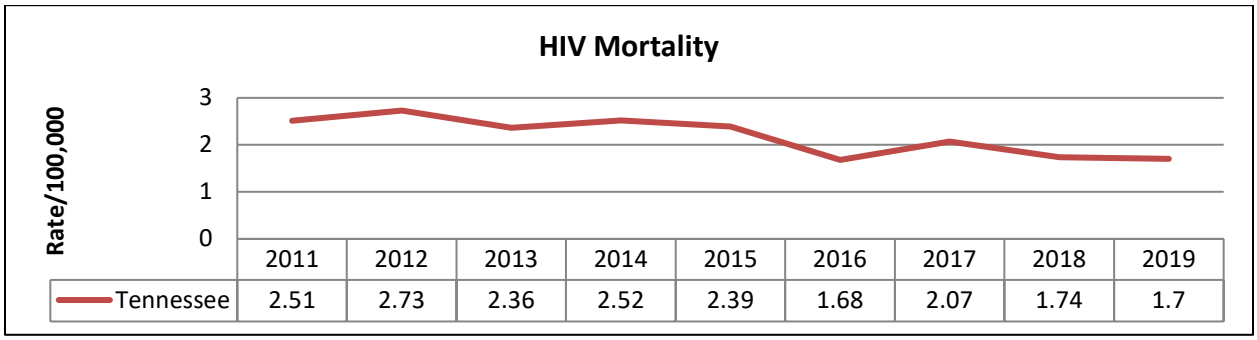
Human immunodeficiency virus (HIV) is a viral infection that attacks the body's immune system. Unlike many other viruses, the human body cannot rid itself of the HIV virus, so infection is lifelong. Because the virus weakens the immune system, people who contract HIV are more susceptible to developing other infections and certain types of cancer. Infections that typically do not occur in people with healthy immune systems, but occur in those with HIV infection, are referred to as "opportunistic infections". Although HIV is currently incurable, treatments exist that prolong and improve the quality of life for people with HIV infection.[60]

Acquired immunodeficiency syndrome (AIDS) is the final stage of HIV infection, and occurs when the immune system is severely impaired by HIV and is vulnerable to opportunistic infections. Not everyone who contracts HIV will develop AIDS.[60]

Human Immunodeficiency Virus (HIV) Mortality:[26]

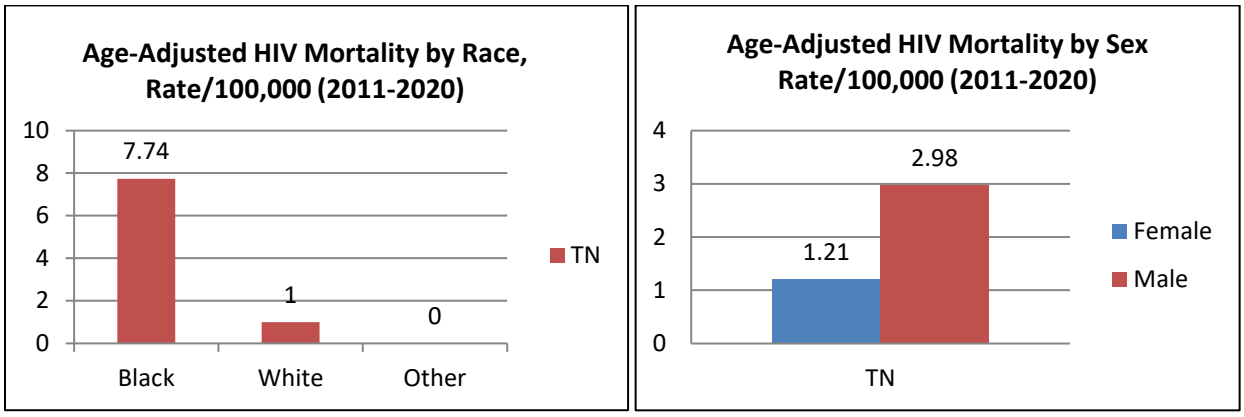
10-Year Average Incidence/100,000: Tennessee = 2.30

There are so few deaths in Sullivan County that reliable rates cannot be calculated. There was a total of 13 cases of HIV fatalities from 2011 to 2020. For a population the size of Sullivan County, there must be at least 20 counts for statically reliable rate calculations.[26] Fortunately, low HIV fatality has been consistent in this time period. State rates are reported bellow.



	2011	2012	2013	2014	2015	2016	2017	2018	2019
Tennessee	2.51	2.73	2.36	2.52	2.39	1.68	2.07	1.74	1.7

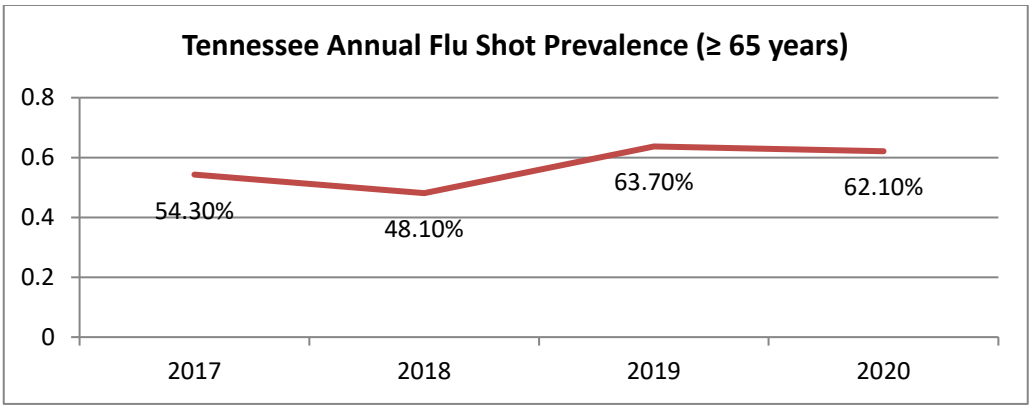
Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020



Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

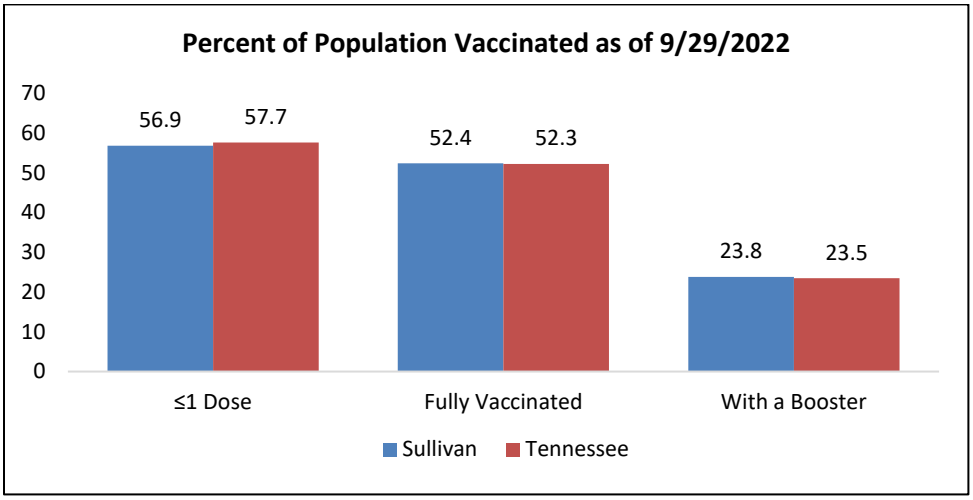
Communicable Disease Risk Factors:

Persons Aged 65 and Older Receiving Seasonal Influenza Vaccination within the Past 12 Months: [61]

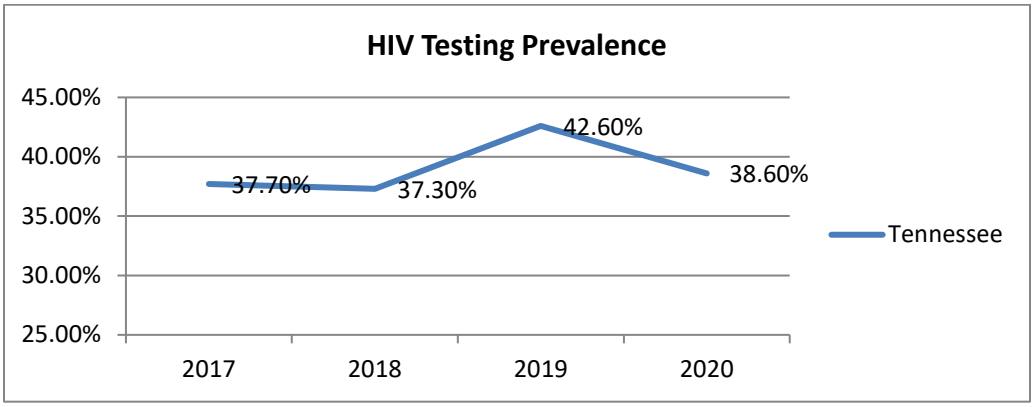


Source: Tennessee Department of Health

COVID-19 Vaccination[61]



HIV Testing (Lifetime History):[61]

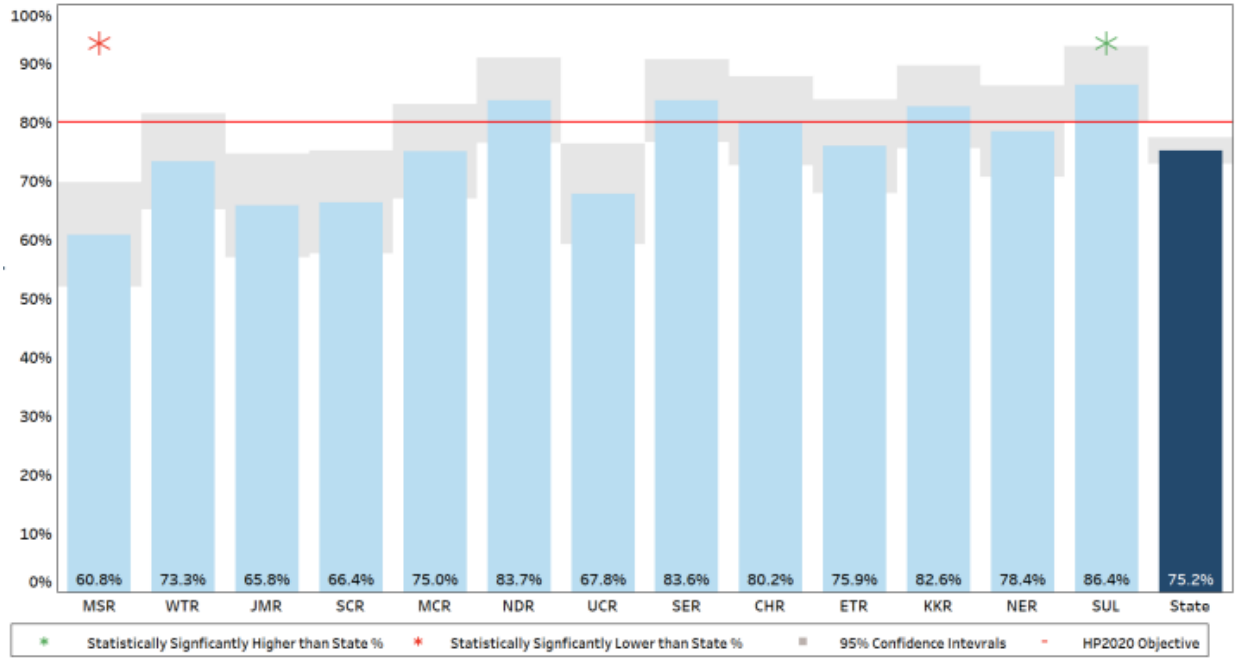


Source: Tennessee Department of Health, Behavioral Risk Factor Surveillance System

Immunization (Sullivan County):[62]

Below is an excerpt from a 2021 survey of immunization status in Tennessee, conducted by the Tennessee Department of Health. The colored boxes represent the percentage of children aged 24 months who have received doses of 4:3:1:FS:3:1:FS, the combined full series of DTaP, IPV, MMR, HIB, HBV, VAR, and PCV on time. Sullivan County (86.4%) had a statistically significantly higher percentage than the state (75.2%).

Percent of 24-month Old Children With On-Time 4:3:1:FS:3:1:4 Series



Source: Tennessee Department of Health

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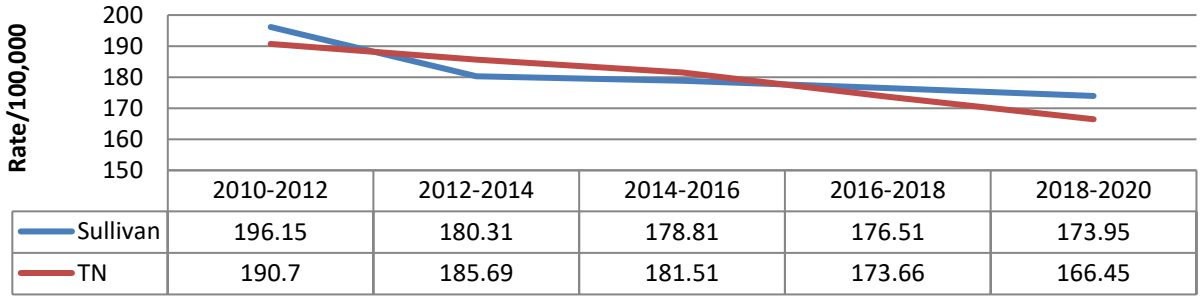
Cancer is a term that broadly applies to diseases that occur when abnormal cells multiply without control and, at times, spread to affect other parts of the body. There are more than 100 different types of cancer.[63] In this section, cancers that occur with high frequency or that have a high fatality rate for which regional data is publicly available are compared to rates for the state of Tennessee during a similar period. Additionally, the prevalence of cancer prevention behaviors is compared between Sullivan County and the state to identify areas of sustainment and improvement for cancer prevention.

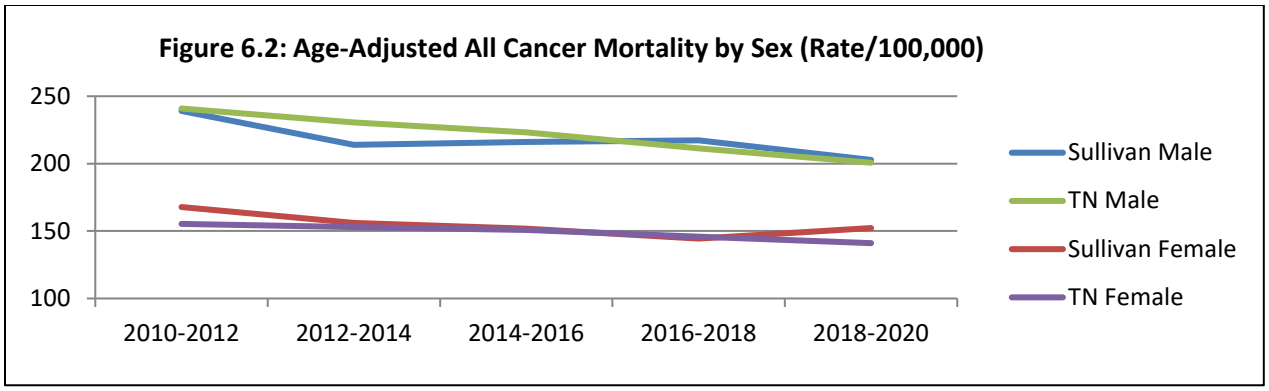
All Cancer Incidence & Mortality:

From 2010-2012 to 2018-2020, the three-year average age-adjusted rate of mortality due to all cancers combined reduced considerably for both Sullivan County and the State (see Figure 6.1). The rate of decrease was slightly greater in the state (-12.7%) than Sullivan County (-11.3%) during this period. Stratifying by sex, it is clear that, although the age-adjusted rate of all cancer mortality decreased during this period for both male and female residents of Sullivan County and the state, the decrease in mortality was greater among males (Sullivan County males = -15.2%; Tennessee males = -16.7%) than females (Sullivan County females = -9.2%; Tennessee females = -9.2%) (see Figure 6.2).[26] Due to the higher rate of decrease in cancer mortality among males during this period, the gap in cancer mortality between sexes was closed substantially. Decreases in trachea, bronchus, and lung cancer mortality, which represents the highest rates of specified cancer mortality in Tennessee, and of which males have the highest death rate, likely contributed greatly to closing this gap (see Figure 6.3). Although great progress has been made in reducing cancer mortality in Sullivan County, continued progress is needed to meet the HP2030 goal of reducing the overall cancer death rate to 122.7/100,000.

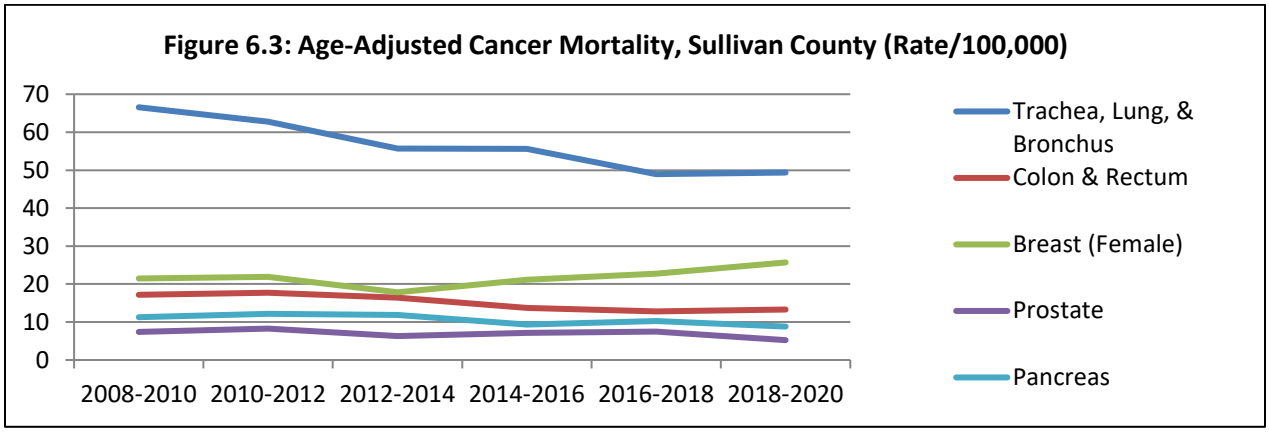
Figure 6.1: Age-Adjusted All Cancer Mortality

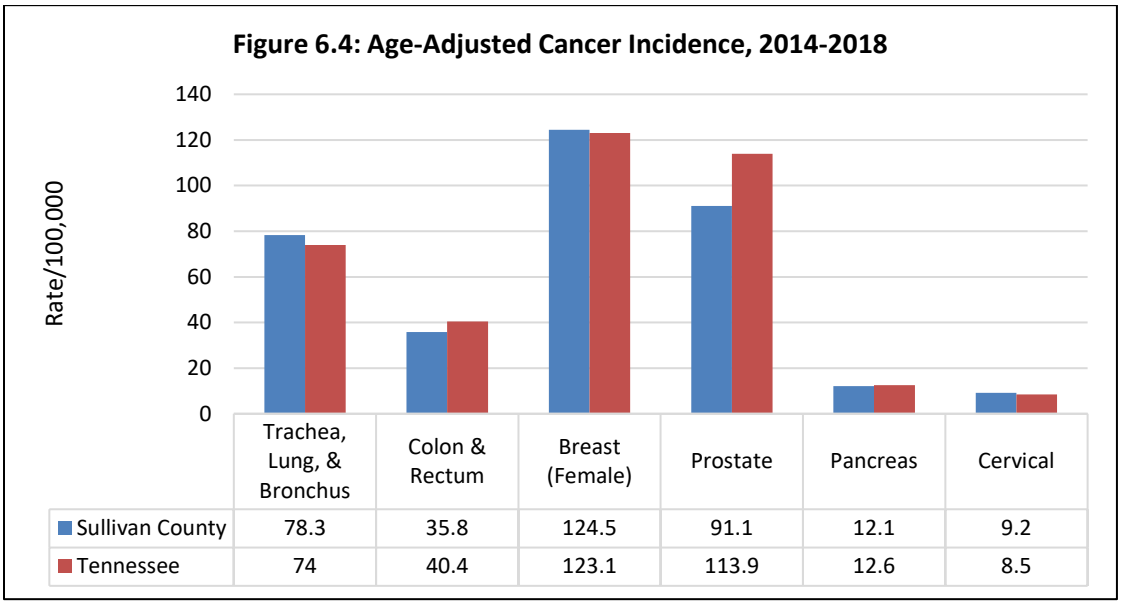


	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	196.15	180.31	178.81	176.51	173.95
TN	190.7	185.69	181.51	173.66	166.45



Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020





Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Trachea, Lung, & Bronchus Cancer:

Risk Factors:

Cigarette smoking is the leading risk factor for lung cancer, associated with approximately 80-90% of all lung cancers. Smokers are between 15 to 30 times more likely to develop lung cancer. The risk of lung cancer increases as the length of time smoking and the number of cigarettes smoked per day increases.[64] Secondhand smoke is also known to cause lung cancer. It is estimated that one out of four nonsmokers in the US and approximately one half of all children in the US are exposed to secondhand smoke.[65]

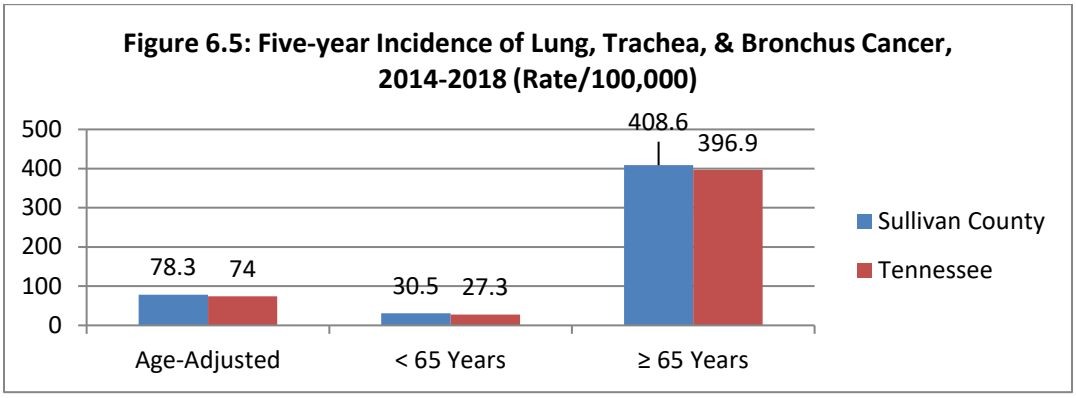
Radon, a naturally occurring radioactive gas that is present in home environments, is the second leading cause of lung cancer death. Nearly one in 15 US households have high levels of radon.[64] Sullivan County is categorized by the US Environmental Protection Agency as having the highest risk level for indoor radon (average household level, 2015 > 4 pCi/L).[66] Health experts recommend individuals to have their homes tested for radon. A home's radon level is modifiable, as radon abatement systems may be installed to reduce the levels of radon gas in a home.

Workplace exposure to toxic substances including: asbestos, arsenic, diesel exhaust, some forms of silica, and chromium, increases risk of lung cancer. The risk of lung cancer due to exposure to some of these substances is increased in people who smoke. Additionally, people with a family history of lung cancer have a higher risk for developing the disease. This may be due to common exposures in the home environment. Dietary factors may increase or decrease risk of developing lung cancer. More research is needed to understand the effects of dietary intake on lung cancer risk.[64]

Lung Cancer Incidence:

In 2019, US incidence of lung and bronchus cancer was 41.1/100,000.[67] From 2014-2018, there was no difference in the five-year average age-adjusted risk of lung cancer between Sullivan County (78.3/100,000) and Tennessee (74.0/100,000). For both the state and Sullivan County, risk of cancer was pronouncedly greater among persons aged 65 and older. (see Figure 6.5).[68] This is not surprising, as lung cancer is largely resultant of cumulative accrual of environmental exposure to toxic substances.

Figure 6.5: Five-year Incidence of Lung, Trachea, & Bronchus Cancer, 2014-2018 (Rate/100,000)



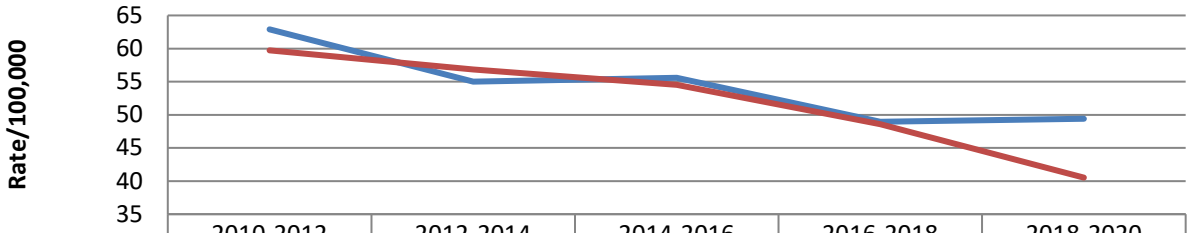
Source: National Cancer Institute

Lung Cancer Mortality:

From 2010-2012 to 2018-2020, rates of fatality from trachea, lung, and bronchus cancer were slightly higher in Sullivan County than the state. Mortality rates have declined more steadily in recent years for

the state (-32.2%) than in Sullivan County (-21.5%) (see Figure 6.6).[26] Sullivan County does not currently meet the HP2030 goal of reducing the rate of lung cancer death to 25.1/100,000.

Figure 6.6: Age-Adjusted Trachea, Lung, and Bronchus Cancer Mortality

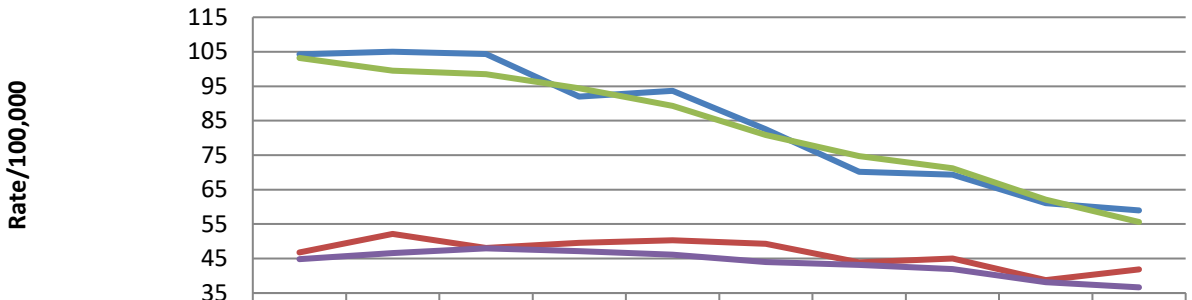


	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	62.9	55.02	55.6	48.95	49.39
TN	59.73	56.83	54.54	48.59	40.52

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Rates of lung cancer mortality declined more among males than females during this period. The rates of decline observed by sex have been similar for both regions (see Figure 6.7).[26]

Figure 6.7: Age-Adjusted Trachea, Bronchus, and Lung Cancer Mortality by Sex



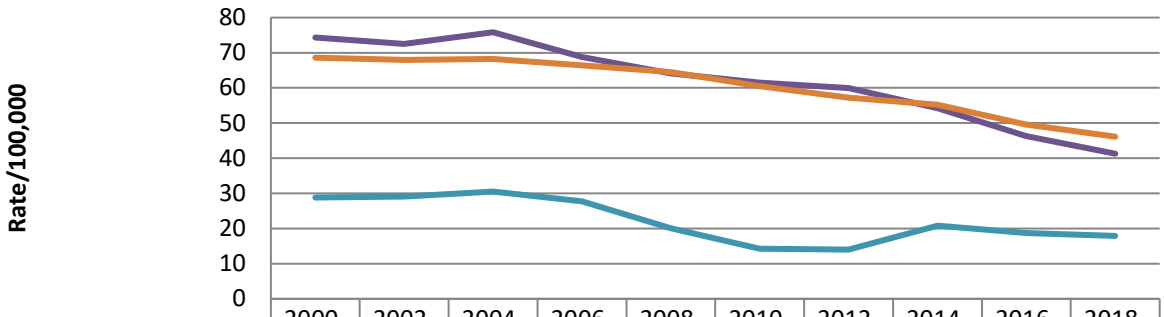
	2000-2002	2002-2004	2004-2006	2006-2008	2008-2010	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan Male	104.21	105.01	104.31	92.02	93.64	82.54	70.21	69.37	61.06	58.97
TN Male	103.19	99.5	98.46	94.39	89.3	80.84	74.74	71.16	62.12	55.61
Sullivan Female	46.82	52.15	48.06	49.58	50.31	49.31	43.86	45.01	38.75	41.82
TN Female	44.79	46.61	47.96	47.15	46.15	43.99	43.18	41.99	38.14	36.65

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Lung cancer mortality has historically been difficult to report by race in Sullivan County. As African Americans comprised 2% of Sullivan's population in 2020, a small (possibly anomalous) change in annual mortality frequency would have a much greater effect on the fatality rate among African Americans than would be observed by a similar change in frequency among Caucasians in a given year. Furthermore, there were 13 lung, trachea, and bronchus cancer deaths among this population between 2011-2020. These are too few deaths to calculate reliable rates even for the decade. Mortality rates for the state are

displayed by race below. A consistent decrease in rate over the decade is appreciated for both Caucasian and African American populations (See Figure 6.8).[26]

Figure 6.8: Age-Adjusted Trachea, Lung, and Bronchus Cancer Mortality by Race in Tennessee



	2000-2002	2002-2004	2004-2006	2006-2008	2008-2010	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
African American	74.34	72.53	75.83	68.8	64.17	61.48	59.92	54.2	46.31	41.28
Caucasian	68.6	68	68.21	66.43	64.54	60.47	57.24	55.21	49.53	46.13
Other	28.83	29.13	30.51	27.75	20.09	14.26	14	20.79	18.71	17.86

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Opportunities for Public Health Intervention:

Behavioral Risk Reduction:

Promotion of smoking prevention and support of smoking cessation are the most impactful activities public health practitioners may take to reduce the incidence of lung cancer is Sullivan County. Additionally, community education of secondhand smoke risk and promotion of secondhand smoke reduction is needed to lower community exposure levels to harmful chemicals from environmental tobacco smoke. Smoking indoors, particularly in rental housing, and in cars are common sources of second-hand smoke exposure. Promotion of a healthy diet, with recommended intake of fruits and vegetables, as well as recommended levels of physical activity may reduce lung cancer risk. Studies suggest that smokers are more likely to maintain poor dietary habits and be physically inactive than nonsmokers.[69]

Environmental Risk Reduction:

Community education of indoor radon risk and radon removal options is needed to inform and empower individuals to reduce their exposure to radon gas at home. Smokers are an important audience to receive this information, as studies have shown that lung cancer risk from radon exposure is increased in people who smoke. Additionally, worker safety regulations for control of toxic workplace exposures should be promoted and enforced.[69] Workers in high risk industries should know their risk and understand how to protect themselves and that their protection is guaranteed by state and federal law.

Colon & Rectum Cancer:

Risk Factors:

Colorectal cancer is the second leading cause of cancer-related death among cancers that affect both men and women. Death from colorectal cancer is preventable if early detection is achieved from regular screening.[70] Some risk factors for colorectal cancer cannot be changed, including: age over 50 years, previous history of colorectal polyps or cancer, a history of inflammatory bowel disease, African American race, and having type two diabetes. However, there are some risk factors that may be changed.[71]

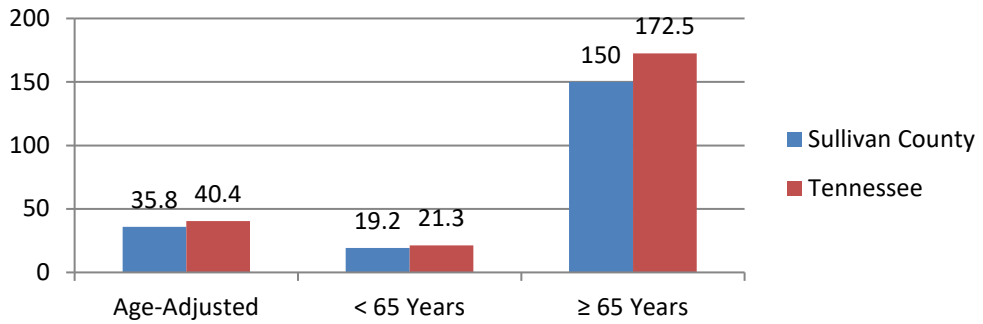
Overweight or obesity increases risk of colon cancer in both men and women, but the association may be stronger in men. Physical inactivity also increases colon cancer risk, while engaging in regular physical activity lowers risk. Dietary intake of individuals may increase or decrease the risk of developing colon cancer depending upon characteristics of one's diet. Diets high in red meats or processed meats increase risk of colon cancer, while diets high in fruits, vegetables, and whole grains are associated with lower risk. Additionally, cooking meats at high temperatures creates chemicals that increase colon cancer risk.[71]

Other behavioral risk factors for colon cancer include smoking and heavy consumption of alcohol. Long-time smokers are more likely to both develop colon cancer and to die from the disease than people who do not smoke. While heavy alcohol consumption is related to increased risk of colon cancer, light use (two or less drinks per day for men and one per day for women) may lower risk of colorectal cancer.[71]

Colorectal Cancer Incidence:

Nationally, the incidence rate of colon and rectum cancer in 2018 was 38.0/100,000.[68] From 2014-2018, the five-year average incidence of colorectal cancer was slightly lower in Sullivan County (35.8/100,000) than Tennessee (40.4/100,000). While incidence was almost identical among persons younger than 65 in both regions, incidence among seniors aged 65 and older was notably higher throughout Tennessee (172.5/100,000) than Sullivan County (150/100,000) (see Figure 6.9).[68]

Figure 6.9: Colon & Rectum Cancer Incidence, 2014-2018 (Rate/100,000)

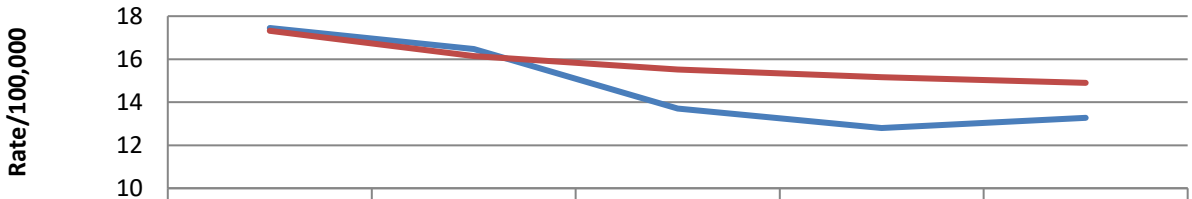


Source: National Cancer Institute

Colorectal Cancer Mortality:

From 2010-2012 to 2018-2020, rates of fatality from colon, rectum, and anus cancer were lower in Sullivan County than the state. Although there seems to have been greater variability in the rate of mortality in Sullivan County than the State, the linear trend over the period is similar to that of Tennessee. Additionally, the percent change in mortality rates has declined for both Sullivan County (-23.9%) and Tennessee (-14.0%) (see Figure 6.10).[26] Although Sullivan County does not currently meet the HP2030 goal of reducing colorectal cancer mortality to 8.9/100,000, if the downward trend continues, this goal may soon be met.

Figure 6.10: Age-Adjusted Colon, Rectum, and Anus Cancer Mortality

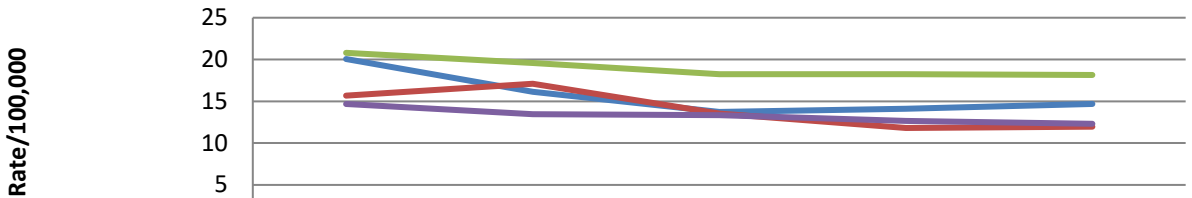


	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	17.45	16.47	13.7	12.8	13.28
TN	17.32	16.14	15.52	15.17	14.9

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

The age-adjusted rate of colon, rectum, and anus cancer mortality was similar between Sullivan County and the state during this period for both sexes. Males had a higher rate of mortality than females during this period, but the difference continues to reduce over time. In fact, in 2012-2014, the three-year average colorectal cancer mortality rate for both sexes had not only converged, but reversed direction whereby women had a slightly higher rate of mortality from this disease in Sullivan County; however, men continued to have higher mortality rates in the following years (see Figure 6.11).[26]

Figure 6.11: Age-Adjusted Colon, Rectum, and Anus Cancer Mortality by Sex

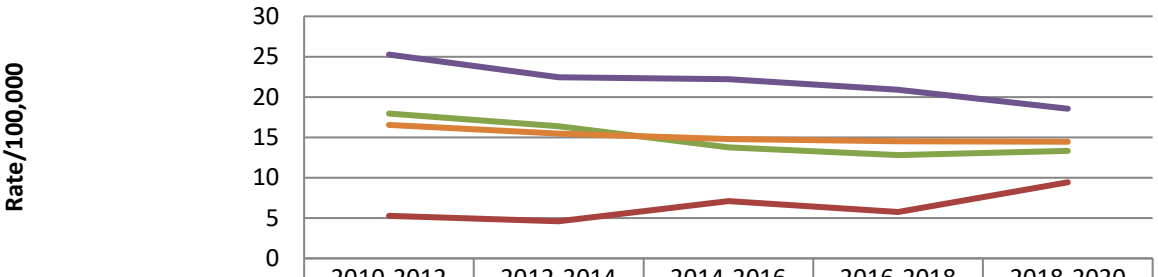


	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan Male	20.06	16.13	13.73	14.12	14.67
TN Male	20.8	19.6	18.23	18.23	18.15
Sullivan Female	15.67	17.1	13.53	11.81	11.95
TN Female	14.68	13.44	13.34	12.66	12.31

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Throughout the state, from 2010-2012 to 2018-2020, African Americans had a higher rate of colorectal cancer mortality than Caucasians. Although mortality rates decreased for both races during this period, the rate of decrease was higher among African Americans (-26.6%) than Caucasians (-12.6%) in Tennessee. Mortality rates among Caucasians in Sullivan County were comparable to the state throughout this period. Due to the small population of African Americans and other races in Sullivan County, and there being less than nine deaths among the population in ten years, there are no reliable statistics in these categories available to compare rates (see Figure 6.12).[26]

Figure 6.12: Age-Adjusted Colon, Rectum, and Anus Cancer Mortality by Race



	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
TN African American	25.26	22.44	22.2	20.9	18.55
Sullivan Caucasian	17.95	16.38	13.76	12.8	13.32
TN Caucasian	16.54	15.48	14.8	14.51	14.46
TN Other	5.27	4.6	7.11	5.74	9.43

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Opportunities for Public Health Intervention:

Behavioral Risk Reduction:

Screening for colorectal cancer should be promoted, as early detection and treatment often prevents death. Smoking avoidance and cessation should also be promoted, as well as moderate consumption of alcohol (two or less drinks per day for men and one drink per day for women), to reduce risk of the disease. Additionally, promotion of a diet low in fat and red meat while rich in fiber, fruits, and vegetables, as well as promotion of physical activity lowers risk of the disease, as does prevention of obesity.[72] Another opportunity for prevention is to increase acceptance of the human papillomavirus (HPV) vaccination, commonly referred to as "Gardasil," as HPV is attributable to about 95% of anal cancers.[73]

Environmental Risk Reduction:

Community promotion of healthy eating as well as facilitating access to healthy foods will foster adoption and maintenance of a healthy diet. Additionally, ensuring community access to recreation areas will promote physical activity. Research has found that environmental changes to increase access to recreation, such as access to public parks, walking trails, and community recreation centers, increase community levels of physical activity.[74]

Female Breast Cancer:

Risk Factors:

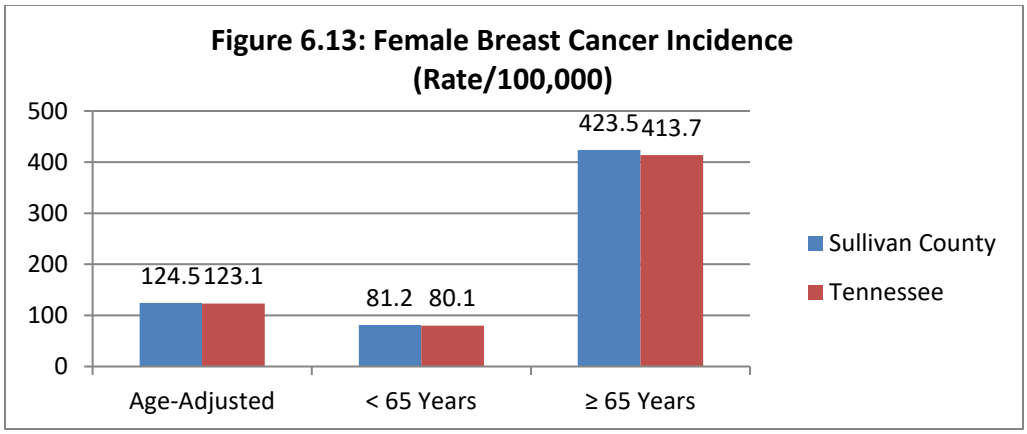
There are many factors associated with development of female breast cancer. Often, women who develop breast cancer may have more than one risk factor. However, some women who develop breast cancer may have no apparent risk factors at all. It is often difficult for health experts to know which exact factors are attributable to individual cases of breast cancer. Although men may also develop the disease, breast cancer is more than 100 times more common among women. Accordingly, this section is exclusive to female breast cancer.[75]

A number of risk factors are not modifiable, but are useful for individuals and healthcare providers to be aware of. As with most cancers, risk of breast cancer increases with age. Most invasive forms develop in women older than 55 years of age. Specific inherited genes play a role in cancer development. Heredity, referring to genes passed from parent to child, is attributed to between 5% - 10% of breast cancer cases. Family or personal breast cancer history increases risk as well. African American women have a higher risk, while Asian, Hispanic, and Native American women have a lower risk of developing breast cancer. Additionally, women with dense breast tissue and those with initiation of menstruation prior to age 12 or those with initiation of menopause after age 55 are at increased risk for breast cancer.[75]

Modifiable risk factors are those that are amenable to changes in lifestyle or living conditions. Some of these include: alcohol consumption, overweight or obesity, physical inactivity, and post-menopausal hormone therapy. As with other cancers, risk of breast cancer increases with heavy alcohol consumption. Women who consume two to five alcoholic drinks daily have about 1 ½ times the risk of developing breast cancer than women who abstain. Being overweight or obese after menopause increases risk of breast cancer. Conversely, physical activity reduces the risk. The American Cancer Society recommends getting at least 2 ½ hours of moderate intensity activity or 75 minutes of vigorous intensity activity each week.[75]

Breast Cancer Incidence:

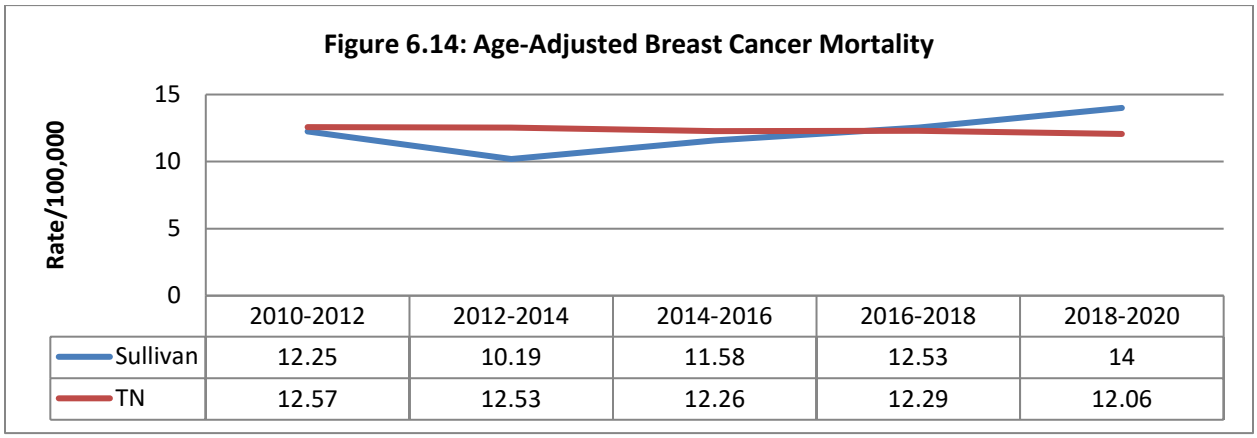
In 2018, national incidence of female breast cancer in the US was 126.3/100,000.[68] From 2014-2018, the five-year average age-adjusted breast cancer incidence rate for Sullivan County (124.5/100,000) was almost identical to that of Tennessee (123.1/100,000). This is an increase to the previous five-year average rate of 121.1 in Sullivan County and 121.7 for the state. Incidence was slightly higher in Sullivan County among persons younger than 65 as well as among seniors aged 65 and older compared to the state (see Figure 6.13).[26]



Source: National Cancer Institute

Breast Cancer Mortality:

From 2010-2012 to 2018-2020, age-adjusted rates of breast cancer mortality remained consistent for both Sullivan County and the state. There was an increase in Sullivan County (14.3%) and a slight decrease in Tennessee (-4.1%) (see Figure 6.14).[26] Both Sullivan County and Tennessee met the HP2030 goal to reduce the female breast cancer mortality rate to 15.3/100,000.

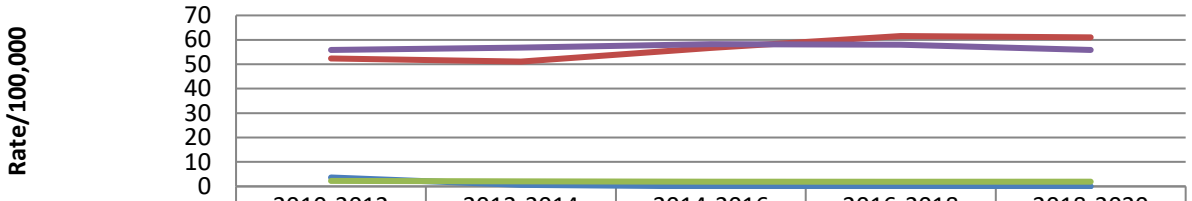


	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	12.25	10.19	11.58	12.53	14
TN	12.57	12.53	12.26	12.29	12.06

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

As with most cancers, rates of breast cancer are much higher among persons aged 65 and older.[26]

Figure 6.15: Female Breast Cancer Mortality by TDH Age Group

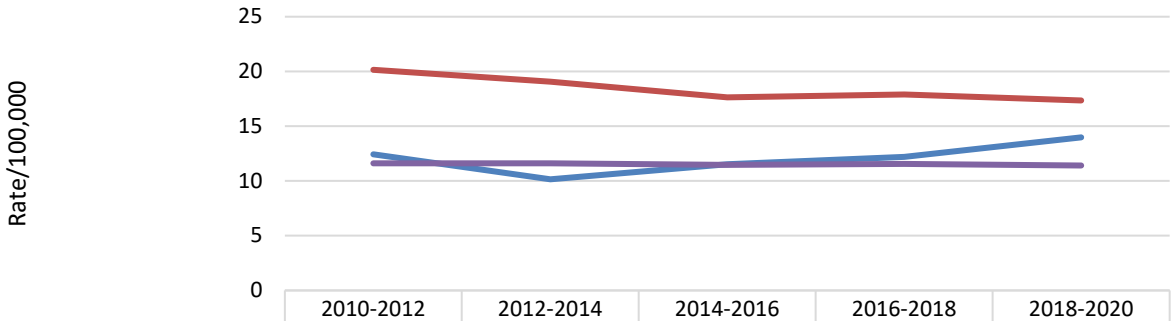


	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan 15-44	3.65	0.62	0	0	0
TN 15-44	2.25	2.03	1.99	1.91	1.96
Sullivan 65+	52.33	51.1	56.71	61.56	60.99
TN 65+	55.86	56.82	58.23	58.05	55.86

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Rates of breast cancer mortality have decreased proportionately among Caucasians in Sullivan County and throughout Tennessee. The rate of breast cancer mortality is notably higher among African American women throughout the state, while there were too few cases among this population in Sullivan County. As stated previously, mortality rates among African Americans in Sullivan County are vulnerable to large effects by small changes in numbers because the population of African Americans in Sullivan County is small, especially when restricting the sample to women alone. The rate of mortality decline among African American women at the state level appears to be similar to that among Caucasian women (see Figure 6.16).[26]

Figure 6.16: Age-Adjusted Female Breast Cancer Mortality by Race



	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan Caucasian	12.42	10.15	11.53	12.2	13.98
TN African American	20.15	19.08	17.63	17.91	17.35
TN Caucasian	11.61	11.61	11.48	11.56	11.41

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Opportunities for Public Health Intervention:

Behavioral Risk Reduction:

Risk of developing breast cancer may be reduced among women by moderating consumption of alcohol to one drink per day or less. Additionally, obesity prevention through physical activity reduces risk as well.

Women may consult their healthcare provider about their breast cancer risk when considering use of oral contraceptive pills or Depo-Provera injections.[75]

Environmental Risk Reduction:

Environmental risk reduction may be achieved by facilitating and promoting increased physical activity through access to recreational areas.

Prostate Cancer:

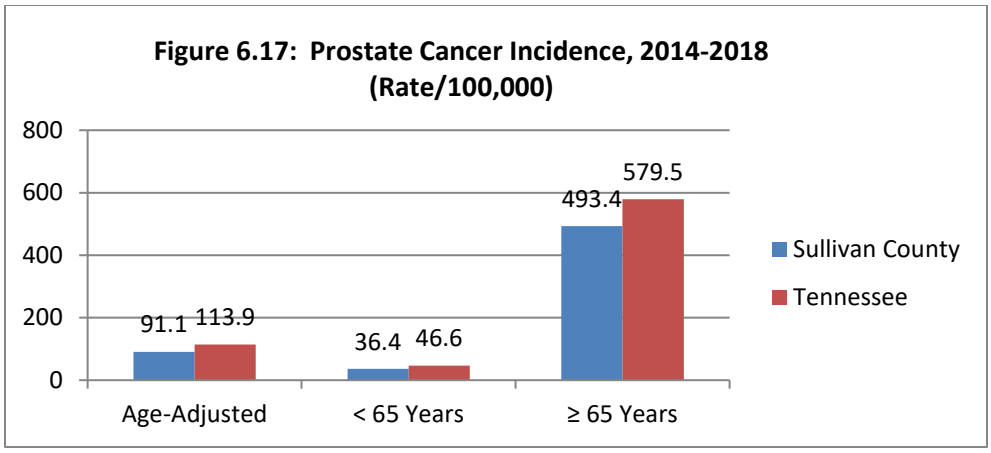
Risk Factors:

Like all cancers, some risk factors for prostate cancer are not modifiable, meaning they are not amenable to behavioral or environmental changes. These include age over 50, African American race, and family history of prostate cancer. Risk of prostate cancer increases greatly after age 50 and 60% of cases occur in men older than 65 years. There appears to be an inherited risk for prostate cancer as well. Men's risk is more than doubled if they have a father or brother with the disease, and risk increases as more relatives are affected.[76]

The associations of modifiable risk factors with prostate cancer remain largely unclear. Diet likely plays a role in prostate cancer risk, but causality is difficult to determine. Research indicates that men who eat a lot of red meat or high-fat dairy products may have a slightly higher risk of developing prostate cancer. However, it is unknown whether this is due to the red meat and high-fat dairy products, or because men who consume diets high in these foods tend to consume fewer servings of fruits and vegetables. Although obesity does not appear to increase the risk of developing prostate cancer, some studies have found that obese men who develop prostate cancer may be more likely to die from the disease than men who are not obese. However, studies investigating this association have produced conflicting results. Workplace environmental exposure may play a role in prostate cancer development as well. Firefighters and Vietnam veterans who were exposed to agent orange may have increased risk of developing prostate cancer, but the strength of evidence is considered weak.[76]

Prostate Cancer Incidence:

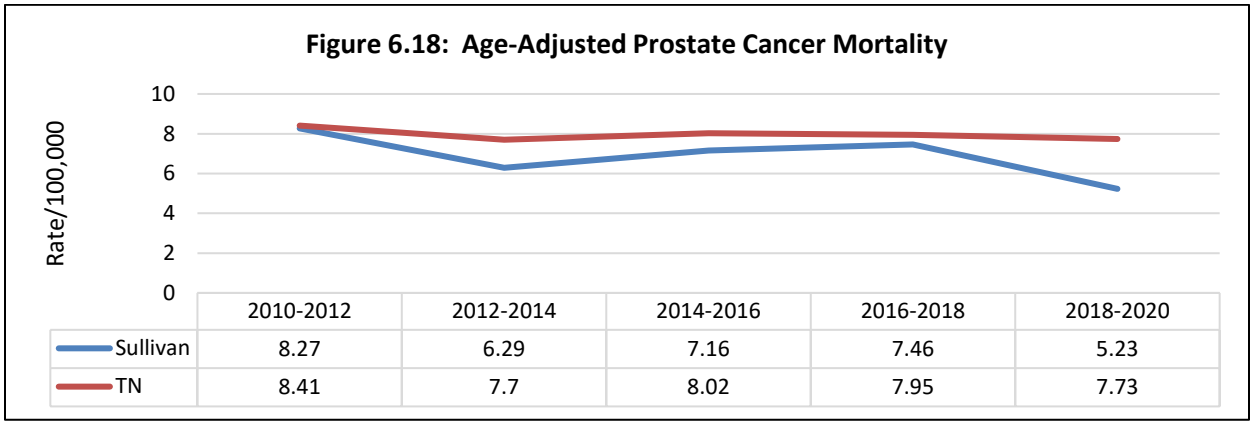
In 2018, national incidence of prostate cancer in the US was 107.5/100,000.[68] From 2014-2018, the five-year average age-adjusted breast cancer incidence rate for Sullivan County (91.1/100,000) was notably lower than that of Tennessee (113.9/100,000). This was true for both persons younger than 65 and those aged 65 and older (see Figure 6.17).[68]



Source: National Cancer Institute

Prostate Cancer Mortality:

From 2000-2002 to 2012-2014, the three-year average age-adjusted prostate cancer mortality rate for Sullivan County was consistently lower than that of the state. Although the mortality rate trend in Sullivan County varied between decreasing and increasing over this period, the overall trend was negative. The percent decrease in prostate cancer mortality was higher in Sullivan County (-36.8%) over this period than in Tennessee (-8.1%) (see Figure 6.18).[26] Both Sullivan County and the state meet the HP2030 goal to reduce the prostate cancer death rate to 16.9/100,000.

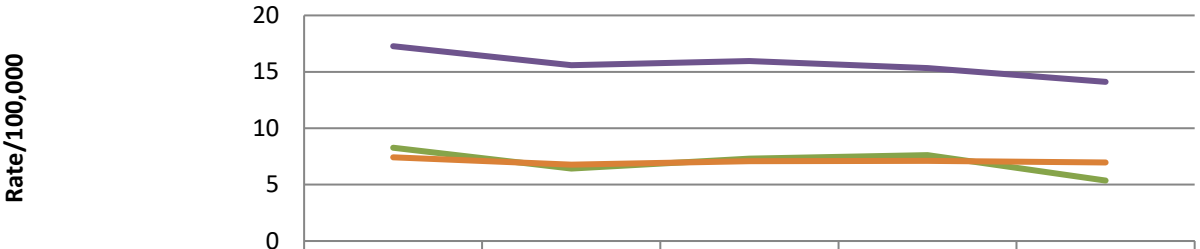


	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	8.27	6.29	7.16	7.46	5.23
TN	8.41	7.7	8.02	7.95	7.73

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

As with many cancers, rates of prostate cancer mortality are higher in Tennessee among African Americans than Caucasians. Throughout the period, rates of prostate cancer mortality were nearly equal among Caucasian men in Sullivan County and the state. As stated previously in this section, there is unreliability in three-year average mortality rate calculations among Sullivan County African Americans during this period due to the vulnerability of small populations to effect size distortion from anomalous changes. However, the period average fatality rate for Sullivan County (7.0/100,000) and Tennessee Caucasian males (7.1/100,000) were nearly half of that of African American males in Tennessee (15.6/100,000) (see Figure 6.19).[26]

Figure 6.19: Age-Adjusted Prostate Cancer Mortality by Race

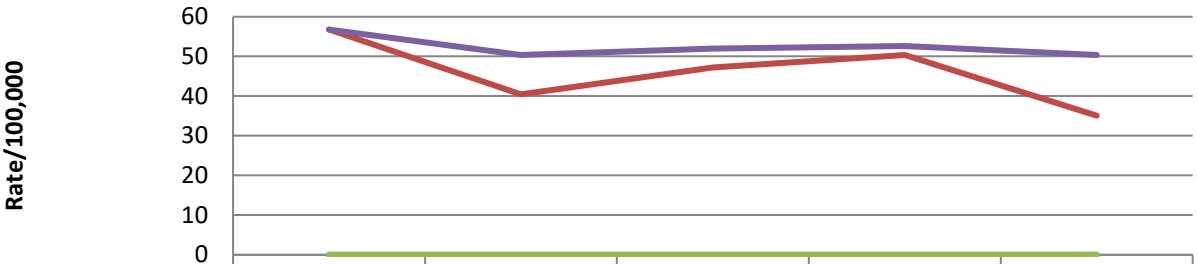


	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan Caucasian	8.27	6.41	7.3	7.62	5.36
TN African American	17.27	15.58	15.95	15.33	14.11
TN Caucasian	7.42	6.77	7.09	7.11	6.95

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

The average three-year prostate cancer mortality rate decreased in the 65 years and older population in both Sullivan County (-38.3) and Tennessee (-11.2) from 2010-2012 to 2018-2022. There were so few fatalities in the 15 to 44 age group that numbers could not be reported to protect the anonymity of the patents. Zeros are reported for display, as the rates are likely to be very low, close to zero, in this group, as less than nine individuals had passed from prostate cancer from 2010-2020 in Tennessee.[26]

Figure 6.20: Prostate Cancer Mortality by TDH Age Group



	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan 65+	56.79	40.46	47.25	50.35	35.06
TN 65+	56.76	50.37	51.95	52.61	50.38
Sullivan 15-44	0	0	0	0	0
TN 15-44	0	0	0	0	0

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Opportunities for Public Health Intervention:

Behavioral Risk Reduction:

Although understanding of modifiable risk and protective factors for prostate cancer is limited, maintaining a diet rich in fruits and vegetables may aid in reducing the incidence and mortality rate of prostate cancer in Sullivan County. Encouraging men to consume fewer quantities of red meat and high-fat dairy products while encouraging cultivation of an active lifestyle may aid in this effort.

Pancreatic Cancer:

Risk Factors:

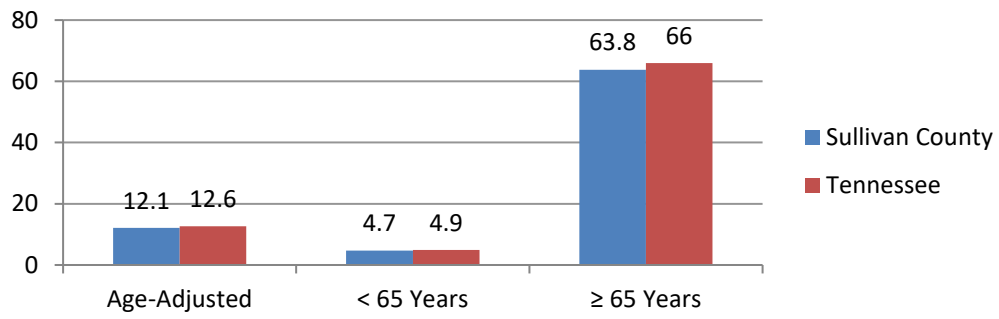
As with other cancers, many of the risk factors for pancreatic cancer cannot be changed. These include age older than 65, male gender (due in part to higher rates of tobacco use by men), African American race, and a family history of pancreatic cancer as well as a number of inherited genetic syndromes. Additionally, medical conditions such as diabetes, chronic pancreatitis, and liver cirrhosis are linked to increased rates of pancreatic cancer.[77]

Risk factors for pancreatic cancer that may be controlled include poor diet, physical inactivity, and heavy consumption of alcohol. Diets that are high in red meats and processed meats, as well as those that are low in fruits and vegetables, have been linked in some studies to pancreatic cancer. However, results of studies have been conflicting. Additionally, some studies have found evidence of an association between physical inactivity and pancreatic cancer; but not all studies have found such associations. Additionally, there is inconsistent evidence that heavy consumption of alcohol may be associated with developing pancreatic cancer. This is a plausible association, as heavy drinking is associated with development of other risk factors, such as chronic pancreatitis and cirrhosis.[77]

Pancreatic Cancer Incidence:

In 2018, national incidence of pancreatic cancer in the US was 13.1/100,000.[68] From 2014-2018, the five-year average age-adjusted pancreatic cancer incidence in Sullivan County (12.1/100,000) was modestly lower than that of the nation in 2018, and almost identical to the average incidence for Tennessee (12.6/100,000). Like most cancers, pancreatic cancer incidence is highest among persons aged 65 and older. (Figure 6.21).

Figure 6.21: Pancreatic Cancer Incidence, 2014-2018 (Rate/100,000)

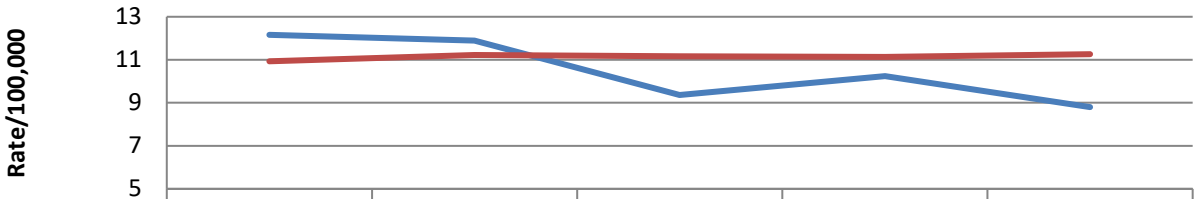


Source: National Cancer Institute

Pancreatic Cancer Mortality:

From 2010-2012 to 2018-2020, the three-year average age-adjusted pancreatic cancer mortality rates have decreased for Sullivan County (-27.6%), but actually increased in Tennessee (+3%). Although the percent increase in mortality was higher in Tennessee than the county, there was more variability in Sullivan County over this period, and the average of three-year mortality rates from 2010-2012 to 2018-2020 in Sullivan County (10.6/100,000) was very close to the average for Tennessee (11.1/100,000) (see Figure 6.22).[26]

Figure 6.22: Age-Adjusted Pancreatic Cancer Mortality

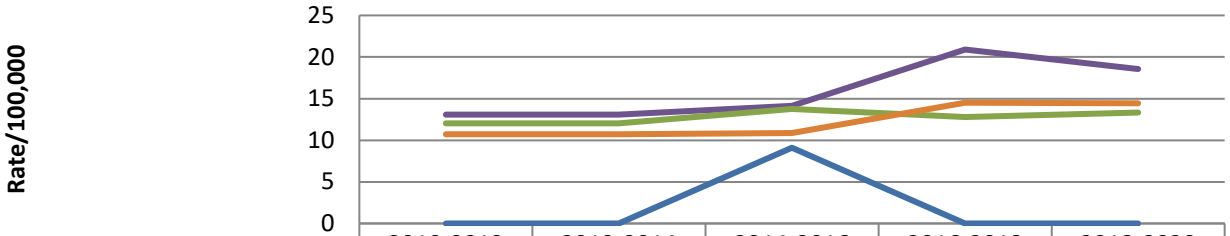


	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	12.16	11.89	9.36	10.24	8.8
TN	10.93	11.22	11.17	11.14	11.26

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Over this period, pancreatic cancer mortality was higher in Tennessee among African Americans than Caucasian persons. The rate of fatality among Sullivan County Caucasians was similar to that observed among Caucasian persons across the state. As with the cancers reported previously in this document, three-year average rates of pancreatic cancer were widely unreported among African Americans in Sullivan County due to vulnerability of estimates to small sample sizes, and these values are reported as zeros. There was, however, one three-year average rate with enough cases to report in 2014-2016 (9.1/100,000) indicating that rates may be slightly lower than that seen in African Americans in the state (see Figure 6.23).[26]

Figure 6.23: Age- Adjusted Pancreatic Cancer Mortality by Race

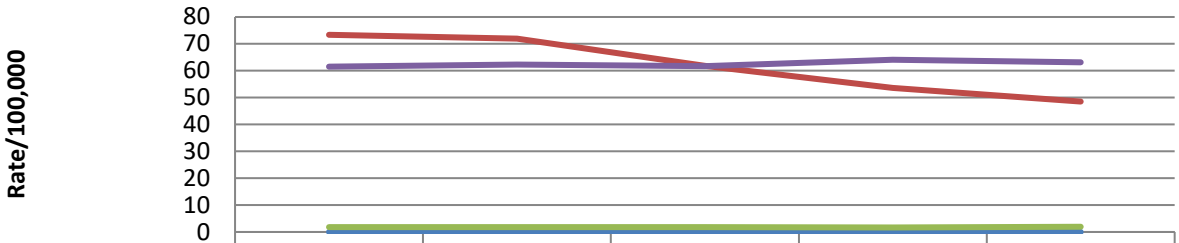


	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan African American	0	0	9.1	0	0
TN African American	13.08	13.08	14.14	20.9	18.55
Sullivan Caucasian	12.03	12.03	13.76	12.8	13.32
TN Caucasian	10.72	10.72	10.87	14.51	14.46

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Rates of pancreatic cancer have decreased in Sullivan County among seniors aged 65 and older from 2010-2012 to 2018-2020, while rates among seniors have remained relatively stable across the state. Mortality rates are very low among persons aged 15-44 (see Figure 6.24).[26]

Figure 6.24: Pancreatic Cancer Mortality by TDH Age Group



	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan 65+	73.37	71.95	61.79	53.6	48.53
TN 65+	61.52	62.28	61.66	64.09	63.14
Sullivan 15-44	0	0	0	0	0
TN 15-44	1.82	1.75	1.77	1.68	1.94

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Opportunities for Public Health Intervention:

Behavioral Risk Reduction:

Although findings regarding the association of various risk factors and development of pancreatic cancer are conflicting, evidence suggests that maintenance of a healthy diet and a physically active lifestyle may be associated with decreased risk of pancreatic cancer. Public health interventions to promote increased consumption of fruits and vegetables and decreased consumption of red meats and processed meats may aid in reducing the incidence of pancreatic cancer in the future.[77] The American Cancer Society recommends consumption of at least 2 ½ cups of fruits and vegetables per day. Additionally, whole-grain

food products are recommended over refined grains. Fish, poultry, and beans are recommended protein sources alternative to red or processed meats.

Avoidance of smoking is the most impactful action individuals may take to prevent pancreatic cancer. Programs promoting smoking prevention and smoking cessation, as well as encouragement of moderate consumption of alcohol may serve to decrease incidence. Additionally, promotion of physical activity to maintain a healthy weight may reduce the incidence of prostate cancer.[77]

Environmental Risk Reduction:

Increased community access to recreational facilities and nutritious foods will create an environment that facilitates Sullivan County residents maintaining a physically active lifestyle and a healthy diet.[77] Additionally, encouraging implementation of smoke-free policies in public buildings and enforcement of smoke-free policies in government buildings will promote smoking cessation and reduce exposure to secondhand smoke.

Cervical Cancer

Unlike many other cancers, in which risk is highest among seniors, new cases of cervical cancer are most common among women aged 35 – 54 years, representing 45.8% of all incident cases nationally. The median age at cervical cancer diagnosis in the US is 50 years old. Similarly, cervical cancer mortality is highest among women aged 45 – 64 years old, accounting for 44.5% of cervical cancer deaths.[78]

The leading risk factor for cervical cancer is the sexually transmitted infection human papilloma virus (HPV). There are more than 150 types of viruses considered part of the HPV group. Nearly all cervical cancers are caused by HPV, an nearly two-thirds of cervical cancers are caused by two types of the virus, HPV 16 and HPV 18.[79]

Smoking also increases risk of cervical cancer. Tobacco by-products have been found in cervical tissue of women who smoke and may damage the DNA of these cells, leading to cancer. Female smokers are twice as likely to develop cervical cancer as women who do not smoke. Additionally, smoking reduces the immune system's ability to fight HPV infection.[80]

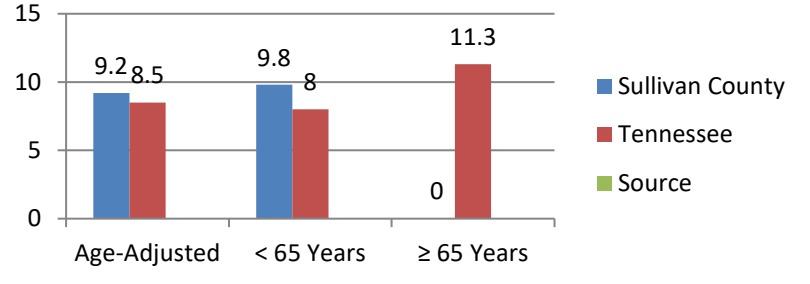
Persons with HIV infection are at higher risk for cervical cancer. Because the HIV virus weakens the immune system, people with HIV are more susceptible to HPV infection and their immune systems are less able to destroy pre-cancerous cells. Also, women with a history of chlamydia infection may be at increased risk for developing cervical cancer. Diet and weight status also play a role in cervical cancer risk. Women whose diets are low in fruits and vegetables may be at increased risk as well, and overweight status is linked with a specific type of cervical cancer.[80]

Cervical Cancer Incidence

As stated above, incidence of cervical cancer is more common among women younger than 65. From 2014-2018, the incidence rate of cervical cancer in the US was 7.7/100,000.[68] The five-year average age-adjusted cervical cancer incidence during this period was higher in Sullivan County (9.2/100,000) than in Tennessee (8.5/100,000). The age-specific incidence in persons younger than 65 was very close to the age-adjusted incidence.[68] As incidence among women older than 65 is very low, incidence rates for

Sullivan County are not available due to the small number of cases (see Fig. 6.25). Interestingly, the incidence of cervical cancer among women 65 and older in the state (11.3/100,000) is higher than the age adjusted rate for the state.

Figure 6.25: Cervical Cancer Incidence (2014-2018) Rate/100,000

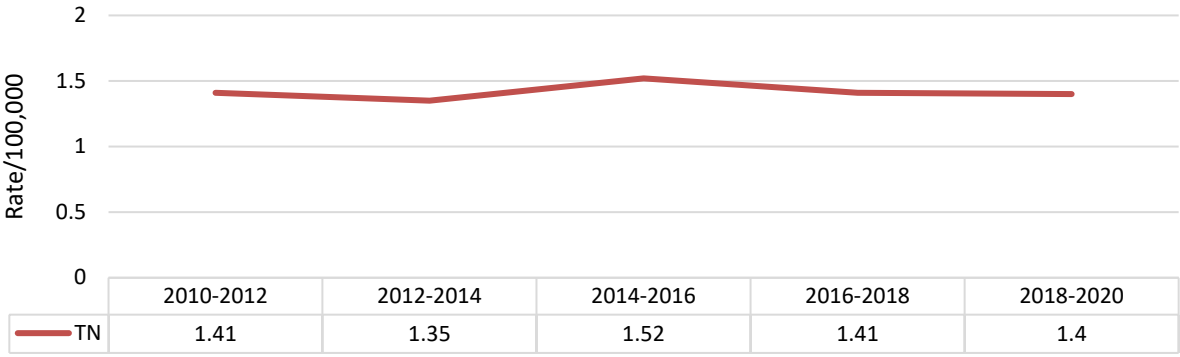


Source: National Cancer Institute

Cervical Cancer Mortality

From 2010-2012 to 2018-2020, the three-year average age-adjusted cervical cancer mortality rates have remained consistent across the state (see Figure 6.26). There were too few cases of cervical cancer deaths among Sullivan County women to calculate reliable rates for three-year intervals; however, the average mortality rate from 2011 to 2020 was 2.47/100,000, indicating slightly higher rates in Sullivan County than the state.[26] During this entire period, Tennessee met the HP2020 goal to reduce cervical cancer mortality to 2.4/100,000, while Sullivan County came close with the 10-year average rate but ultimately did not reach the goal. There is currently no corresponding HP2030 goal aimed at reducing cervical cancer mortality, as the goal is to increase the proportion of females getting screened for cervical cancer.

Figure 6.26: Age-Adjusted Cervix Uteri Cancer Mortality



	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
TN	1.41	1.35	1.52	1.41	1.4

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Opportunities for Public Health Intervention:

Behavioral Risk Reduction:

As almost all cases of cervical cancer are caused by human papillomavirus (HPV), there is great opportunity for reduction of cervical cancer incidence by increasing the rate of HPV vaccination with Gardasil. HPV is easily transmitted by person-to-person sexual contact. As the infection is very common, most people contract HPV after their first sexual contact. Currently, three vaccinations have been approved for HPV prevention, two forms of a vaccination called "Gardasil" and another called "Cervarix." Although they do not cure preexisting infections, they provide strong protection against new infections. Because areas not covered by a condom may be infected with the HPV virus, use of condoms is not entirely protective against HPV infection, although consistent use is associated with reduced risk.[79] As cervical cancer is almost exclusively caused by HPV infection, immunization with HPV vaccination is the best method to prevent cervical cancer from developing.

It is currently recommended that women aged 21 to 65 receive cervical cancer screening by pap smear every three years, or women aged 30 to 65 receive screening by a combination of pap smear and HPV testing every five years.[81] Accordingly, tertiary prevention of cervical cancer associated morbidity and mortality may be accomplished by increased access and acceptance of cervical cancer screening.

Environmental Risk Reduction

Although primary and tertiary prevention of cervical cancer are mostly specific to behaviors, acceptance of vaccination and appropriate screening, acceptance of vaccination may be increased by expanding HPV vaccination services and awareness campaigns in the community. There is also research that suggests women who had ever used an intrauterine device (IUD) had a lower risk of developing cervical cancer. The effect on risk was seen even in women who had an IUD for less than a year, and the protective effect remained after the IUDs were removed. Increased acceptance, awareness, and use of IUDs among women and providers may help to decrease Sullivan County's incidence rate.[80]

Cancer Prevention:

The United States Preventive Services Taskforce (USPSTF) is an independent volunteer panel of national health experts in preventive and evidence-based medicine. The USPSTF makes recommendations about clinical preventive services based on the best available scientific evidence. Healthcare providers look to the USPSTF for guidance when providing preventive health services to patients.

Breast Cancer Screening:

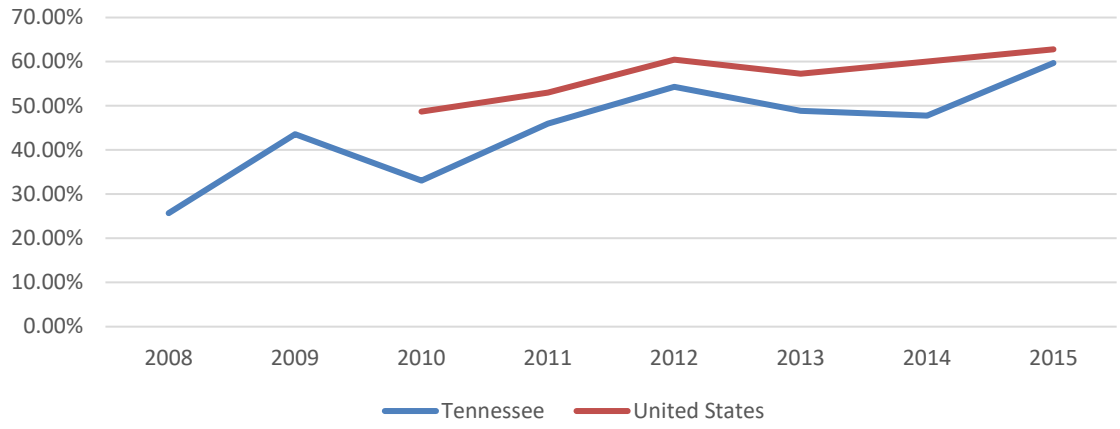
The USPSTF states that, although biennial mammography screening among women aged 40 to 49 years may reduce the risk of breast cancer death, the number of deaths prevented from regular screening in this age group is small and the risk of misdiagnosis and unnecessary biopsy is greater in this group. For women aged 50 to 74 years, biennial mammography screening is recommended. However, for women aged 75 and older, there is currently not strong enough evidence to assess the balance of risk and benefit from regular mammography and no recommendations are made.[82]

Cervical Cancer Prevention (HPV Vaccination):

Vaccination for human papillomavirus (HPV) is recommended for all children aged 11 or 12 and effective immunization is achieved with two shots given within a six to twelve-month period. Children older than 14 will require three shots administered over a six-month period. Teens who did not receive the vaccination at a younger age are also encouraged to receive a three shot series. Vaccination is further recommended for women younger than 26 and for men younger than 21. Additionally men who have sex with men, transgendered adults, and persons with certain immunocompromising conditions are recommended to receive vaccination if they are younger than 26.[83]

Currently, the reporting of HPV vaccination is optional, but not required, of healthcare providers in the state of Tennessee. Accordingly, any documentation of vaccination administration currently maintained by the state would not facilitate accurate estimates of HPV vaccination prevalence in the population. For this reason, estimates of HPV vaccination rates in Sullivan County or the Northeast Tennessee region are not reported in this assessment.

Figure 6.28: Percent of Females Aged 13-17 Receiving Two Doses of HPV Vaccination



Source: Centers for Disease Control and Prevention

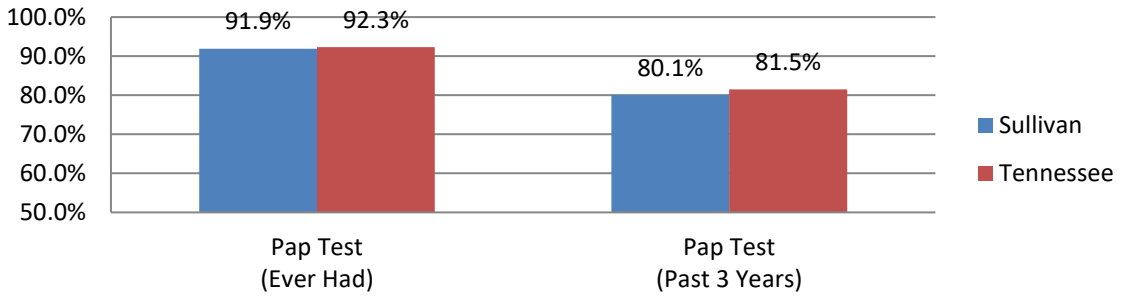
Cervical Cancer Screening:

The USPSTF was in the process of updating their recommendations for clinical prevention of cervical cancer at the time of the writing of this report, and the 2018 recommendation was the most current available. The USPSTF recommends, at the time of authorship, against screening for cervical cancer in women younger than 21. Furthermore, the USPSTF recommends against cervical cancer screening in women older than 65 who have had adequate prior screening and do not have a history of precancerous lesion of the cervix or cervical cancer. For women aged 21 to 65, screening for cervical cancer with Pap smear is recommended every three years. For those aged 30 to 65 who want to lengthen the time between screenings, Pap smear cytology and HPV testing is recommended every five years.[84]

The prevalence of Pap testing, both lifetime history and within the past three years, was similar between Sullivan County and the state. For both, more than 90% of women have received a Pap test within their

lives and about 80% of women aged 18 and older have had a Pap test as of 2011-2013 (see Figure 6.29).[21] More recent data is not currently available for Sullivan County.

Figure 6.29: Cervical Cancer Screening History; 3-Year Avg. (2011-2013)



Source: Tennessee Department of Health

Colorectal Cancer Screening:

The USPSTF recommends colorectal cancer screening for adults aged 50 to 75. Screening for older adults aged 76 to 85 is determined on an individual basis depending on individuals' history of screening, life expectancy, and physical health. For adults aged 50 to 75, stool-based testing has been shown to reduce colorectal cancer death. Two methods of stool-based testing, guaiac-based fecal occult blood testing (gFOBT) and fecal immunochemical tests (FIT) are recommended by the USPSTF to be conducted every year in this age group. A newer method, multi-targeted stool DNA testing (FIT-DNA) has a stronger ability to detect cancers than FIT alone and is recommended to be conducted every one to three years for practitioners who select this method.[85]

Two common forms of direct visualization tests for colorectal cancer screening include sigmoidoscopy and colonoscopy. Both flexible sigmoidoscopy and colonoscopy have been shown to reduce deaths from colorectal cancers. However, sigmoidoscopy may cause harm such as colonic perforations and bleeding; although this is rare. Additionally, colonoscopy may cause harm from bowel preparation prior to the procedure, sedation during the procedure, or the procedure itself. The USPSTF recommends conducting either flexible sigmoidoscopy, or colonoscopy, every 5 years for persons aged 50 to 75.[85]

Prostate Cancer Screening

In 2012, the USPSTF released a recommendation against use of prostate-specific antigen (PSA) screening for prostate cancer. Although there is some potential benefit of early detection to prevent prostate cancer mortality, given the risk of harm (e.g. unnecessary testing due to false positive results, over-diagnosis and overtreatment, and treatment-associated morbidity including incontinence and impotence) associated with use of PSA screening, the USPSTF currently advises that, for men aged 55-69, the decision to use PSA testing should be an individual one arrived at in consultation with their healthcare provider. For men aged 70 and older, the USPSTF recommends against use of PSA screening.[86]

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This section assesses trends in mortality and prevalence of risk factors for chronic diseases other than cancers. For assessment of cancers, see the cancer section. Conditions assessed in this section are organized into three broad categories including cardiovascular diseases, respiratory diseases, and diabetes. Each section will review trends in mortality from various chronic conditions associated with the overarching illness category and will present available prevalence data for risk or protective factors associated with diseases.

Leading Causes of Death

To begin this section, it is appropriate to review the 10 leading causes of death in Sullivan County and the state of Tennessee to give context to the relative burden of chronic disease on mortality (see Table 7.1). Several superficial observations may be readily made. First, the eight leading causes of death for Sullivan County and Tennessee are similar in both nature and rank. Suicide was previously ranked in the leading causes of death for both Sullivan County and Tennessee, but was not ranked for 2020 despite suicide rates increasing substantially for both state and county. However, accidents are still ranked among the leading causes of death for both Sullivan County and the State.[87]

Table 7.1: 10 Leading Causes of Death, 2020 (Age-Adjusted Rate/100,000)

Rank	Tennessee		Sullivan County		% Difference Compared to State
1st	Diseases of the Heart	212.0	Diseases of the Heart	261.4	20.9%
2nd	Malignant Neoplasms	164.3	Malignant Neoplasms	169.3	3.0%
3rd	Accidents	86.4	Accidents	86.0	-0.5%
4th	COVID-19	80.2	COVID-19	71.8	-11.1%
5th	Chronic Lower Respiratory Diseases	51.2	Cerebrovascular Disease	43.5	0.7%
6th	Alzheimer's Disease	44.4	Chronic Lower Respiratory Diseases	43.4	16.5%
7th	Cerebrovascular Disease	43.2	Alzheimer's Disease	38.9	-13.2%
8th	Diabetes Mellitus	30.2	Diabetes Mellitus	19.9	-41.1%
9th	Pneumonia and Influenza	18.5	Chronic Liver Disease	19.5	18.5%
10th	Chronic Liver Disease	16.2	Pneumonia and Influenza	17.7	-4.4%

Source: Tennessee Department of Health, Health Information Tennessee

To assess the leading causes of death in Sullivan County further, it is important to review an epidemiologic concept known as "epidemiologic transition". Epidemiologic transition refers to changes observed in a population attributed to changes in demography associated with medical and economic advancements. In the 19th century, many leading causes of death were from infectious diseases, and mortality rates among infants and children were much higher. With advancements in medical sciences and improvements in various standards of living, nutrition, and sanitation, infant and child mortality decreases and people are enabled to live longer lives. With this change comes a shift in demographics whereby populations become older and, accordingly, leading causes of death transition to those associated with age, such as degenerative diseases, and those largely attributable to behavioral risk factors, such as smoking, poor diet, and heavy alcohol consumption.[88]

In 2010-2014, for at least six of the 10 leading causes of death in Sullivan County (diseases of the heart, malignant neoplasms, cerebrovascular disease, chronic lower respiratory diseases, diabetes, and chronic

liver disease and cirrhosis) the burden of mortality may be lessened with reductions in common behavioral risk factors, such as smoking, poor diet, physical inactivity, and heavy alcohol consumption. Accordingly, the burden of these diseases in Sullivan County is largely amenable to public health intervention.

From 2015 to 2020, mortality rates have increased for most of the 10 leading causes of death. The largest factor attributed to this increase was excess deaths related to COVID-19. The largest increase and decrease of note in Sullivan County were the 62.3% increase in accidental deaths (53.2% in Tennessee) and the 31.7% decrease in pneumonia and influenza deaths (20.6% decrease in Tennessee). During this time, Sullivan County's top 10 leading mortality rates have increased an average of 12.2% for leading causes that were ranked in the leading 10 causes for both 2015 and 2020, similar to the average increase in leading mortality rates seen in Tennessee (9.4%).

Among the top three leading causes (diseases of the heart, malignant neoplasms, COVID-19), there is an average difference of 4.3% in mortality rates between Sullivan County and Tennessee with rates being higher in Sullivan County. Higher rates in Sullivan County was consistent throughout the 10 Leading Causes of Death; however, mortality rates for diabetes, Alzheimer's, and COVID19 were significantly higher in Tennessee than Sullivan County. Additionally, excluding diabetes where Tennessee rates are nearly twice those of Sullivan County's rates, Sullivan County's 10 Leading Causes of Death mortality rates were an average of 3.0% higher than those of the state, which is consistent with the average for the top three leading causes.

Three of Sullivan County's leading causes of death in 2020 fell short of the HP2030 goals set for those causes. As demonstrated by the malignant neoplasm death rate (169.3/100,000), which is a general term for aggressive forms of cancer, Sullivan County falls short of the HP2030 goal of reducing the overall cancer death rate to 122.7/100,000. Additionally, the accident-related death rate in Sullivan County (86.0/100,000) was higher than the goal of 43.2/100,000, and the chronic liver disease and cirrhosis death rate (19.5/100,000) was higher than the goal of 10.9/100,000.

Since HP2020, Healthy People 2030 changed the criteria for the diabetes mortality objective from "all diabetes deaths" to "all-cause mortality among people with diagnosed diabetes" to better describe the impact of diabetes on health, as it is less likely to have died directly from diabetes as it is to have died from a cause related to diabetes such as heart disease. Because of this change in health objectives, diabetes mortality rates can no longer be compared to HP2030 objectives, and the way in which diabetes deaths are reported needs to be reevaluated to better reflect these changes.

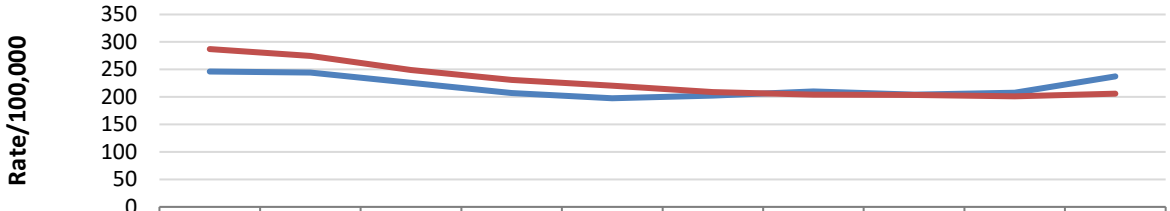
Cardiovascular Diseases and Risk Factors

General Disease of the Heart:

From 2000-2002 to 2008-2010, three-year average rates of mortality attributed to diseases of the heart declined for both Sullivan County and Tennessee, and then remained consistent through 2016-2018. Heart disease mortality rates remained comparable between the state and county throughout the period, though an increase was seen in Sullivan County in 2018-2020. Accordingly, the percent increase in heart

disease mortality observed for the state was less than 1%, while Sullivan County's rates increased by 16.3% between 2014-2016 and 2018-2020 (see Table 7.2 & Figure 7.1).[26]

Figure 7.1: Age-Adjusted Mortality (Rate/100,000) for Diseases of the Heart

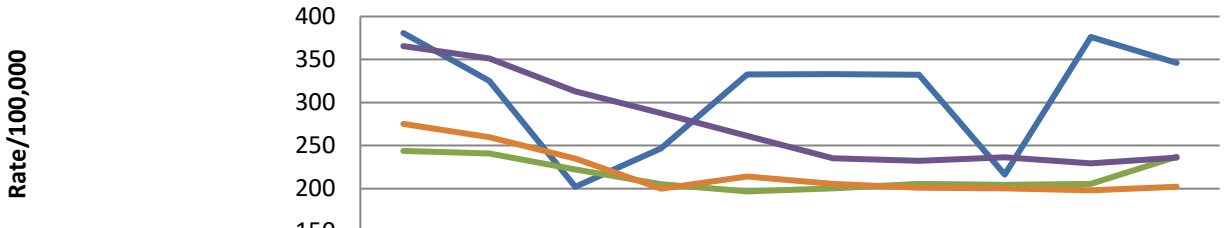


	2000-2002	2002-2004	2004-2006	2006-2008	2008-2010	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	246.26	244.59	225.92	207.29	197.61	202.49	209.99	204.29	207.86	237.52
TN	287.08	274.39	249.09	231.02	220.57	208.71	204.47	203.84	201.13	205.81

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Throughout this period in Tennessee, the age-adjusted mortality rate among African Americans was consistently higher than that for Caucasians. Rates of mortality were similar between Caucasians in Sullivan County and the state during this period. Whereas there was a fairly linear decline in heart disease mortality among African Americans throughout the state over this period, the mortality rate remains high with no linear decrease appearing among African Americans in Sullivan County from 2000-2002 to 2018-2020. This is likely due to low counts of African Americans residing in Sullivan County, resulting in higher vulnerability to statistical variation. However, it is important to note that there was also a slight increase in heart disease mortality among Caucasians in Sullivan County toward the end of this period (see Figure 7.2).[26]

Figure 7.2: Age-Adjusted Mortality for Heart Disease by Race (Rate/100,000)

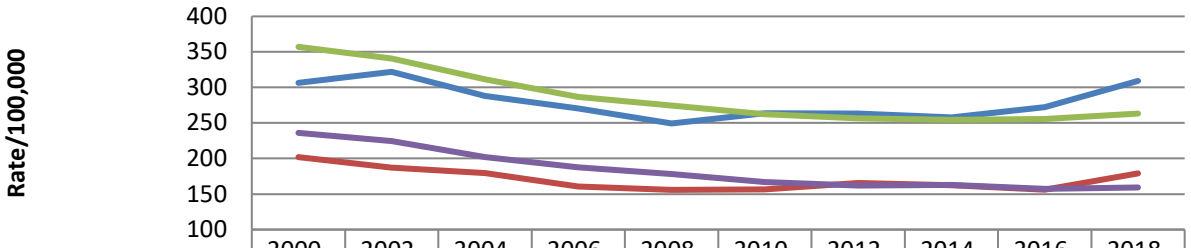


	2000-2002	2002-2004	2004-2006	2006-2008	2008-2010	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan African American	380.82	325.19	202.16	246.95	332.6	333.25	332.43	216.25	376.22	345.99
Sullivan Caucasian	243.86	240.82	222.41	205.1	196.81	200.44	205.59	204.32	205.65	237.02
TN African American	365.61	351.12	313.11	287.79	261.42	235.25	232.19	236.27	229.4	236.2
TN Caucasian	275.24	259.92	234.92	200.13	213.96	205.43	200.98	200.38	198.05	202.35

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Rates of heart disease mortality were higher among males than females for both Sullivan County and the state. Further, mortality rates by sex were fairly congruent between Sullivan County and Tennessee, becoming nearly identical toward the end of the period (see Figure 7.3) The increase in mortality seen in Sullivan County for both genders mirrors the increase seen in Figure 7.1.[26]

Figure 7.3: Age-Adjusted Mortality for Heart Disease by Sex



	2000-2002	2002-2004	2004-2006	2006-2008	2008-2010	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan Male	306.69	321.96	288.17	270.6	249.32	263.93	263.25	257.76	272.44	309.05
TN Male	357.11	340.59	311.29	286.67	274.6	262.36	256.31	254.44	255.56	263.05
Sullivan Female	201.95	187.08	179.57	160.52	155.84	156.48	165.55	162.25	156.27	178.95
TN Female	236.06	224.73	202.06	187.64	178.37	166.78	162.14	162.82	157.29	159.11

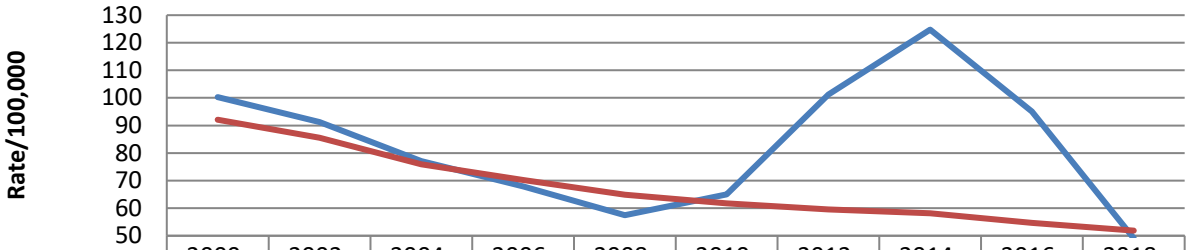
Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Myocardial Infarction:

Myocardial infarction (MI) refers to the death of heart tissue due to insufficient supply of oxygen. Commonly known as a "heart attack", it is a major cause of death and disability worldwide. Coronary artery disease (CAD) is the leading cause of MI,[89] and having an MI may be the first manifestation of CAD.[90]

From 2000-2002 to 2008-2010, crude mortality rates for acute myocardial infarction decreased steadily in Sullivan County, at a slightly greater rate than that observed for the state. However, from 2008-2010 to 2018-2020, the three-year average rates of MI mortality increased in Sullivan County, while continuing to decrease throughout Tennessee, peaking in 2014-2016 before rapidly declining to rates comparable to the state in 2018-2020 (see Figure 7.4).[26]

Figure 7.4: Acute Myocardial Infarction Fatality



	2000-2002	2002-2004	2004-2006	2006-2008	2008-2010	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	100.23	91.24	77.09	67.87	57.51	64.96	101.18	124.76	95.02	49.08
TN	92.08	85.56	75.96	70.2	64.84	61.72	59.55	58.2	54.65	51.86

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

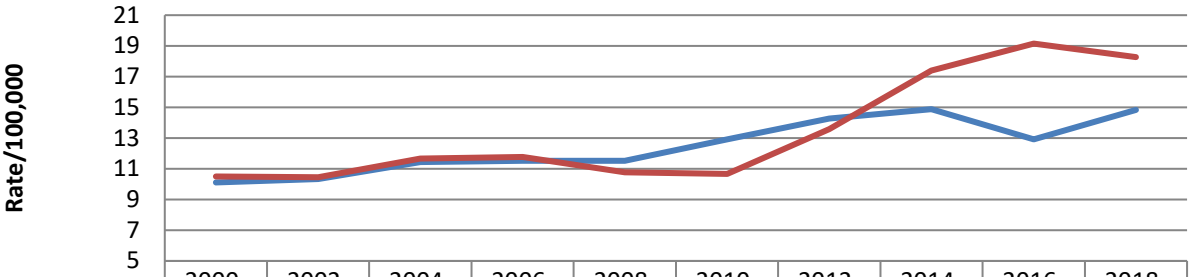
Heart Failure:

Heart failure is a progressive condition in which the heart muscle is unable to keep up with the body's demand for blood and oxygen. This causes changes to the heart over time, which lead to the buildup of fluid in the lungs. For this reason, the condition is sometimes known as "congestive heart failure."[91]

Although some congenital conditions may lead to heart failure, common causes are coronary artery disease (CAD), high blood pressure, and diabetes. People who are older than 65 are at increased risk for heart failure. In fact, heart failure is the leading cause of hospitalization among persons older than 65. Additionally, African Americans, men, people who have had a previous heart attack, as well as those who are obese are at increased risk for the condition.[92]

From 2000-2002 to 2006-2008, the three-year average mortality rates for congestive heart failure were nearly the same for Sullivan County and Tennessee. Heart failure mortality then began to increase in Sullivan County until 2014-2016, and state rates began to increase even more greatly from 2010-2012 to 2016-2018. However, from 2016-2018 to 2018-2020, the difference between mortality rates began to close, and the state had a higher mortality rate than Sullivan County (see Figure 7.5).[26]

Figure 7.5: Heart Failure Mortality



	2000-2002	2002-2004	2004-2006	2006-2008	2008-2010	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	10.11	10.33	11.44	11.53	11.51	12.92	14.26	14.88	12.91	14.83
TN	10.5	10.45	11.66	11.76	10.78	10.67	13.59	17.4	19.15	18.28

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

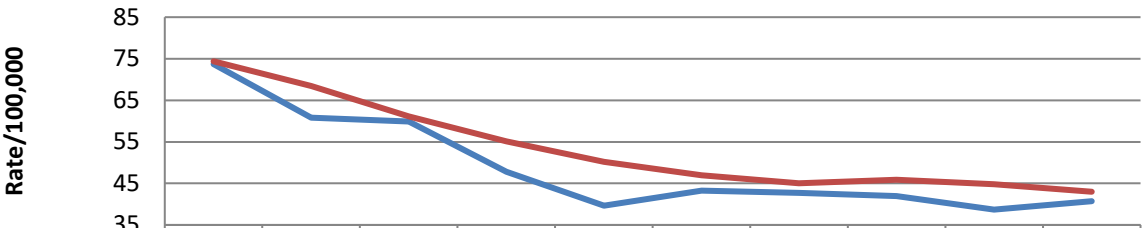
Cerebrovascular Disease:

The term "cerebrovascular disease" (CVD) refers broadly to conditions related to blood vessels in the brain that cause temporary or permanent damage from bleeding or lack of oxygen to the brain's tissue. Conditions referred to by this term include stroke and brain aneurysms, although many other conditions could be considered cerebrovascular diseases. Stroke is an interruption of blood flow to the brain that causes loss of neurologic functioning. Stroke may be "hemorrhagic" caused by bleeding in the brain, or "ischemic" caused by a lack of oxygen to the brain from blockage of a blood vessel. An aneurysm is an area of a blood vessel in the brain that is weakened, resulting in a bulging of the blood vessel wall. This may result from a birth defect, atherosclerosis, high blood pressure, or head injury.[93]

The majority of deaths related to CVD occur in people older than 65. Stroke is the third leading cause of death in the US and 25% of people who recover from a stroke will have another within five years of their first. Modifiable risk factors for stroke include smoking, high blood pressure, diabetes, high cholesterol, and physical inactivity. Risk of stroke increases with age and is more common in men than women. Additionally, African Americans, and persons with a history of previous stroke or heart attack are at greater risk.[93]

Rates of CVD mortality have decreased from 2000-2002 to 2008-2010 for both Sullivan County and the state. Mortality rates were higher in Tennessee during this period; however, rates have remained consistent from 2010-2012 to 2018-2020 (see Figure 7.6).[26]

Figure 7.6: Cerebrovascular Disease Mortality



	2000-2002	2002-2004	2004-2006	2006-2008	2008-2010	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	73.7	60.8	59.92	47.78	39.63	43.28	42.75	41.96	38.69	40.73
TN	74.38	68.41	61.16	55.11	50.15	46.99	44.99	45.91	44.82	42.99

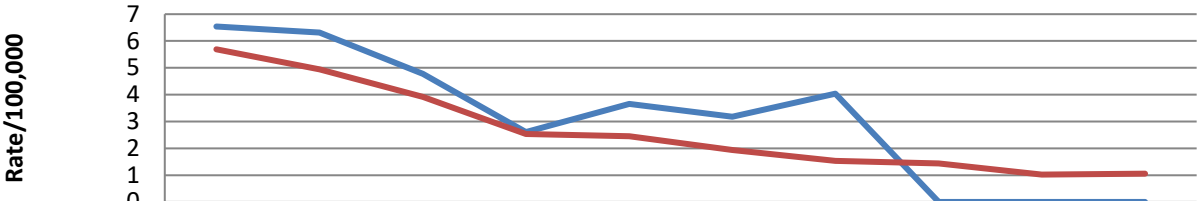
Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Atherosclerosis:

Atherosclerosis is a disease in which plaque builds up inside of arteries, hardens, and causes the arteries to narrow. This narrowing of the arteries limits the flow of oxygenated blood to vital organs. Atherosclerosis is a risk factor for cardiovascular diseases such as coronary heart disease and peripheral artery disease, as well as chronic kidney disease. Although the cause of atherosclerosis is unclear, smoking, physical inactivity, and an unhealthy diet increase the risk of developing the condition.[94]

There were too few cases of Atherosclerosis mortality in Sullivan County after 2004-2006 to report accurately, thus there is a lack of reliability in Figure 7.7. However, Sullivan County mortality does appear to follow Tennessee's trends as atherosclerosis mortality decreases, despite mortality rates appearing slightly higher in Sullivan County during this period.[26]

Figure 7.7: Atherosclerosis Mortality



	2000-2002	2002-2004	2004-2006	2006-2008	2008-2010	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	6.54	6.31	4.78	2.61	3.66	3.18	4.04	0	0	0
TN	5.69	4.94	3.92	2.53	2.45	1.94	1.53	1.43	1.02	1.05

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Cardiovascular Disease Risk Factors:

Angina pectoris is the medical term for chest pain that results from coronary heart disease. It occurs when the heart does not receive enough oxygenated blood due to narrowing of the heart's arteries,

caused by atherosclerosis. Angina is referred to as "stable" or "unstable". Stable angina occurs during periods of physical exertion, when the heart has to work harder to circulate blood, lasts a short time (5 minutes or less), and usually is relieved by medication.[95] Unstable angina occurs during periods of rest, comes as a surprise, and may last longer than stable angina. Angina is not technically a risk factor for cardiovascular disease, but rather a warning sign that cardiovascular illness is present. Unstable angina usually does not get better with rest or medication and may be an indication that a person is having a heart attack.[96]

High blood pressure, also called "hypertension", is a risk factor for several cardiovascular illnesses including stroke, heart failure, angina, and heart attack.[97] **High cholesterol** can cause atherosclerosis, which reduces blood flow through blood vessels. This may lead to several cardiovascular diseases including angina, heart attack, or stroke.[98]

Another risk factor for cardiovascular disease is **obesity**. Obesity is defined as having a body mass index of 30 or higher. Nearly 17% of American children, and 35% of adults, are obese. People with obesity are more likely to have high cholesterol, higher blood pressure, and diabetes.[99] People who have **diabetes** are more than twice as likely to develop heart disease or have a stroke than people without the condition. Additionally, diabetics tend to develop cardiovascular diseases at an earlier age than normal. High levels of glucose in the blood can lead to increased deposits of fatty materials on blood vessel walls, affecting blood flow and causing atherosclerosis.[100]

Respiratory Diseases and Risk Factors

Chronic Obstructive Pulmonary Disease (COPD):

Chronic obstructive pulmonary disease (COPD) is a term that refers to several chronic respiratory diseases that cause airflow blockage and breathing problems. Included in the term are emphysema, chronic bronchitis, and in some cases, asthma. Tobacco smoke is the predominant risk factor for COPD. Other risk factors include genetic traits and workplace or in-home air pollutants. Avoiding tobacco smoke and air pollutants lowers the risk of developing COPD and early detection of related conditions may deter or slow its progression. The following sections address the three respiratory conditions encompassed by the COPD grouping.[101]

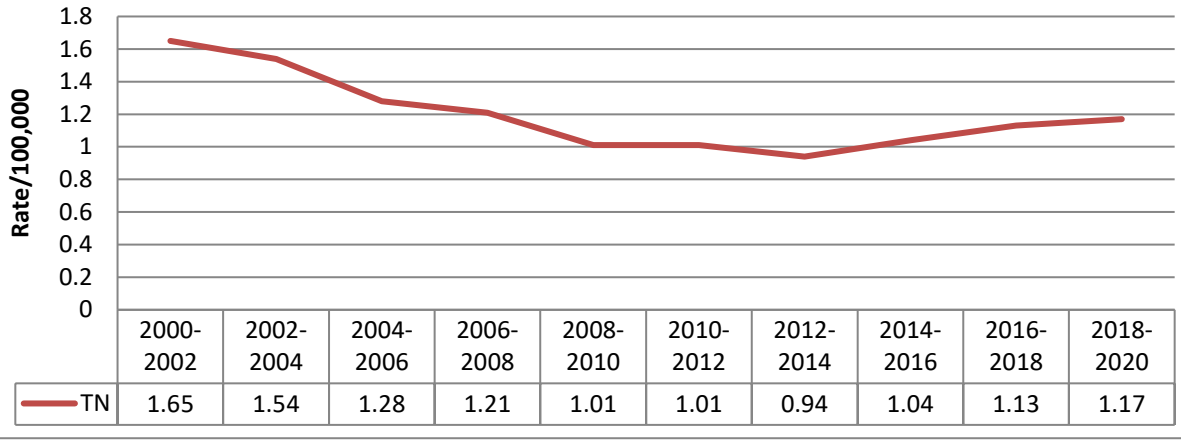
Asthma:

Asthma is a chronic lung disease that affects people of all ages, and often starts in childhood. It is characterized by narrowing of the airway caused by inflammation, which leads to chest tightness, shortness of breath, and wheezing lung sounds. Asthma may cause peoples' airways to react strongly to certain inhaled substances. Risk factors for asthma include: a family history of asthma, certain viral respiratory infections during childhood, certain allergic conditions, cigarette smoking or secondhand

smoke, and obesity. Additionally, environmental exposure to industrial or wood dusts, and certain chemical fumes and molds may cause asthma.[102]

There are too few deaths attributed to asthma in Sullivan county to report reliably, as well as for confidentiality concerns. This may be due to underreporting, as many deaths associated with asthma are ultimately attributed to other conditions or illnesses such as pneumonia or influenza. Changing the criteria for reporting for asthma may allow for more accurate surveillance. One way to accomplish this is to measure asthma-associated deaths, as opposed to asthma-attributed deaths in a way similar to the diabetes all-cause mortality is being addressed by Healthy People 2030. Tennessee asthma mortality rates, however, have steadily decreased from 2000-2002 to 2008-2010. Tennessee's asthma mortality then began to increase from 2012-2014 to 2018-2020 (See Figure 7.8). In the year 2020, women had higher rates of asthma mortality than men (Figure 7.9).[26]

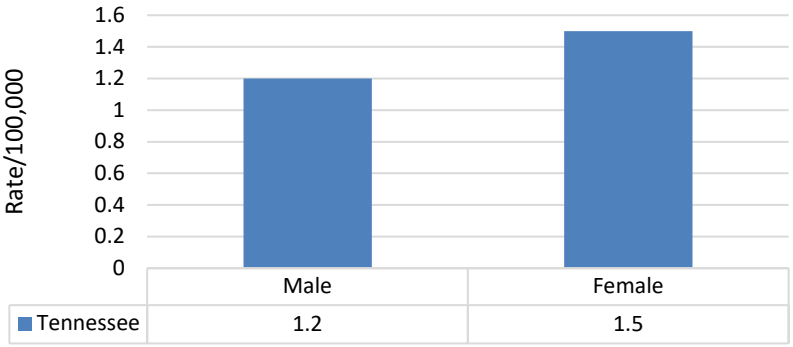
Figure 7.8: Crude Asthma Mortality



	2000-2002	2002-2004	2004-2006	2006-2008	2008-2010	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
TN	1.65	1.54	1.28	1.21	1.01	1.01	0.94	1.04	1.13	1.17

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Figure 7.9: Age-Adjusted Asthma Mortality by Sex (2020)



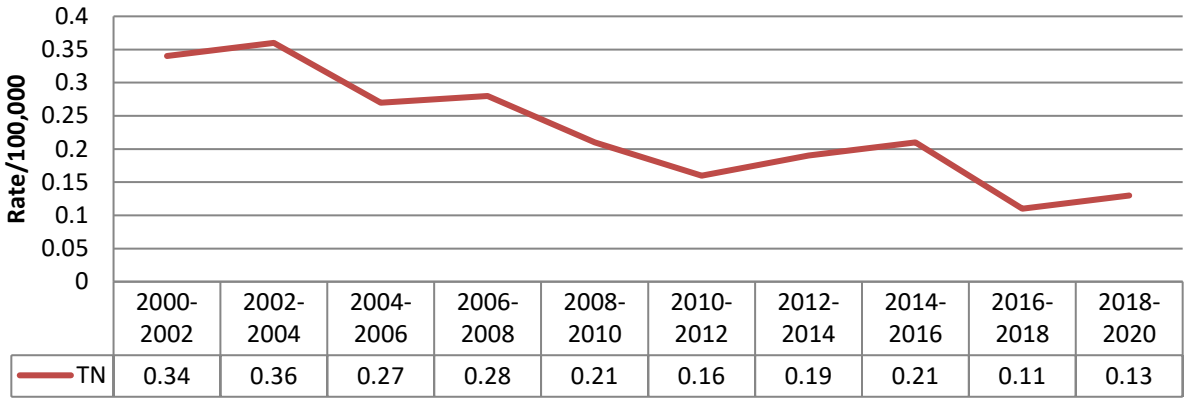
Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Chronic Bronchitis:

Bronchitis is an inflammation of the bronchial tubes, which carry air to the lungs. This inflammation causes mucus production, leading to cough and difficulty breathing. Chronic bronchitis is a long-term condition that never completely resolves. Smoking is the most common cause, but air pollution may contribute to development of the condition as well.[103]

Mortality from chronic bronchitis is lower than that of asthma in both Sullivan County and Tennessee. Although Sullivan County statistics cannot be displayed for the same reasons as asthma statistics, there is a downward trend in bronchitis mortality for the state (see Figure 7.8).[26]

Figure 7.9: Crude Bronchitis (Chronic and Unspecified) Fatality



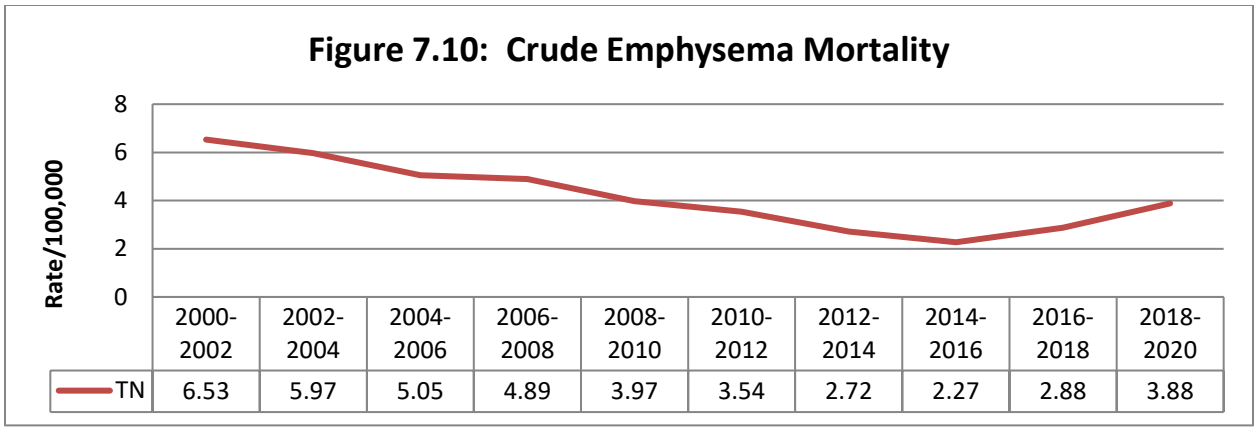
	2000-2002	2002-2004	2004-2006	2006-2008	2008-2010	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
TN	0.34	0.36	0.27	0.28	0.21	0.16	0.19	0.21	0.11	0.13

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

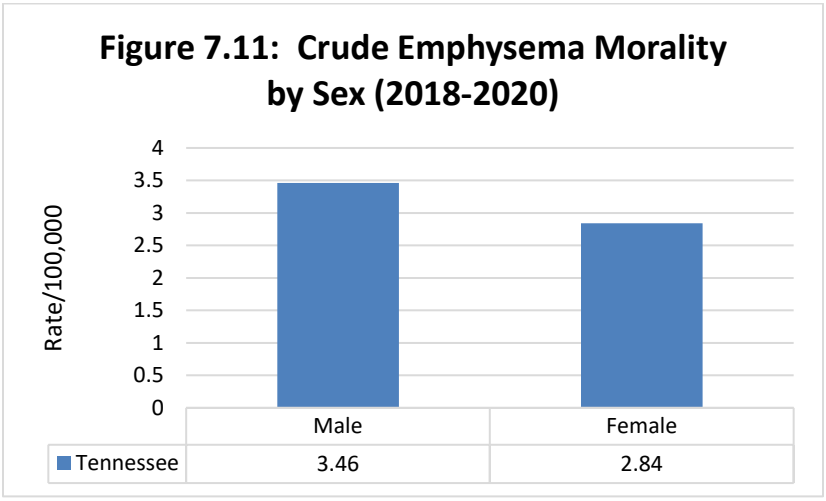
Emphysema:

Emphysema is a chronic respiratory disease, meaning it does not go away, in which the air sacks of the lungs, called alveoli, become damaged. When this happens, the body has difficulty getting the amount of oxygen it needs and people with the disease may feel that they cannot catch their breath. People with emphysema may also develop a cough or have trouble breathing while performing physical tasks. Smoking is the leading cause of emphysema. Quitting smoking will help prevent developing the disease later in life, and will prevent the disease from becoming worse among people who currently have emphysema.[104]

Mortality is much higher from emphysema than from the other diseases included in the COPD grouping. From 2000-2002 to 2014-2016, a relatively linear reduction was observed in three-year average emphysema mortality rates across Tennessee (65.2% decrease). However, mortality rates increased 70.9% from 2014-2016 to 2018-2020 (Figure 7.10), resembling the increase seen in recent years in the other respiratory diseases previously discussed in this section. Opposite of asthma mortality, where it was observed that men had higher asthma mortality rates than women, women had higher emphysema mortality rates than men in the year 2020 (see Figure 7.11).



Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020



Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Influenza & Pneumonia:

Influenza, also called the "flu", is a contagious respiratory illness caused by the influenza virus. It causes infection in the nose, throat, and lungs. The flu may lead to other medical complications, such as bacterial pneumonia, ear or sinus infections, dehydration, and worsening of chronic medical conditions such as heart failure, asthma, and diabetes. In some cases, influenza may lead to death. Although anyone may develop the flu, some people are at higher risk of severe complications; including seniors older than 65 years, persons with chronic lung or heart diseases, pregnant women, young children, and diabetics.[105]

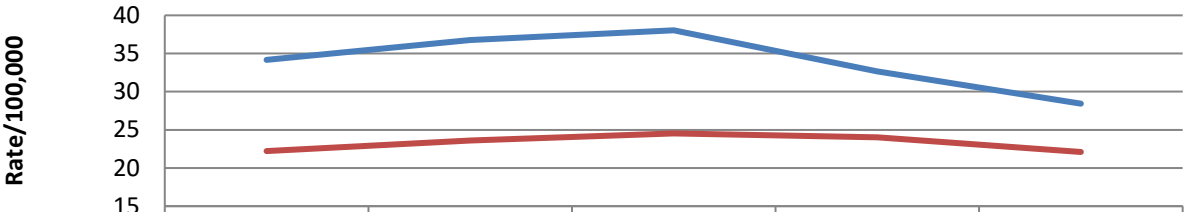
Pneumonia is a lung infection that may be viral, bacterial, or caused by certain fungi. It may also be a complication of the flu or COVID-19. Although most healthy people recover from pneumonia within a few weeks, it may be life-threatening. Pneumonia causes the air sacks in the lungs, called alveoli, to become inflamed and fill with fluid. This causes cough, fever, and trouble breathing. When the alveoli fill up with fluid, it becomes difficult for blood to carry the appropriate amount of oxygen throughout the body. This reduction in circulating oxygen, along with the possibility of infection spreading to other parts

of the body may lead to death in people who are more vulnerable. This includes seniors older than 65 years, young children, and people with weakened immune systems.[106]

Three-year average rates of influenza and pneumonia mortality combined were higher in Sullivan County than Tennessee from 2010-2012 to 2018-2020. The state has experienced a little to no change in mortality and has been fairly consistent throughout this time (see Figure 7.11). Mortality was higher among males than females for both Sullivan County and Tennessee, although the difference was slightly greater in Sullivan County (see Figure 7.12). Whereas mortality was slightly higher among Caucasians in Sullivan County than among those in Tennessee, mortality rates among African Americans in Sullivan County were not reported due to the smaller population and concerns for anonymity (see Figure 7.13).[26]

From 2011 to 2013, prevalence of influenza vaccination was slightly higher in Sullivan County than Tennessee. Still, less than half of the populations surveyed reported receiving a vaccination for both (see Figure 7.13). A smaller percent of both the Sullivan County and Tennessee populations have received a pneumonia vaccination in their lifetime than have received influenza vaccination. Still vaccination prevalence is expected to be higher in Sullivan County than the state in more recent years (see Figure 7.23).[61]

Figure 7.12: Influenza & Pneumonia Mortality



	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	34.18	36.78	38.04	32.66	28.43
TN	22.22	23.59	24.53	24.01	22.1

Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Figure 7.13: Age-Adjusted Influenza & Pneumonia Mortality by Sex (2018-2020)

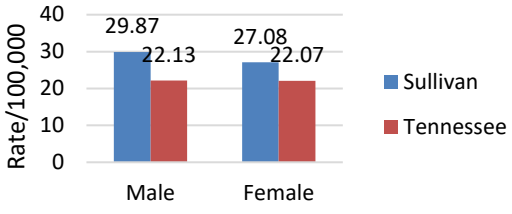
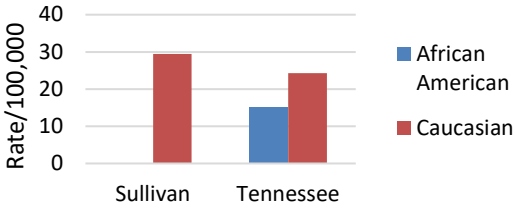
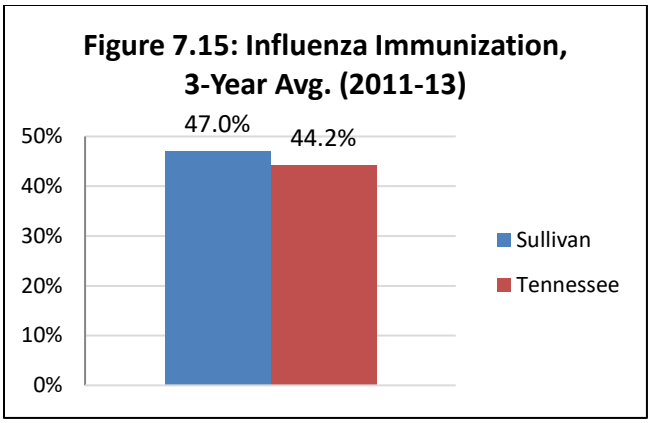


Figure 7.14: Aga-Adjusted Influenza & Pneumonia Mortality by Race (2018-2020)



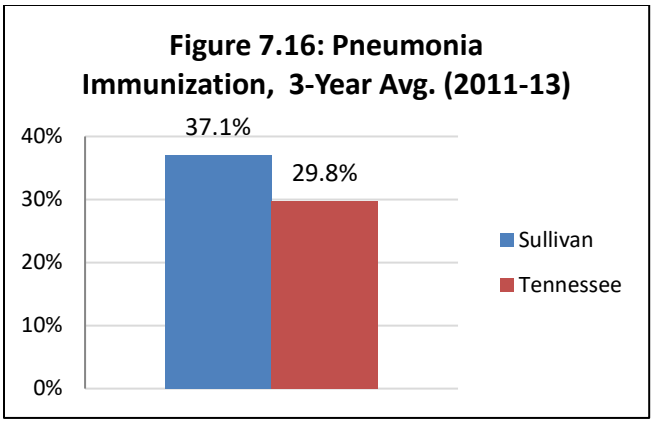
Source: Center for Disease Control and Prevention, Underlying Cause of Death 1999-2020

Figure 7.15: Influenza Immunization, 3-Year Avg. (2011-13)



Source: Tennessee Department of Health

Figure 7.16: Pneumonia Immunization, 3-Year Avg. (2011-13)



Source: Tennessee Department of Health

Diabetes and Associated Risk Factors:

Diabetes is a disease in which levels of sugar, called glucose, in the blood are higher than normal. When we eat food, the sugars and starches we eat are converted by our bodies into glucose, which is needed by cells to function normally. The pancreas is an organ that produces a hormone called insulin, which helps cells use glucose that is circulating in the blood. People with diabetes, have a difficult time using the glucose circulating in their blood because either their pancreas does not produce enough insulin, or their bodies do not use the insulin produced as well as others without the disease. Either way, diabetes causes excess glucose to build up in the blood.[107]

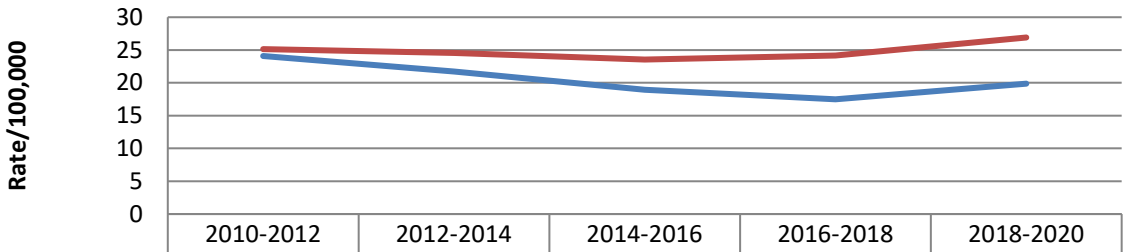
There are two types of diabetes, type 1 and type 2. Type 1 diabetes, sometimes called insulin-dependent diabetes mellitus, is usually diagnosed in children and young adults and occurs when the body does not produce enough insulin. Type 1 diabetes accounts for about five percent of diabetes in America.[108] Type 2 diabetes is the most common form of the disease, and occurs when individuals' bodies do not use the insulin they produce properly. Initially, the body will produce extra insulin, but eventually will not be able to produce enough insulin to keep glucose levels normal.[109]

Diabetes may lead to heart disease, blindness, kidney failure, and sometimes lower-extremity amputation due to blood vessel damage. In the United States, diabetes is the eighth leading cause of death.[110] Risk factors for type 2 diabetes are older age, obesity, family history of diabetes, impaired glucose tolerance, physical inactivity and race. African Americans, as well as American Indians, Pacific Islanders, and some Asian Americans are at greater risk of developing type 2 diabetes.[109] The risk factors for type 1 diabetes are not as well understood. Those that are known, such as autoimmune dysfunction and genetic traits are not modifiable.[108]

From 2010-2012 to 2018-2020, three-year average rates of diabetes-related mortality were higher for the state than in Sullivan County. Sullivan County experienced a 17.4% decrease in diabetes mortality, where the state ultimately observed a 7.0% increase by the end of the period (see Figure 7.17). Mortality is higher for males than females and among African Americans than Caucasians in both Sullivan County and

the state.[26] As previously described, Healthy People 2030 have changed their goals around diabetes mortality to reflect all-cause diabetes mortality. This is likely due to the expected high frequency of instances where the attributed cause of death was not diabetes, but fatality was heavily affected by diabetes. Changing the way diabetes mortality is measured and reported will provide more comprehensive understanding of the disease and the relationship diabetes has with other causes of death.

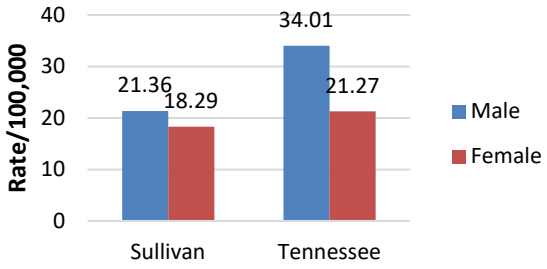
Figure 7.17: Age-Adjusted Diabetes Mortality



	2010-2012	2012-2014	2014-2016	2016-2018	2018-2020
Sullivan	24.09	21.71	18.95	17.49	19.89
TN	25.16	24.57	23.55	24.18	26.91

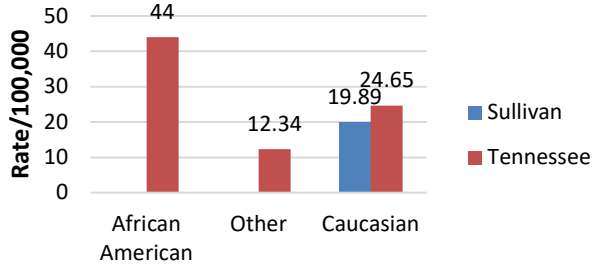
Source: Center for Disease Control and Prevention

Figure 7.18: Age-Adjusted Diabetes Mortality by Sex (2018-2020)



Source: Center for Disease Control and Prevention

Figure 7.19: Age-Adjusted Diabetes Mortality by Race (2018-2020)



Source: Center for Disease Control and Prevention

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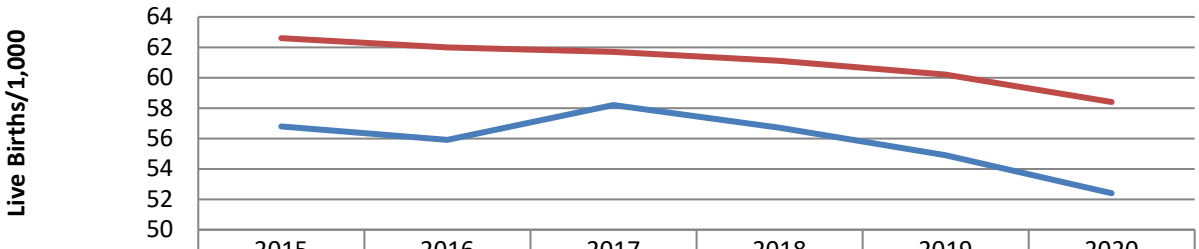
Pregnancy & Prenatal Care

Fertility

Rates of general fertility, calculated as the ratio of the number of live births during the calendar year to the total population at mid-year, among women in Sullivan County aged 15 to 44 fluctuated from 2015-2017 (2.5%), then decreased from 2017-2020 (-10%). During this period from 2015-2020, fertility rates decreased steadily throughout the state (-6.7%). Throughout this period, fertility rates in Sullivan county were lower than that for the state (see Figure 8.1).[111]

Figure 8.1: Fertility Rates Among Women Aged 15-44



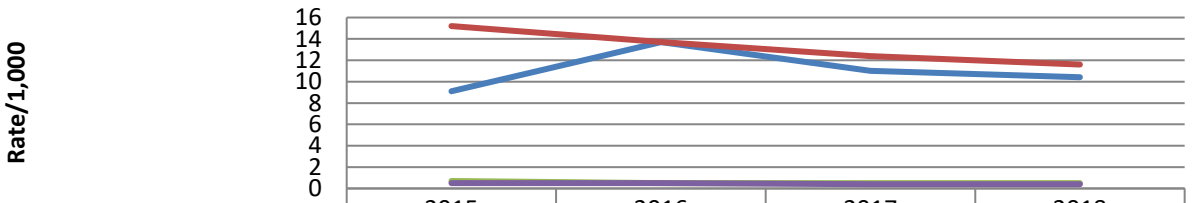
	2015	2016	2017	2018	2019	2020
Sullivan	56.8	55.9	58.2	56.7	54.9	52.4
Tennessee	62.6	62	61.7	61.1	60.2	58.4

Source: Tennessee Department of Health

Pregnancy

Whereas fertility rates reported above included only live births for the specified populations, below we present pregnancy rates, which refer to the sum of live births, reported fetal deaths, and induced termination of pregnancies per 1,000 women in the specified population age groups. For both age groups, rates of pregnancy were similar between Sullivan County and the state. Not surprisingly, the rate of pregnancy is higher among older adolescents, as evidenced by the higher rate observed when the age category is restricted to include only teens aged 15-17. For both Sullivan County and Tennessee, rates have remained consistent for Sullivan County while decreasing throughout the state (see Figure 8.2).[111]

Figure 8.2: Adolescent Pregnancy Rates



	2015	2016	2017	2018
Age (15-17) Sullivan	9.1	13.7	11	10.4
Age (15-17) TN	15.2	13.7	12.4	11.6
Age (10-14) Sullivan	0.7	0.5	0.5	0.5
Age (10-14) TN	0.5	0.5	0.4	0.4

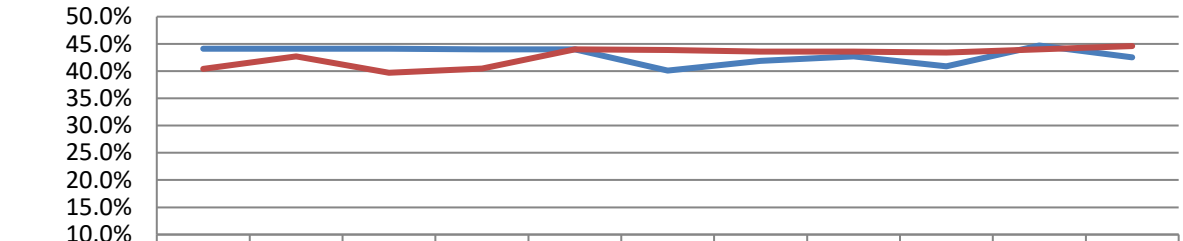
Source: Tennessee Department of Health

Live Births to Unmarried Mothers

Childbearing among unmarried women is of public health interest, as non-marital births are at greater risk for adverse birth outcomes, such as low birthweight, preterm delivery, and infant mortality, than are children born to married women. Additionally, children born to single mothers are more likely to have limited access to social and financial resources.[112] Accordingly, children born to unmarried women are more likely to be raised in a single-parent household and experience unstable living conditions and develop socio-emotional problems than children raised in a married household.[113] In 2020, the birth rate for unmarried women in the United States was 38.6/1,000 unmarried women aged 15-44 years and accounted for 40.5% of all births.[114]

From 2010-2020, the percent of live births to unmarried mothers in both Sullivan County and throughout Tennessee has seen some fluctuation over the decade, but stayed between 40-45%. The difference in 2020 was less than five percent (4.8%) higher in Tennessee.[111]

Figure 8.3: Percent of Live Births to Unmarried Mothers



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Sullivan	44.1%	44.1%	44.1%	44.0%	44.0%	40.1%	41.9%	42.7%	40.9%	44.7%	42.5%
TN	40.4%	42.7%	39.7%	40.5%	44.0%	43.9%	43.6%	43.6%	43.4%	44.0%	44.6%

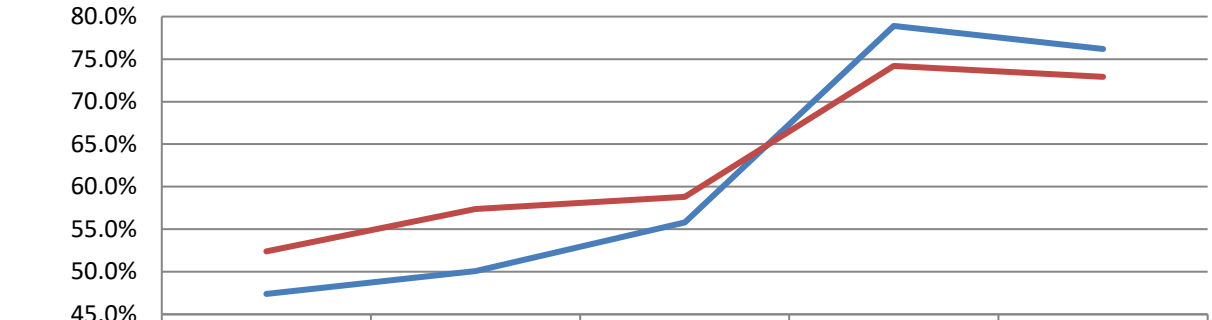
Source: Tennessee Department of Health

Prenatal Care

The data presented below, obtained by a publicly available data query from the Annie E. Casey foundation, presents the percent of live births that were to mothers who received adequate prenatal care. Although the data source does not specifically define the term "adequate prenatal care", the United States National Library of Medicine recognizes prenatal care as healthcare received during pregnancy. It includes routine medical examinations and diagnostic evaluations received by women during the course of their pregnancy.[115] Prenatal care may reduce the risk of pregnancy complications, sudden infant death syndrome (SIDS), and neurologic birth defects.[116]

The percent of live births in Tennessee that were born to mothers who received adequate prenatal care observed a large increase (39.1%) from 2016 to 2020, with Sullivan County closely following the same trend with even greater percent change (60.8%). The five-year average percent, from the same time period, was similar for Sullivan County (61.7%) to the state (63.14%) (see Figure 8.4).[117]

Figure 8.4: Percent of Live Births to Mothers Who Received Adequate Prenatal Care



	2016	2017	2018	2019	2020
Sullivan	47.4%	50.1%	55.8%	78.9%	76.2%
TN	52.4%	57.4%	58.8%	74.2%	72.9%

Source: Annie E. Casey Foundation, Kids Count Data Center

Infant and Child Morbidity & Mortality

The rate of death among infants is a well-recognized indicator of the health and well-being of a nation. This is because many of the factors that affect the overall health of a population also affect the health outcomes of newborns. The most common causes of infant mortality in the United States are: birth defects, prematurity, maternal complications during pregnancy, sudden infant death syndrome, and injuries.[118]

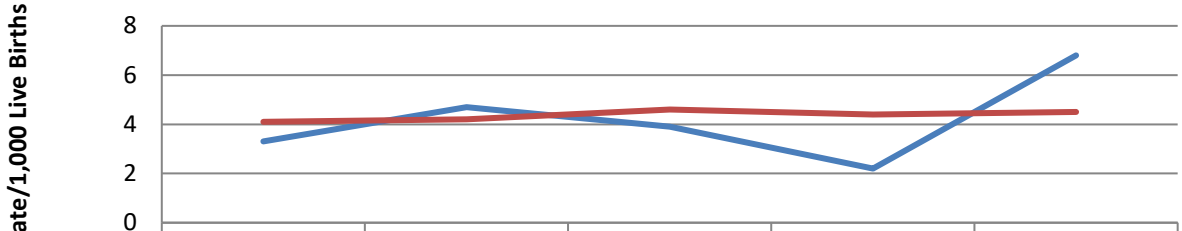
Many factors affect the outcome of pregnancies. Some factors, such as race, ethnicity, age, location, education, and income, either cannot be changed or result from complex social and political factors that are generally outside the scope of traditional public health interventions. However, there are other factors associated with the outcome of pregnancy that may be ameliorated by public health intervention or public policy modification. Improved access to healthcare, maintenance of a healthy diet and weight, tobacco avoidance, regular physical activity, receiving recommended prenatal health care, discussing medication use during pregnancy with a healthcare provider, and avoiding excessive consumption of alcohol are all measures which improve birth outcomes that may be achieved through public policy and lifestyle modifications.[118]

Neonatal Mortality:

Neonatal mortality is defined as death of a baby within the first 28 days of life. Figure 8.5 below shows that neonatal mortality rates have remained consistent from 2015-2019. Further, while a decrease was observed in Sullivan County from 2016 to 2018, the rate of neonatal mortality more than doubled (209%) from 2018 to 2019. It should be noted, however, that differences in the five-year average rate of neonatal

mortality were not as pronounced between Sullivan County (4.18/1,000) and Tennessee (4.36/1,000).[119] Neither Sullivan County or the State met the HP2030 goal of reducing the neonatal mortality rate to 2.0/1,000.

Figure 8.5: Neonatal Mortality, 2015-2019



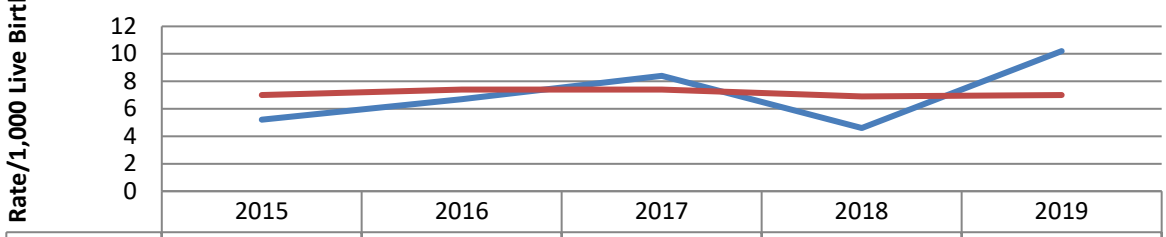
	2015	2016	2017	2018	2019
Sullivan	3.3	4.7	3.9	2.2	6.8
TN	4.1	4.2	4.6	4.4	4.5

Source: Annie E. Casey Foundation, Kids Count Data Center

Infant Mortality:

Infant mortality is defined as death occurring to babies younger than one year of age. Similar to neonatal mortality, infant mortality remained consistent throughout the state (0% change) from 2015-2019, and Sullivan County experienced a decrease in 2018, followed closely by a 121.7% increase in mortality the following year. This resulted in a 96.2 % increase in mortality from 2015-2019 for Sullivan County, to be compared to the 0% change in Tennessee (see Figure 8.6). Despite this, from 2015-2019, the five-year average rate of infant mortality was nearly identical in Sullivan County (7.02/1,000) and the state (7.14/1,000). Average rates of infant mortality were higher than average rates of neonatal mortality during this period.[119] Sullivan County met the HP2030 goal to reduce the infant mortality rates to 5.0/1,000 in 2018. However, the five-year average rate did not meet this goal.

Figure 8.6: Infant Mortality, 2015-2019



	2015	2016	2017	2018	2019
Sullivan	5.2	6.7	8.4	4.6	10.2
TN	7	7.4	7.4	6.9	7

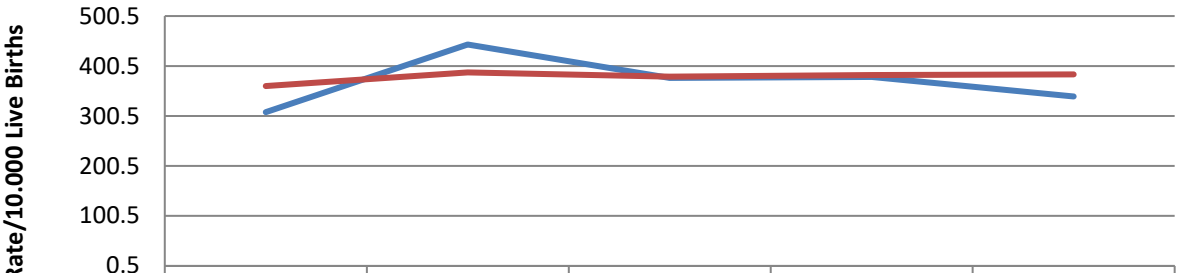
Source: Annie E. Casey Foundation, Kids Count Data Center

Birth Defects:

Rates of birth defects, defined by the Tennessee Department of Health as, congenital malformations, deformations, and chromosomal abnormalities, have remained consistent and stable throughout the

state and Sullivan County. From 2015-2019, there was a small increase in birth defect rates in Sullivan County (10.2%), with a single notable increase observed in 2016. Five-year average rates of birth defects in Sullivan County (369.3/10,000 live births) were lower than that for the state (378.7/10,000 live births) (see Figure 8.7).

Figure 8.7: Birth Defect Rate



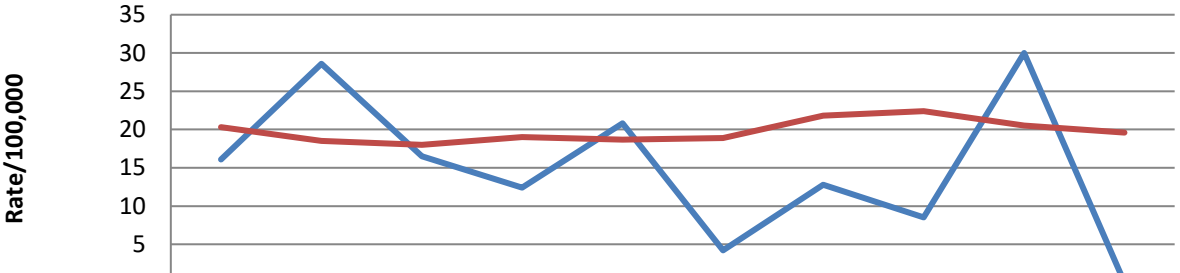
	2015	2016	2017	2018	2019
Sullivan	308.2	443.5	376.6	378.5	339.7
TN	360.4	387.7	379.1	382.5	383.6

Source: Tennessee Department of Health, Office of Vital Records and Statistics, Tennessee Birth Defects Registry

Child Mortality:

From 2010-2019, the rate of mortality among children aged one to 14 in Sullivan County varied greatly by year; however, there appears to be no remarkable change in child mortality rates during this period (see Figure 8.8). It should be noted that the value for Sullivan County in 2019 is represented as zero because the actual value was not in accordance with the Tennessee Department of Health guidelines for release of aggregate data to the public, likely for anonymity or reliability concerns. The five-year average child mortality rates were equal for Sullivan County and Tennessee (18.9/100,000) from 2010-2014, and the four-year average from 2015-2018 was lower in Sullivan County (13.9/100,000) than the state (20.9/100,000).[120]

Figure 8.8: Child Mortality Among Children Aged 1-14 Years



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sullivan	16.1	28.6	16.5	12.4	20.8	4.2	12.8	8.5	30	0
TN	20.3	18.5	18	19	18.7	18.9	21.8	22.4	20.5	19.6

Source: Annie E. Casey Foundation, Kids Count Data Center

Leading Causes of Infant Mortality:

The three-year average infant death rates per 100,000 live births were too low in Sullivan County in 2019-2021 to report. The leading causes of infant death in Sullivan County for years 2019-2021 and Tennessee for the year 2020 are displayed in Table 8.1. Note that the years of data displayed are different between the county and the state; therefore, comparisons should be made conservatively and rates for the state were not included. In both Tennessee and Sullivan County, the leading cause of infant death was congenital malformations, deformations, and chromosomal abnormalities.

Table 8.1: Leading Causes of Infant Mortality

Sullivan County (2019-2021)		Tennessee (2020)	
Cause	**Rank**	**Cause**	**Rank**
Congenital Malformations, Deformations and Chromosomal Abnormalities	1	Congenital Malformations, Deformations and Chromosomal Abnormalities	1
Sudden Infant Death Syndrome (SIDS)	2	Short Gestation and Low Birthweight Disorders	2
Short Gestation and Low Birthweight Disorders	4	Accidents (Unintentional Injuries)	3
Accidents (Unintentional Injuries)	4	Sudden Infant Death Syndrome (SIDS)	4
Respiratory Distress of Newborn	4	Complications of Placenta, Cord, and Membranes	5
Assault (Homicide)	4	Atelectasis	6
Complications of Placenta, Cord and Membranes	4	Bacterial Sepsis of Newborn	6
Renal Failure and other Disorders of Kidney	9	Maternal Complications of Pregnancy	8
Maternal Hypertensive Disorders	9	Necrotizing Enterocolitis of Newborn	9
Intrauterine Hypoxia and Birth Asphyxia	9	Respiratory Distress of Newborn	9
Bacterial Sepsis of Newborn	9	Assault (Homicide)	11
Unrankable Causes	2	Diseases of the Circulatory System	12

Source: Tennessee Department of Health

Low Birth Weight & Preterm Delivery

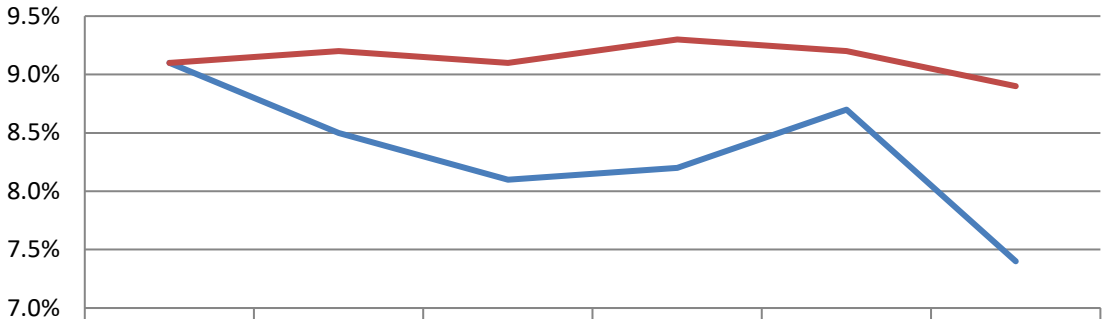
Low Birth Weight:

Nationally, 8.2% of newborns were considered low birth weight, defined as weight less than 5.5 pounds at birth, in 2020.[121] Low birth weight infants may develop sickness or infection within the first week of life. Long-term effects, including delayed motor and social development or learning disabilities, may develop as well. Modifiable risk factors for low birth weight include tobacco smoking, maternal alcohol consumption, and lack of weight gain during pregnancy. Other, risk factors include maternal age younger than 15, history of previous preterm delivery, low income, low education, mother being unmarried, and domestic violence.[121]

Receiving regular prenatal healthcare to identify conditions or behaviors that may increase risk of low birth weight is important for prevention. Prevention of low birth weight also includes quitting smoking, avoiding alcohol during pregnancy, taking a daily folic acid supplementation, and controlling high blood pressure and diabetes[121]

From 2010-2014, the percent of live births with low birth weight was lower in Sullivan County than Tennessee. The five-year average percent of low birth weight per live births was less than ten percent for both Sullivan County (8.3%) and the state (9.1%) (see Figure 8.10). Percentages in Sullivan County dropped steadily during this period, excluding the year 2019, while percentages remained stable throughout the state. Similar percentages of low birth weight births were observed during this period among Caucasian newborns in Sullivan County and Tennessee. However, the percent of low birth weight in live births among African Americans in Tennessee was much higher than that observed for Caucasian newborns. There was considerable variation in the percent of African American newborns with low birth weight in Sullivan County, due to a small population of African Americans in this county resulting in greater statistical variability (see Figure 8.11).[111]

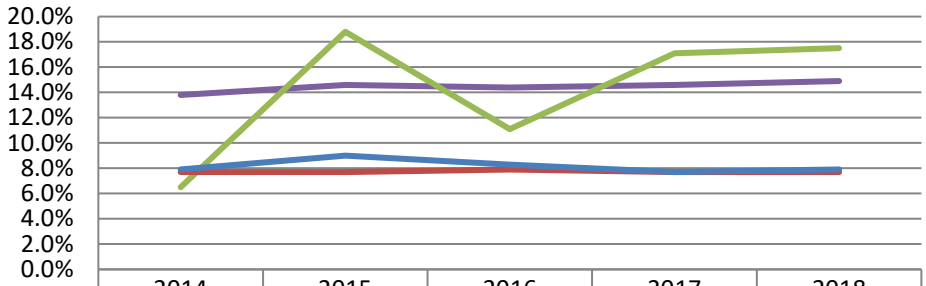
Figure 8.10: Percent of Live Births with Low Birthweight (Crude)



	2015	2016	2017	2018	2019	2020
Sullivan	9.1%	8.5%	8.1%	8.2%	8.7%	7.4%
TN	9.1%	9.2%	9.1%	9.3%	9.2%	8.9%

Source: Annie E. Casey Foundation, Kids Count Data Center

Figure 8.11: Percent of Live Births with Low Birthweight by Race



	2014	2015	2016	2017	2018
African American TN	13.8%	14.6%	14.4%	14.6%	14.9%
African American Sullivan	6.5%	18.8%	11.1%	17.1%	17.5%
Caucasian TN	7.7%	7.7%	7.9%	7.7%	7.7%
Caucasian Sullivan	7.9%	9.0%	8.3%	7.7%	7.9%

Source: Tennessee Department of Health, Birth Statistics

Preterm Delivery:

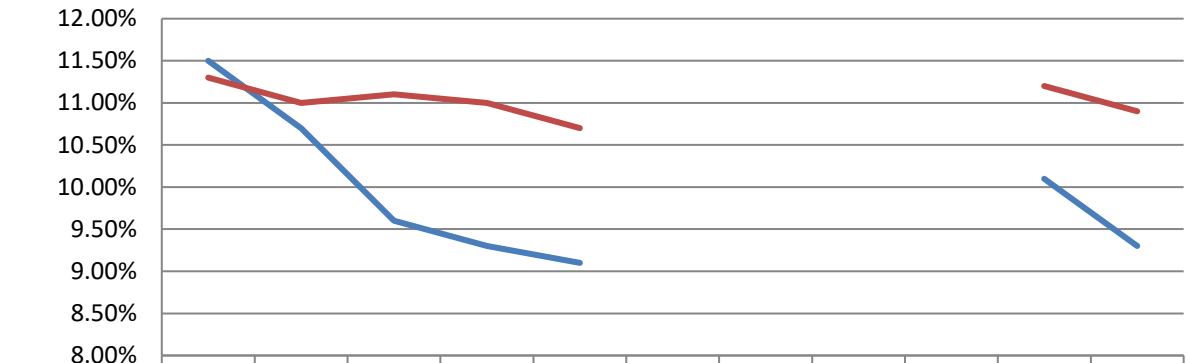
Nationally, 12% of newborns were born preterm in 2020, defined as birth before 37 weeks gestation.[122] As previously described, short gestation periods resulting in preterm deliveries is among the top three causes of death in infants. The Centers for Disease Control and Prevention reports that 1 out of every 10 infants are born preterm in 2021[123]. A racial difference exists in the rate of preterm births. In 2021, the rate was 50% higher among African American women (14.8%) than Caucasian (9.5%) or Hispanic women (10.2%) nationally. Preterm birth may lead to developmental problems with a baby's brain, lungs, eyes, inner ears, or liver.[123]

Mothers who are younger than 18 or older than 35 are more likely to deliver preterm than women between the ages of 18-35. Medical conditions, such as high blood pressure and diabetes, also increase the likelihood of preterm birth. Maternal weight status is also associated, as those who are underweight or obese are at increased risk of early delivery. Behavioral factors such as smoking, illicit drug use, and alcohol consumption, as well as lifestyle factors, including domestic abuse and stressful living or working conditions are also associated.[124]

Similar to low birth weight, the percent of preterm live births in Sullivan County was slightly lower than that observed for Tennessee from 2010 to 2020. Note that there are no values for years 2015 to 2018, as it was against the Tennessee Department of Health's aggregate data policy to report values that are so small that patient anonymity is at risk. This does, however, indicate that percentages lowered further during this time and then returned to values resembling trends earlier in the decade. Since 2011, Sullivan County has met the HP2020 goal to reduce the rate of preterm births to 11.4% of live births. In 2020, Sullivan County had already met the HP2030 objective of reducing the percentage of preterm births to 9.4%.

Similar to that observed throughout the United States, a greater proportion of African American mothers in Tennessee delivered preterm than Caucasian mothers. Rates were generally lower in Sullivan County during this period than the state, and African American women in Sullivan County had a lower percentage of preterm birth than Caucasian women, as there was actually 0% preterm births among African American women in Sullivan County in the year 2020 (see Figure 8.13).

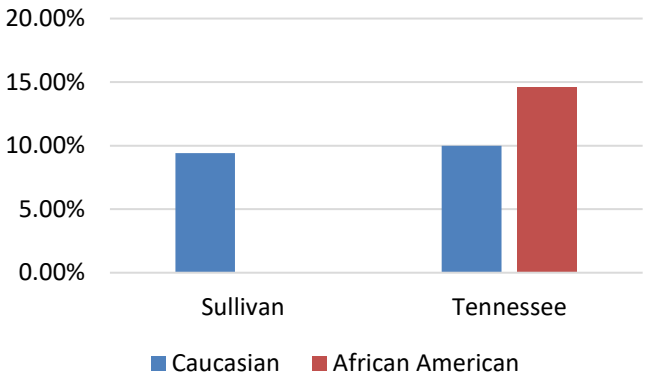
Figure 8.12: Percent Preterm Live Births



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Sullivan	11.50%	10.70%	9.60%	9.30%	9.10%					10.10%	9.30%
TN	11.30%	11.00%	11.10%	11.00%	10.70%					11.20%	10.90%

Source: Tennessee Department of Health, Birth Statistics

Figure 8.13: Percent of Live Births with Pre-term Birth by Race, 2020



Source: National Institutes of Health

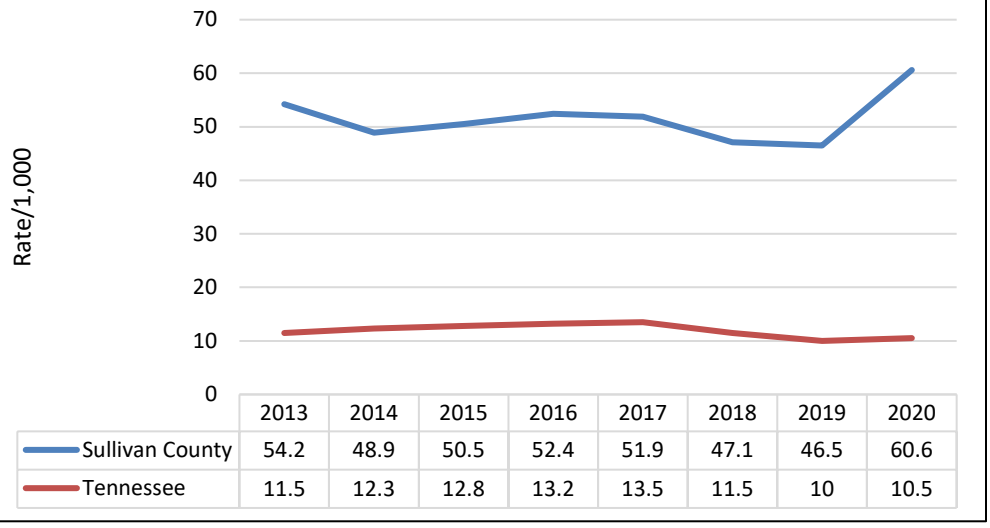
Neonatal Abstinence Syndrome:

Neonatal Abstinence Syndrome (NAS) is a group of adverse medical conditions that occur when a fetus is exposed to opioid drugs during pregnancy. NAS is often a hidden consequence of the opioid pandemic experienced in recent years. Although fetal exposure to other substances may lead to NAS, drugs such as heroin, codeine, oxycodone, methadone, and buprenorphine are commonly associated with the condition. When taken during pregnancy, these drugs are passed from the mother to the fetus, causing the baby to become dependent on the substance. When the baby is born, it no longer receives the substance it is dependent on and withdrawal symptoms may ensue.[125]

Babies born with NAS are more likely to be admitted into an intensive care unit, have additional health problems, and require longer hospital stays than babies born without the condition.[125] In addition to NAS, conditions associated with fetal exposure to opioid drugs include premature birth, low birth weight, sudden infant death syndrome, small head circumference, and other birth defects. Treatment for NAS typically ranges from one week to six months.[126]

From 2013 to 2020, state rates have remained consistent, decreasing by 8.7% over nearly a decade. For these years, rates of NAS were remarkably higher in Sullivan County than those observed for Tennessee (see Figure 8.14). Incidence of NAS in Sullivan County appeared to slowly be decreasing from 2013-2019, but 2020 displayed a sharp increase in NAS (30.3%).[127] This mirrors the sharp increase in opioid overdose rates in the same year, and specifically the rapid rise in fentanyl overdose rates in Sullivan County (See Figure 4.20).

Figure 8.14: NAS Incidence



	2013	2014	2015	2016	2017	2018	2019	2020
Sullivan County	54.2	48.9	50.5	52.4	51.9	47.1	46.5	60.6
Tennessee	11.5	12.3	12.8	13.2	13.5	11.5	10	10.5

Source: Annie E. Casey Foundation, Kids Count Data Center

NAS Prevention

To combat the rise of NAS in Tennessee, the state has implemented several policies and working groups in recent years aimed at improving understanding of the opioid epidemic and the epidemiology of NAS, and modifying the legal environment that drugs are prescribed within. In 2012, the *Prescription Safety Act* was enacted to address the opioid drug epidemic, and a *Controlled Substances Monitoring Database* was established to help prescribers and pharmacists reduce over-prescribing of opioid drugs and prevent patients from "doctor shopping."[128] In 2013, Tennessee made NAS a reportable condition, meaning that health care providers are legally mandated to notify the Tennessee Department of Health of each baby diagnosed with the condition for monitoring and data collection.[129]

Past NAS prevention programs conducted in Tennessee were mostly "secondary" or "tertiary" in nature, meaning they focused on providing prevention services to women who were already at risk of delivering a baby with NAS, or provision of medical care to babies after they were born with the condition. Currently,

state-level plans are underway to increase "primary" prevention efforts, which aim to prevent women from becoming at risk for NAS delivery before they become pregnant. To accomplish this, public health practitioners are shifting their focus to drug-awareness and health-education campaigns to reduce substance abuse, unsafe sex, and unintended pregnancy in women of reproductive age. Additionally, health advocates are petitioning state lawmakers to provide better access to contraceptives that are long-acting and do not require active compliance on the part of the user to low income women and teens.[128] The state of Colorado implemented a program in 2009 that provided long-acting reversible forms of birth control to low income young women. After only two years of implementation, the state observed a 34% decrease in teen abortions and, after four years, they observed a 40% reduction in the teen birth rate.[130]

Substance Use Among Women Delivering Babies with NAS:

Throughout Tennessee, the most common source of fetal drug exposure to babies born with NAS since 2013 has been drugs used for physician-supervised drug replacement therapy, also known as medication assisted treatment (MAT). Drugs commonly used for this purpose are methadone and buprenorphine. Of note, is that the proportion of women delivering a baby with NAS reporting exposure to supervised replacement therapy drugs has decreased for each year of data since 2018, and the percent of babies born with NAS who was exposed to prescription opioids without the mother having a prescription has also decreased each year. Conversely, increases have been observed each year in the proportion of babies with NAS exposed to heroin and other non-prescription substances (see Table 8.2).[131]

Table 8.2: Non-Mutually Exclusive Sources of Exposure for NAS Cases, TN

	2018	2019	2020
Medication assisted treatment	**67.5%**	**64.9%**	**62.0%**
Prescription opioid without prescription	**29.8%**	**26.5%**	**23.5%**
Other non-prescription substance	**22.2%**	**23.4%**	**25.2%**
Non-opioid prescription without a prescription	**12.6%**	**11.0%**	**11.5%**
Legal prescription of an opioid pain reliever	**6.0%**	**5.2%**	**2.7%**
Legal prescription of a non-opioid	**8.4%**	**6.7%**	**5.5%**
Heroin	**6.6%**	**8.2%**	**10.3%**
Other non-prescription substance	**2.2%**	**4.6%**	**5.1%**
No known exposure	**0.9%**	**1.0%**	**0.0%**

Source: Tennessee Department of Health

Maternal & Child Health (Other)

Sudden Infant Death Syndrome:

Sudden infant death syndrome (SIDS) is a medical term used to refer to babies who die within one week to one year of life. It is a general term applied to infants whose cause of death remains undetermined after autopsy, death scene investigation, and medical history review. It usually occurs while babies are sleeping and the babies are typically considered healthy prior to their death.[132]

Although there is no way to determine which babies will experience SIDS, there are preventive measures to reduce the risk of SIDS occurrence. Healthy babies should sleep on their backs on bedding that is firm and flat. Cushions, pillows, and fluffy blankets should be avoided. Smoking should be avoided during pregnancy, and smoke-free areas should be established anywhere in a home that a baby will be. Babies should receive regular wellness check-ups and routine immunizations. Additionally, breast feeding aids in keeping babies well and may help prevent SIDS.[133]

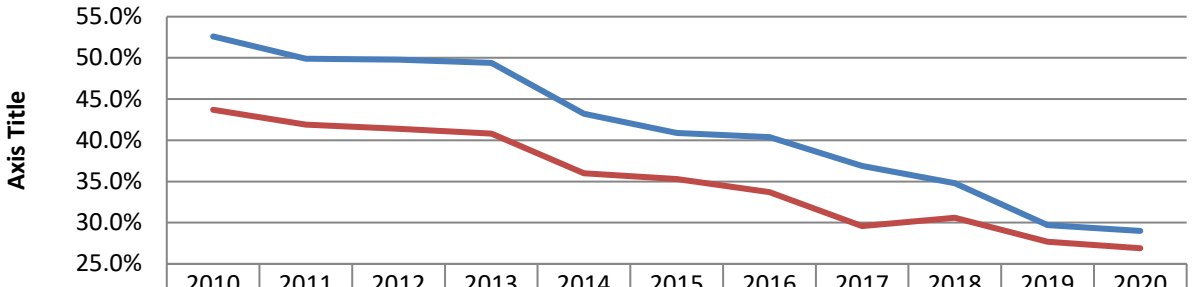
Specific annual SIDS incidence data is not publicly available for Sullivan County. In 2020, there were 29 deaths classified as sudden infant death syndrome in Tennessee, resulting in a crude fatality rate of 36.30/100,000 infants. Additionally, there was a higher percentage of SIDs among infants of the African American population.[26]

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC):

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is a federally funded nutrition program designed to provide supplemental food to low income pregnant women, postpartum and breastfeeding women, and to infants and children until the age of five. The program provides participants with supplemental foods and nutrition education, as well as promotion and support of breastfeeding. The WIC program, funded by the United States Department of Agriculture, has proven to prevent and improve nutrition-related health problems in children.[134]

Enrollment of children under the age of five in the WIC program has decreased across Tennessee and in Sullivan County from 2010-2020. Program participation was higher in Sullivan County than the state for each of these years.[135]

Figure 8.16: Percent of Children Under 5 Enrolled in WIC



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Sullivan	52.6%	49.9%	49.8%	49.4%	43.2%	40.9%	40.4%	36.9%	34.8%	29.7%	29.0%
TN	43.7%	41.9%	41.4%	40.8%	36.0%	35.3%	33.7%	29.6%	30.6%	27.7%	26.9%

Source: Annie E. Casey Foundation, Kids Count Data Center

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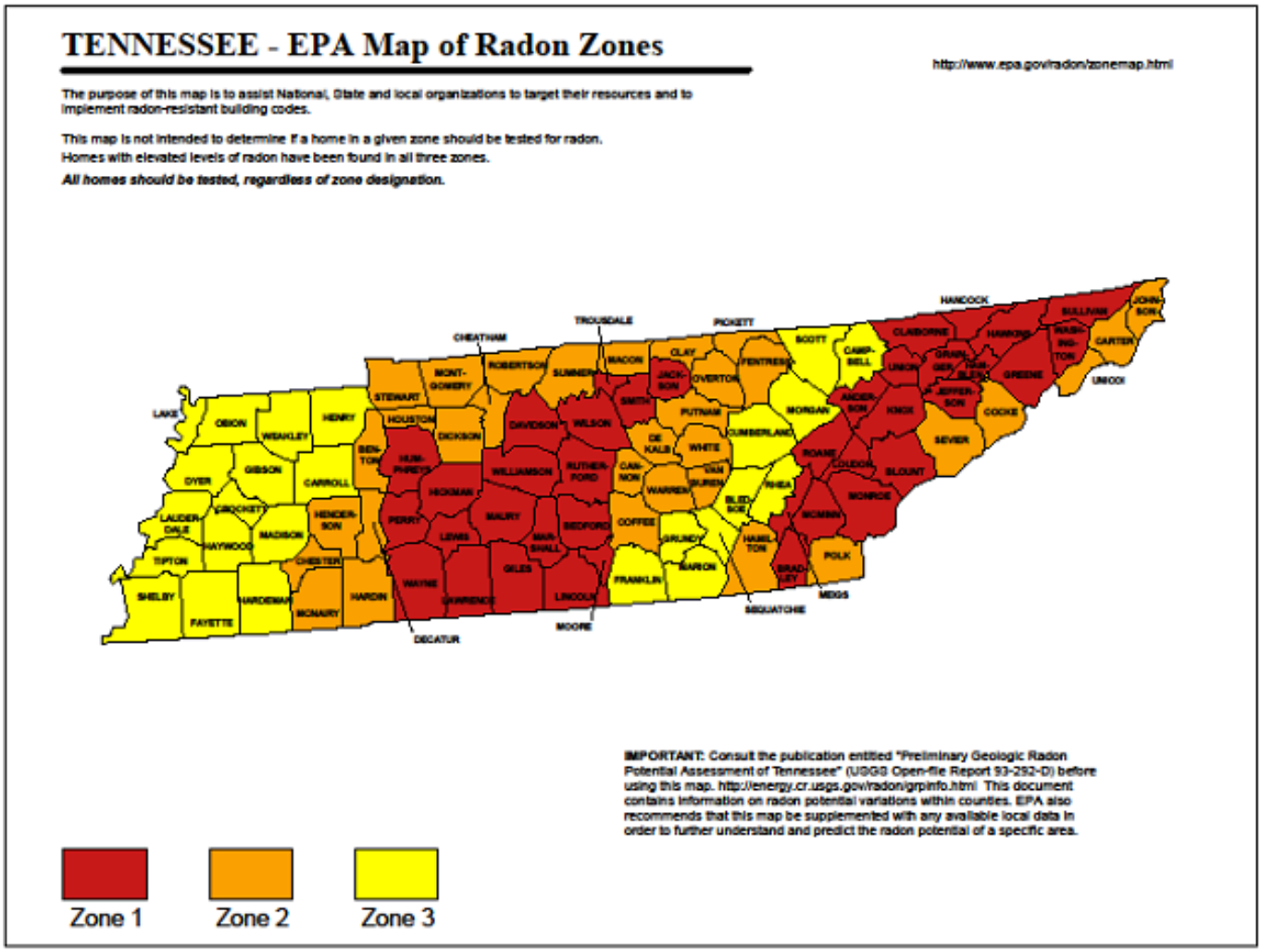
Air Quality

Radon:

Radon is a naturally occurring radioactive gas that is released during the decay of uranium found in rocks and soil, and is the second leading cause of lung cancer death in the United States. Nearly one in 15 US households has high levels of radon.[136] Sullivan County is categorized by the US Environmental Protection Agency as a having the highest risk level for indoor radon (Zone 1 = average household level, 2015 > 4 pCi/L).[137]

Although radon occurs naturally, there are steps homeowners can take to reduce levels of radon in their homes. The Tennessee Department of Environment and Conservation (TDEC) recommends all homeowners test their homes for radon, and offers free radon testing kits.[138] Home radon testing kits are available from the TDEC at this website: https://tdec.tn.gov/Radon_Online/frmRADON_Online.aspx.



Source: US Environmental Protection Agency

Criteria Pollutants:

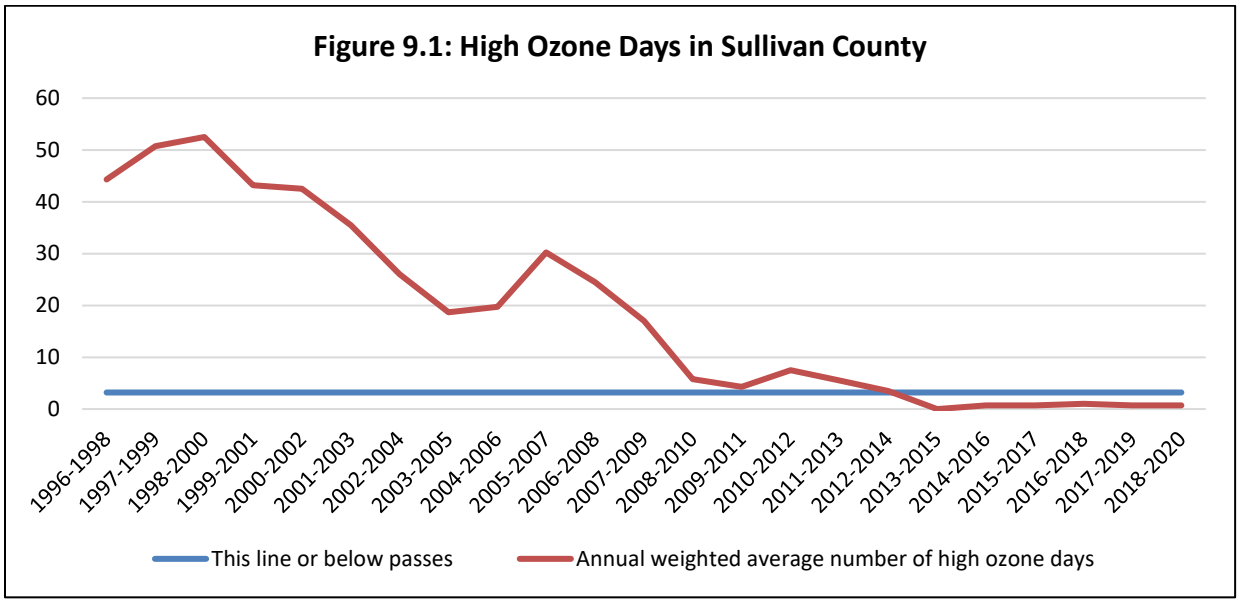
The US Clean Air Act recognizes six air pollutants, referred to as criteria pollutants, which are found commonly throughout the United States and are associated with adverse health effects. These pollutants can be harmful to human health and the environment if concentration levels exceed certain limits. The Clean Air Act requires the US Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) to establish target levels for each criteria pollutant at a concentration that reduces risk to the health of vulnerable populations so as to protect the public's health. Even when NAAQS are met, individual members of high risk groups may, at times, experience adverse health effects related to a given pollutant.[139] Each of the six criteria pollutants are reviewed below. For some pollutants, data on concentration levels were not available and the pollutant is introduced without concentration levels reported.

Ozone:

Ozone is a gas that is found naturally in the atmosphere and shields the earth from the sun's rays. However, when ozone occurs at the ground level, it can lead to health problems for children, the elderly, and people who have lung diseases, such as asthma. Ground level ozone is not emitted into the air directly, but is created by chemical interactions between nitrogen oxides, volatile organic compounds, and sunlight. Emissions from industrial facilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are common sources of these chemicals.[140]

Over the past two decades, reductions in ambient ozone levels have been reported in Sullivan County. An area air quality advocacy group attributes this downward trend to reductions in air pollutants emitted from electric utilities and large industrial complexes, as well as stronger emissions standards for automobile engines and interstate speed reductions for heavy commercial vehicles (see Figure 9.1).[141]

Figure 9.1: High Ozone Days in Sullivan County



Source: American Lung Association

As demonstrated in the illustration above (see Figure 9.1), three-year weighted average number of high ozone days in Sullivan County have decreased overall from 1996-1998 to 2018-2020. During this time, National Ambient Air Quality standards have changed several times, and each change lowering the accepted ozone concentration further. With the exception of two periods (2005-2007 & 2010-2012), three-year average number of high ozone days have been within federally mandated NAAQS for ozone concentration for their respective periods. The 2005-2007 period, which exceeded the NAAQS set at that time, was attributed to a record drought.[141]

Carbon Monoxide:

Carbon monoxide (CO) is a colorless, odorless gas produced when certain materials are burned. CO can be harmful to health in large concentrations because it reduces the capacity of blood to carry oxygen to vital organs. Increased levels of CO in the air can be harmful to the public, especially to persons with preexisting heart conditions. Persons with heart disease have a decreased ability to transport oxygenated blood under normal conditions and are vulnerable to added stress during physical activity from CO's blood-oxygen decreasing effect. Gasoline-fueled vehicles are the major causes of CO pollution in the United States.[142] Data for ambient CO concentrations was not located for Sullivan County or Northeast Tennessee.

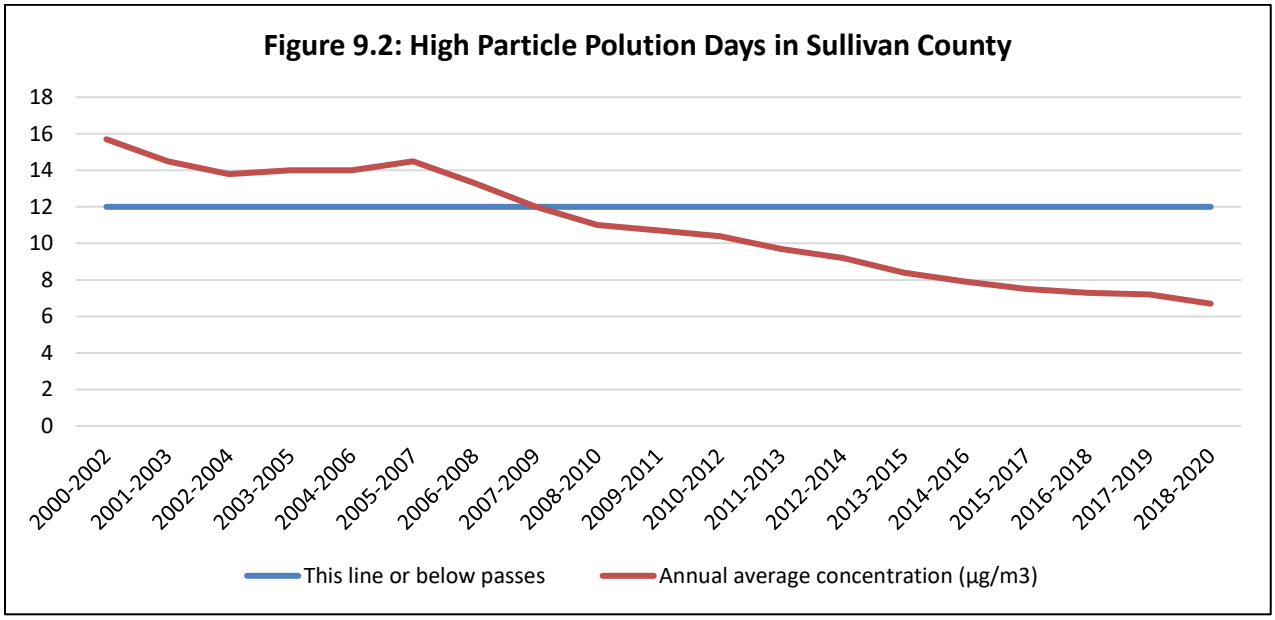
Sulfur Dioxide:

Sulfur dioxide (SO_2) is a harmful gas produced predominantly by fossil fuel-burning power plants and industrial facilities. Short term exposure to SO_2 is harmful to the respiratory system and can make breathing difficult for children, the elderly, and persons with asthma or other lung diseases. Additionally, SO_2 is harmful to the environment and can damage plants and contribute to acid rain. Data for SO_2 was not recorded by the Tennessee Department of Environmental Conservation for Sullivan County until 2016.[143] At the time of this document's press, valid measures for SO_2 were not publicly available for Sullivan County.

Particulate Matter:

Particulate matter (PM), also known as particle pollution, is a general term for a broad group of substances that exist as particles of different sizes suspended in the air. The chemical and physical properties of these substances vary greatly. As opposed to some particles in the air, such as dust or smoke, that are large enough to see with the naked eye, particulate matter is so small that it can only be observed with a powerful microscope. PM is classified by diameter. For instance, particulate matter 2.5 ($PM_{2.5}$) is the smallest category, having a diameter of 2.5 micrometers or smaller; 30 times smaller than the diameter of human hair. For this reason, it is referred to as fine particulate matter.[142]

In 2012, the US EPA lowered the NAAQS for $PM_{2.5}$ from 15 to 12 micrograms per cubic meter ($\mu g/m^3$). Data available for Sullivan County shows that from 2000-2020, average concentrations of $PM_{2.5}$ in Sullivan County have steadily decreased and remains below the passing line set by the American Lung Association. The passing line is based around the most recent NAAQS of 12 $\mu g/m^3$, indicating the county is well within NAAQS for $PM_{2.5}$ (see Figure 9.2).[141]

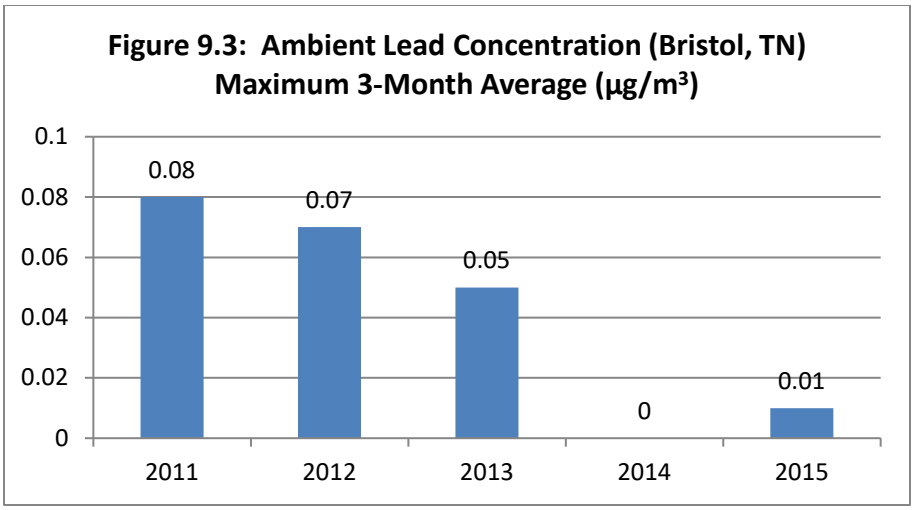


Source: American Lung Association

Lead:

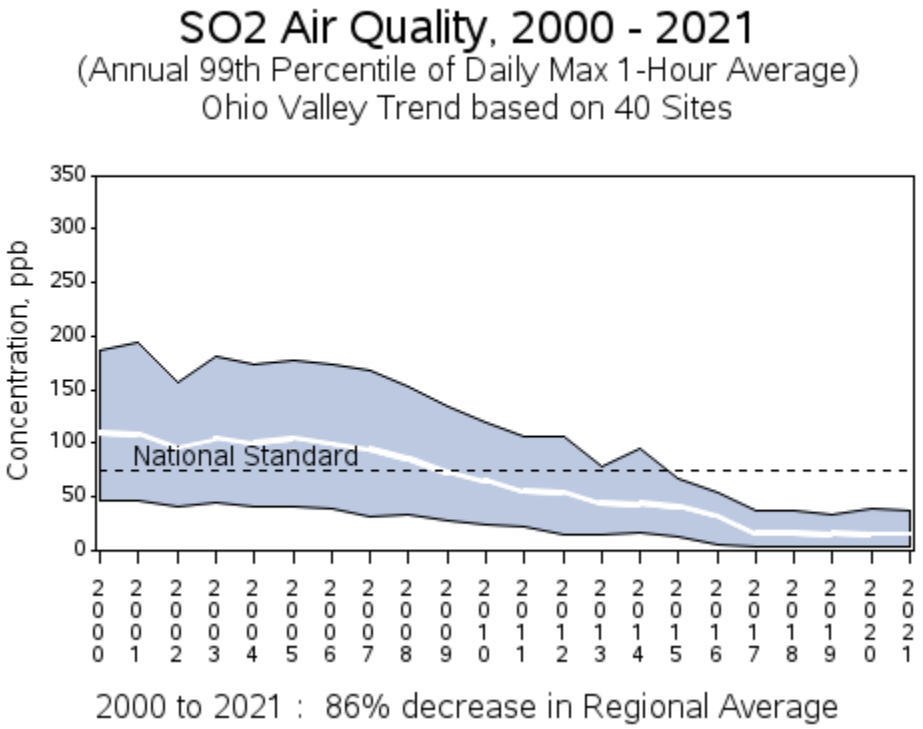
Historically, automobile combustion of lead-based gasoline was the primary source of lead air pollution. Since the elimination of leaded gasoline in the mid-1990s, the majority of lead air pollution comes from industrial operations including lead smelting and battery recycling processes. Lead accumulates in the body and may cause abnormal nervous system development in young children, leading to lower cognitive abilities and behavioral problems.[142]

The NAAQS for lead is 0.15 micrograms per cubic meter ($\mu g/m^3$) in total suspended particles for a three-month average.[139] Three-month average measures of ambient lead in Bristol have decreased overall from 2011-2015, and have remained well below NAAQS for each of these years (see Figure 9.3). More recent data was not available for Sullivan County, though SO2 air quality trends for the Ohio Valley Region, which includes all of Tennessee, is visualized in Figure 9.4 displaying that the region's SO2 concentration has remained below national standards since 2015.[144]



Source: Northeast Tennessee Ozone Action Partnership

Figure 9.4



Source: Environmental Protection Agency

Nitrogen Dioxide:

Nitrogen dioxide (NO_2) is a gas released into the atmosphere from burning fuel. Common sources of NO_2 are emissions from automobiles and fossil fuel-burning power plants. NO_2 irritates the respiratory system. Short-term exposure may aggravate symptoms of persons with respiratory diseases, such as asthma,

causing respiratory distress and increased hospital utilization. Long-term exposure may lead to the development of asthma and increased susceptibility to respiratory infections.[145] Data was not available for NO_2 concentrations in Sullivan County.

Waterway Quality

Impaired Waterways:

The following table reports contamination of local waterways by pollutant type and source. The federal Clean Water Act requires states to report which waterways, including lakes and streams, are expected to violate water quality standards by exceeding tolerable levels of contamination and need additional pollution control efforts. These waterways are therefor considered impaired (see Table 9.1).[146]

Table 9.1: Impaired Waterways in Sullivan County 2022		
South Fork Holston River		
Water Way	**Pollutant**	**Pollutant Source**
Dry Creek	E. Coli	Animal Feeding Operations (NPS)
Madd Branch	E. Coli	Municipal, Channelization
Gammon Creek	E. Coli	Channelization, Pasture Grazing
Beaver Creek	E. Coli, Siltation	Channelization, Pasture Grazing Sources Outside State Borders
Little Creek	E. Coli, Siltation	Channelization Sources Outside State Borders, Municipal
Fall Creek	E. Coli	Pasture Grazing, Municipal
Kendrick Creek	E. Coli, Siltation, Litter	Pasture Grazing, Municipal
Rock Springs Branch	E. Coli, Siltation	Pasture Grazing, Municipal
Mill Creek	E. Coli	Pasture Grazing
Unnamed Trib to Reedy Creek	E. Coli, Flow Regime Modification	Municipal, Dam or Impoundment
Walker Fork Creek	E. Coli	Pasture Grazing
Lynch Branch	E. Coli	Pasture Grazing
Bear Creek	E. Coli	Pasture Grazing
Horse Creek	E. Coli	Pasture Grazing
Russell Creek	E. Coli	Pasture Grazing
Candy Creek	E. Coli	Pasture Grazing
Unnamed Trib to South Fork Holston River	E. Coli	Pasture Grazing

Paddle Creek	E. Coli	Pasture Grazing
Unnamed Trib to South Fork Holston River	E. Coli	Pasture Grazing
Morrell Creek	E. Coli	Pasture Grazing
Weaver Branch	E. Coli	Pasture Grazing
Timbertree Branch	E. Coli	Pasture Grazing
Reedy Creek	E. Coli, Siltation	Pasture Grazing, Municipal
Painter Spring Branch	E. Coli	Pasture Grazing
Booher Creek	E. Coli	Pasture Grazing
Muddy Creek	E. Coli	Pasture Grazing
Little Horse Creek	E. Coli	Pasture Grazing
Wagner Creek	E. Coli	Pasture Grazing
Back Creek	E. Coli, Siltation	Pasture Grazing, Unrestricted Cattle Access
Blair Gap Branch	E. Coli	Pasture Grazing
Miller Branch	E. Coli	Pasture Grazing
Woods Branch	E. Coli	Pasture Grazing
Thomas Creek	E. Coli	Pasture Grazing
Sinking Creek	Sedimentation/ Siltation	Municipal
Evans Creek	Litter, Sedimentation	Municipal
Steele Creek	Low Flow Alterations	Upstream Impoundments
Cedar Creek	E. Coli, Siltation	Municipal
Whitetop Creek	E. Coli, Siltation	Pasture Grazing, Municipal
Tranbarger Branch	E. Coli, Substrate Alterations	Municipal
Gravelly Branch	Litter	Municipal
Gaines Branch	E. Coli, Siltation	Pasture Grazing, Municipal
Hicks Creek	Litter	Rural Residential Areas
Robinson Creek	E. Coli	Pasture Grazing
Watauga River		
Darr Creek	E. Coli, Siltation, Litter	Pasture Grazing

Source: Tennessee Department of Environment and Conservation

Water Utility Violations:

Table 9.2 below presents water utility districts within Sullivan County and they nature and frequency of water system contamination violations issued from 2016-2020.[147]

Table 9.2: Public Water System and Type of Violation by Year [Nature of Violation and (Annual Frequency)]					
Utility District	**2016**	**2017**	**2018**	**2019**	**2020**
Bloomingdale Utility District	NA	NA	NA	NA	NA
Blountville Utility District	NA	NA	NA	NA	NA
Bluff City Water Department	NA	Simazine (1); LASSO (1);	NA	NA	Chlorobenzene (1); Benzene (1); Toluene (1); Dichloropropane (1); Ethylbenzene (1); Tetrachloroethylene (1); Trichloroethylene (2); Trichlorobenzene (1); Dichloroethylene (3); Total Xylenes (1); Dichloromethane (1); Dichlorobenzene (2); Vinyl chloride (1); Dichloroethane (1); Trichloroethane (1); Carbon Tetrachloride (1); Styrene (1); Total Haloacetic Acids (1); TTHM (1);
Bristol Dept. Utilities	NA	NA	NA	NA	NA
Bristol-Bluff City Utility District	NA	Picloram (1); Atrazine (1);	NA	NPDWR Violation	NA

Holston Utility District	HAA5, Chlorine, Coliform (TCR), TTHM,	HAA5, Chlorine, Coliform (TCR), TTHM,	HAA5, Chlorine, Coliform (TCR), TTHM,	HAA5, Chlorine, Coliform (TCR), TTHM,	HAA5, Chlorine, Coliform (TCR), TTHM,
Intermont Utility District	Chlorine (1)	NA	NA	NA	NA
Jacobs Creek Job Corps Center - USFS	HAA5, Chlorine, E. Coli Coliform (TCR), TTHM, Nitrate, Mercury, Selenium, Cadmium,Chromium, Fluoride, Arsenic, Barium, Toxaphene, Methoxychlor, BHC-GAMMA, Endrin	Chlorine, Coliform, HAA5, TTHM, E. Coli, Nitrate, Mercury, Selenium, Cadmium, Fluoride, Arsenic, Barium, Cadmium, Chromium,Toxaphene, Methoxychlor, Endrin,	Chlorine, Coliform, HAA5, TTHM, E. Coli, Nitrate, Mercury, Selenium, Cadmium, Chromium, Fluoride, Arsenic, Barium, Toxaphine, Methoxychlor, Endrin	NA	NA
Kingsport Water Department	NA	NA	NA	NA	NA
Robindale Water Association	NA	NA	NA	NA	NA
South Bristol - Weaver Pike	NA	NA	NA	NA	NA

Source: US Environmental Protection Agency

Childhood Blood Lead Levels

Exposure to lead during childhood can have serious implications for children's cognitive function. Further, the effects of childhood lead exposure are lasting and do not get better with time. Even small amounts of lead detected in children's blood has been associated with lowered IQ, reduced ability to pay attention, and poorer academic achievement. Exposure to lead in the home may come from paint in homes built before 1978 or from water pumped through leaded pipes. Testing may be conducted to determine if your home was finished with materials containing lead.[148]

In the past, a blood lead level (BLL) of 10 micrograms of lead per deciliter of blood (µg/dL) was considered concerning. While there is no safe level of lead in children, the CDC uses a blood lead reference value of 3.5 micrograms of lead per deciliter of blood to identify children with higher BLLs than most other children's levels in the US. Medical treatment is not recommended for children with concentrations lower than 45 µg/dL. However, parents should be aware of the hazard of residential lead exposure if their child has a concentration greater than 3.5 µg/dL and seek consultation to identify the source.[148]

The following tables and figures represent the number of children under the age of 6 who were screened for elevated BLL, as well as the number of children with BLL ≥5 µg/dl, measured in Sullivan County and for the state of Tennessee. Figures were not included due to the vast population difference between the state and Sullivan County, as well as counts of high BLL being reported instead of rates.

Table 9.3: Blood Lead Level (BLL) Testing in Children under 6 years

Year	Number of Children Tested		Number of Children with BLL>=5	
	Sullivan County	Tennessee	Sullivan County	Tennessee
2013	2730	84912	8	455
2014	2644	84473	8	407
2015	2629	86027	6	334
2016	2497	90872	7	431
2017	1909	87178	4	346
2018	2266	84205	4	438
2019	2264	91857	5	416
2020	1937	82942	3	332

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2022 County Health Ranking, Tennessee: Sullivan County = 30th					
Metric*	**Sullivan**	**TN**	**County Health Ranking**	**Year of Data**	**Measurement Definition**
Length of Life	**	**	**30**		
Premature Death (YPPL/100,000)	10,600	9,900		2018-2020	Years of potential life lost before age 75 per 100,000 population (age-adjusted)
Quality of Life	**	**	**16**		
Poor or Fair Health	23%	20%		2019	Percentage of adults reporting fair or poor health (age-adjusted)
Poor Physical Health Days	4.9	4.5		2019	Number of days in past 30 days that physical health was reported "not good" (age-adjusted)
Poor Mental Health Days	5.6	5.1		2019	Number of days in past 30 days that mental health was reported "not good" (age-adjusted)
Low Birthweight	8%	9%		2014-2020	Percentage of live births with low birthweight (< 2,500 grams)
Health Behaviors	**	**	**10**		
Adult Smoking	23%	21%		2019	Percentage of adults who are current smokers
Adult Obesity	36%	37%		2019	Percentage of adults that report a BMI of 30 or more
Food Environment Index	6.7	6.2		2019	Index of factors that contribute to a healthy food environment (0 worst, 10 best)
Physical Inactivity	32%	29%		2019	Percentage of adults aged 20+ reporting no leisure-time physical activity
Access to Exercise Opportunities	68%	62%		2010&2021	Percentage of population with adequate access to locations for physical activity
Excessive Drinking	15%	17%		2019	Percentage of adults reporting binge or heavy drinking
Alcohol-Impaired Driving Deaths	18%	23%		2016-2020	Percentage of driving deaths with alcohol involvement
Sexually Transmitted Infections	317.7	601.7		2019	Number of newly diagnosed chlamydia cases per 100,000 population
Teen Births	29	27		2014-2020	Number of births per 1,000 female population aged 15-19
Clinical Care	**	**	**5**		
Uninsured	12%	12%		2019	Percentage of population under age 65 without health insurance
Primary Care Physicians	800:1	1,400:1		2019	Ratio of population to primary care physicians
Dentists	1,310:1	1,790:1		2020	Ratio of population to dentists
Mental Health Providers	760:1	590:1		2021	Ratio of population to mental health providers
Preventable Hospital Stays	3,996	4,331		2019	Number of hospital stays for ambulatory-care conditions per 1,000 Medicare enrollees
Flu Vaccinations	51%	50%		2019	Percentage of free-for-service (FFS) Medicare enrollees that had an annual flu vaccination
Mammography Screening	50%	43%		2019	Percentage of female Medicare enrollees aged 67-69 received mammography screening
Social & Economic Factors	**	**	**17**		
High School Graduation	87%	88%		2016-2020	Percentage of adults ages 25 and over with a high school diploma or equivalent
Some College	61%	62%		2016-2020	Percentage of adults age 25-44 with some pose-secondary education
Unemployment	7.2%	7.5%		2020	Percentage of population ages 16 + unemployed but seeking work

Children in Poverty	21%	18%		2020	Percentage of children under age 18 in poverty
Income Inequality	4.4	4.7		2016-2020	Ratio of household income at the 80th percentile to income at the 20th percentile
Children in Single-Parent Household	25%	28%		2016-2020	Percentage of children living in a household headed by a single parent
Social Associations	14.0	11.1		2019	Number of membership associations per 10,000 population
Violent Crime	484	621		2014-2016	Number of reported violent crimes per 100,000 population
Injury Deaths	101	100		2016-2020	Number of deaths due to injury per 100,000 population
Physical Environment	**	**	**93**		
Air Pollution – Particulate Matter	7.2	8.0		2018	Avg. daily density of fine particulate matter (µg/m^3)
Severe Housing Problems	11%	14%		2014-2018	Percentage of households with ≥ 1 of 4 housing problems: overcrowding, high housing costs, lack of kitchen plumbing facilities
Driving Alone to Work	85%	82%		2016-2020	Percentage of work force that drives alone to work
Long Commute – Driving Alone	27%	36%		2016-2020	Percentage of workers commuting alone for more than 30 minutes
*Color Code: Green = Sullivan Co. outcome > 1% better than TN; Yellow = Sullivan Co. within 1% of TN; Red = Sullivan Co. outcome > 1% worse than TN					
Source: Robert Wood Johnson Foundation & University of Wisconsin; County Health Rankings					