

THE BURDEN OF CARDIOVASCULAR
DISEASES AND TRANSIENT ISCHEMIC
ATTACK IN DELAWARE
2011-2015

Issued November 2018

DIABETES AND HEART DISEASE PREVENTION AND CONTROL PROGRAM



DELAWARE HEALTH AND SOCIAL SERVICES

Division of Public Health

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Executive Summary

The Burden of Cardiovascular Diseases and Transient Ischemic Attack in Delaware, 2011-2015 provides a comprehensive examination of the burden of cardiovascular disease and transient ischemic attack (TIA) in the state's population. The Diabetes and Heart Disease Prevention and Control Program (DHDPCP) within Delaware's Division of Public Health (DPH) produced this report to provide trends for the prevalence of both cardiovascular disease and TIA, and mortality trends for cardiovascular disease.

Data analyzed in this report include the Behavioral Risk Factor Survey (BRFS) and mortality data from 2011-2015. A single year (2015) is presented for emergency department visits and hospital discharges (2011) to provide the most current and accurate burden on the Delaware hospital systems. When appropriate, this report provides differences in demographic characteristics and risk factor statuses.

Cardiovascular disease (CVD) is a broad classification referring to heart disease, vascular diseases, and cerebrovascular diseases. Prevalence data exists for only a select few CVD conditions. Hospital discharge and mortality data capture International Classification of Disease (ICD) codes, ICD-9-CM and ICD-10; therefore, all CVD conditions and TIA are included. In addition, risk factors associated with CVD and TIA are included.

Highlights of CVD and TIA information presented in the report are:

- According to the 2015 Delaware BRFS, 4.2 percent of Delaware's adult population (18 years and older) were diagnosed with coronary heart disease or angina. There has been no significant change in this number over the previous five years. As age increases, so does the risk of developing coronary heart disease or angina. Delaware adult males were more likely to report having coronary heart disease or angina than Delaware adult females. Delaware adults with a disability were more likely to report having coronary heart disease or angina than Delaware adults without a disability. Delaware adults who reported having high blood pressure were also more likely to report having coronary heart disease or angina, compared to Delaware adults who reported having normal blood pressure.
- According to the 2015 BRFS, 4.8 percent of Delaware's adult population (18 years and older) reported ever having a heart attack. There has been no significant change in this number over the previous five years. As age increases, so does the likelihood of reporting ever having heart attack. Delaware adults with a disability were more likely to report ever having a heart attack, compared to Delaware adults without a disability. Delaware adults reporting having high blood pressure were more likely to report ever having a heart attack, compared to Delaware adults reporting normal blood pressure.
- During the period from 2011 through 2015, the prevalence of reporting ever having a stroke has also stayed approximately the same, fluctuating between 3.2 percent and 3.6 percent in Delaware. As age increases, so does the risk reporting ever having a stroke. Delaware adults with a disability were more likely to report ever having a stroke, compared to Delaware adults without a disability. Delaware adults reporting having hypertension were more likely to report ever having a stroke, compared to Delaware adults reporting having normal blood pressure.

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- During 2015, there were more than 25,000 emergency department visits to Delaware hospitals with the chief complaint of “cardiac syndrome.” This includes chest pain, tachycardia, bradycardia, and other arrhythmias.
- There were over 3,100 emergency room visits to Delaware hospitals for the chief complaint of “stroke syndrome” during 2015. This includes all forms of stroke and TIA.
- In 2011, the most recent year available at the time of writing this report, there were 16,419 hospital discharges for “diseases of the circulatory system,” accounting for 14.9 percent of all Clinical Classifications Software (CCS) diagnostic code discharges that year. Heart disease comprises the largest percentage of all “diseases of the circulatory system” hospital discharges. There are 11 groupings and 10,458 discharges for 2011. Vascular disease comprises just shy of 18 percent of all “diseases of the circulatory system” hospital discharges. In 2011, there were 2,910 vascular disease hospital discharges. Cerebrovascular Disease and TIA were responsible for slightly more than 18 percent of all “diseases of the circulatory system” or 3,051 hospital discharges in Delaware in 2011.
- “Diseases of the heart” were consistently the second leading cause of death in Delaware from 2011 through 2015, closely following malignant neoplasms. There were 9,294 deaths (23 percent of total deaths) caused by “diseases of the heart” during this period.
- Cerebrovascular disease was responsible for 2,139 deaths from 2011 through 2015 in Delaware.
- Vascular disease contributes a relatively small number of deaths, compared to heart disease and cerebrovascular disease. There were only 431 deaths from essential hypertension and hypertensive renal disease and aortic aneurysm and dissection from 2011 through 2015 in Delaware.

Analyzing data highlighted within this report provides an overview of the burden of CVD and TIA within the state of Delaware. It provides a resource to evaluate the determinant of CVD and TIA. This report is intended to be used for program planning and policy development both within the government and also by valued stakeholders. This report is planned to be updated in five-year intervals. This report will be available on the DHDCPC website: <http://www.dhss.delaware.gov/dhss/dph/dpc/diabetes.html>.

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Introduction

Cardiovascular disease (CVD) is a broad classification referring to heart disease, vascular disease, and cerebrovascular disease. The two main heart disease conditions are coronary artery disease and heart attack. Other heart disease conditions include acute coronary syndrome, angina, arrhythmias, cardiomyopathy, congenital heart defects, heart failure, and rheumatic heart disease. Vascular disease refers to a group of diseases affecting the circulatory system. These conditions include atherosclerosis, aortic aneurysm, peripheral artery disease, and hypertension. Cerebrovascular disease include nontraumatic subarachnoid and intracranial hemorrhage, cerebral infarction, and occlusion and stenosis of cerebral and precerebral arteries.

Cerebral infarction, also referred to as stroke, is a type of cerebrovascular disease. During a stroke, blood flow is interrupted to the brain, causing the affected area of the brain to begin to die. Symptoms of the damage show in the areas of the body controlled by the affected area of the brain. There are two different types of stroke: ischemic stroke and hemorrhagic stroke. Transient ischemic attack (TIA) is usually included in the definition of stroke. However, it is not considered a cerebral infarction nor is it included as a cerebrovascular disease, but rather a cerebrovascular event resulting in no permanent damage because it is a temporary loss of blood supply to the brain. Symptoms of TIA are similar to stroke, but are not permanent.

In 2015, the Centers for Disease Control and Prevention (CDC) estimated 28.4 million adults in the United States have been diagnosed with heart disease. In addition, 6.3 million adults have had a stroke and survived. It is estimated more than 795,000 people in the United States have a stroke annually. Of these, 610,000 people are experiencing their first stroke.

During 2015 according to the Behavioral Risk Factor Survey (BRFS), more than 52,000 Delaware adults reported ever having coronary heart disease, heart attack, or angina. In the same year, more than 26,000 Delawareans reported ever having a stroke and surviving. In 2015, there were more than 28,000 emergency department visits for “cardiac syndrome” or “stroke syndrome” in Delaware or to a neighboring emergency department reporting to Delaware. In addition, there were 16,419 hospital discharges for “diseases of the circulatory system,” accounting for 14.9 percent of all hospital discharges in 2011. More than 10,000 Delaware residents died from cardiovascular disease conditions between 2011 and 2015.

In addition to the complex relationships among cardiovascular disease conditions and TIA, many risk factors and lifestyle behaviors contribute to the risk of developing one or more of these conditions. The 2015 BRFS shows many of these risk factors affect a large portion of the Delaware adult population:

- High cholesterol – almost 40 percent among Delaware adults
- Not consuming the recommended number of fruits and vegetables – almost 85 percent among Delaware adults
- No physical activity and/or being obese – almost 30 percent among Delaware adults
- Smoking – 17 percent among Delaware adults
- Diabetes – 11.5 percent.

Methods

This report uses four separate surveillance systems to describe cardiovascular disease and TIA in Delaware:

1. Behavioral Risk Factor Survey (BRFS) for prevalence
2. Syndromic surveillance of chief complaints from hospital and ambulatory care facilities, reported as chief complaints to the Delaware Electronic Reporting and Surveillance System (DERSS)
3. Hospital discharges (reported as claims through the UB-04 CMS-1450 hospital billing form¹)
4. Mortality (reported from death certificates).

Both hospital discharges and mortality use International Classification of Disease (ICD) as the underlying coding for conditions. In contrast, the BRFS asks respondents to report disease conditions through a survey. Therefore, the BRFS captures only a few of the most significant cardiovascular diseases.

International Classification of Disease (ICD)²: Hospital Discharge and Mortality

ICD is the code used worldwide to classify mortality data. The Clinical Modification (CM) is the international code used to classify morbidity data from a variety of sources. Health care professionals use these classification standards to report diseases and health conditions, and to identify health trends.

Clinical Classifications Software³

Clinical Classifications Software (CCS) is a classification scheme created for the Healthcare Cost and Utilization Project, a partnership among federal, state, and industry stakeholders and sponsored by the Agency for Healthcare Research and Quality. The classification schemes created group-related ICD codes into larger clinically meaningful categories for presenting descriptive analysis. CCS collapses the following smaller ICD categories (heart disease conditions, vascular disease conditions, cerebrovascular disease conditions, and transient ischemic attacks) into one larger category: “diseases of the circulatory system.”

Hospital Discharges

Hospital discharge, or hospitalization, refers to any discharge from a non-federal, short-stay, acute-care hospital in Delaware. Hospital discharges are expressed as numbers of discharges, not as unduplicated patients; as a result, a single patient with multiple hospitalizations can be counted more than once. Delaware hospital discharge data are based on inpatient hospitalizations and do not include outpatient, clinic, or emergency department data. Unless otherwise specified, the data presented represent discharges from the following hospitals and systems: Alfred I. duPont Hospital for Children, St. Francis Hospital, Christiana Care Health System (which consists of Christiana Hospital, the Health System’s main

¹ Department of Health & Human Services, Centers for Medicare & Medicaid Services. *CMS Manual System Pub 100-04 Medicare Claims Processing*, 2012. <https://www.cms.gov/Regulations-and-Guidance/Guidance/Transmittals/Downloads/R2492CP.pdf> (Retrieved April 18, 2018).

² World Health Organization. (2016). *International Statistical Classification of Diseases and Related Health Problems* (5th ed.). <http://www.who.int/classifications/icd/en/> (Retrieved January 17, 2018).

³ Healthcare Cost and Utilization Project (HCUP). 2018. *HCUP User Support (HCUP-US)*. <https://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp> (Retrieved February 2, 2018).

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campus located in Newark, and Wilmington Hospital), Bayhealth Medical Center (which consists of Kent General Hospital and Milford Memorial Hospital), Beebe Medical Center, and Nanticoke Memorial Hospital⁴. Hospital discharge data is sorted by ICD-9-CM into categories by CCS. The broad category “diseases of the circulatory system” defined by CCS includes all cardiovascular disease and stroke.

Mortality Data⁵

As defined by ICD-10, cardiovascular disease includes heart disease, diseases and disorders of the circulatory system, and cerebrovascular diseases. Many of these conditions are complexly interrelated. Heart disease is a group of diseases affecting only the heart and its structures. Vascular diseases refer to diseases affecting the circulatory system; cerebrovascular diseases includes stroke. However, TIAs are not included in cerebrovascular disease, as defined by ICD-10. Mortality data use the *ICD-10 Cause-of-Death Lists for Tabulating Mortality Statistics Instruction Manual* from the CDC to classify ICD-10 codes into larger, broader categories. Analysis and presentation of mortality data uses ICD-10 codes and the related definitions.

Other Data Systems

Data systems that do not use the ICD coding are an important part of presenting the burden of CVD and TIA in Delaware. Delaware does not have a registry of those diagnosed with any of the diseases detailed in this report. As a result, prevalence is presented for selected cardiovascular diseases and stroke.

Behavioral Risk Factor Survey (BRFS)⁶

Respondents to the BRFS are asked the following questions:

- (Ever told) you had a heart attack, also called a myocardial infarction?
- (Ever told) you had angina or coronary heart disease?
- (Ever told) you had a stroke?
- Have you EVER been told by a doctor, nurse, or other health professional that you have high blood pressure?
- Are you currently taking medicine for your high blood pressure?
- Have you EVER been told by a doctor, nurse or other health professional that your blood cholesterol is high?

In the case of heart attack and stroke, only respondents who had an event and survived without major sequelae are able to respond. This is a significant limitation to using survey data in reporting prevalence for conditions with high morbidity and high mortality. In addition, the question regarding stroke does not differentiate between those who have had stroke or a TIA.

⁴ Delaware Health Statistics Center. Delaware Hospital Discharge Summary Report, 2011. Delaware Health and Social Services, Division of Public Health, 2017. http://dhss.delaware.gov/dhss/dph/hp/hosp_dis_data.html (Retrieved November 15, 2018).

⁵ Delaware Health Statistics Center. Delaware Vital Statistics Executive Summary Report, 2015. Delaware Health and Social Services, Division of Public Health, 2017. <http://dhss.delaware.gov/dhss/dph/hp/files/mort15.pdf> (Retrieved November 15, 2018).

⁶ Delaware Division of Public Health. Delaware Behavioral Risk Factor Survey. <http://www.dhss.delaware.gov/dhss/dph/dpc/brfsurveys.html> (Retrieved December 14, 2018).

Chief Complaint Data⁷

For analysis of chief complaint syndromic surveillance, the CDC's SAS-based macro program, EARS v4r5 was used. Modifications were made to the cardiac category to more accurately capture chief complaints related to the above ICD-9-CM and ICD-10 coded conditions while not picking up background noise. These modifications were made based on reading the chief complaints submitted to the Delaware Department of Health and Social Services, Division of Public Health (DPH). Chief complaints can vary among hospital and emergency departments (ED), and among those who enter the chief complaint. Therefore, by reviewing the chief complaint nomenclature, modifications to the definitions were tailored to how chief complaints were coded by the various hospitals and EDs.

Classification Differences and Challenges among Categories

This report presents data from a number of different data systems to tell a well-rounded story of the burden of cardiovascular diseases in Delaware. Each data system provides elements to help us understand the larger picture. However, these systems are independent of each other, despite using the same coding system. Hospital discharges count discharges, not patients. One patient could potentially have multiple discharges during the analysis year. Mortality data counts each death. Likewise, while hospital discharge and mortality data both use ICD coding, data are presented in the most commonly used data presentation categorization method. Therefore, diseases in mortality categories and hospital discharge categories differ. Hospital discharge includes more diseases in the "diseases of the circulatory system," examples of which are hemorrhoids and TIA are not included in mortality data.

⁷ Centers for Disease Control and Prevention. *Early Aberration Reporting System (EARS)*. http://channelingreality.com/Competitiveness/Oklahoma/Hadron_Analex/DOCS/CDC_Ears_Presentation.pdf (Retrieved December 5, 2018).

Cardiovascular Disease Definitions

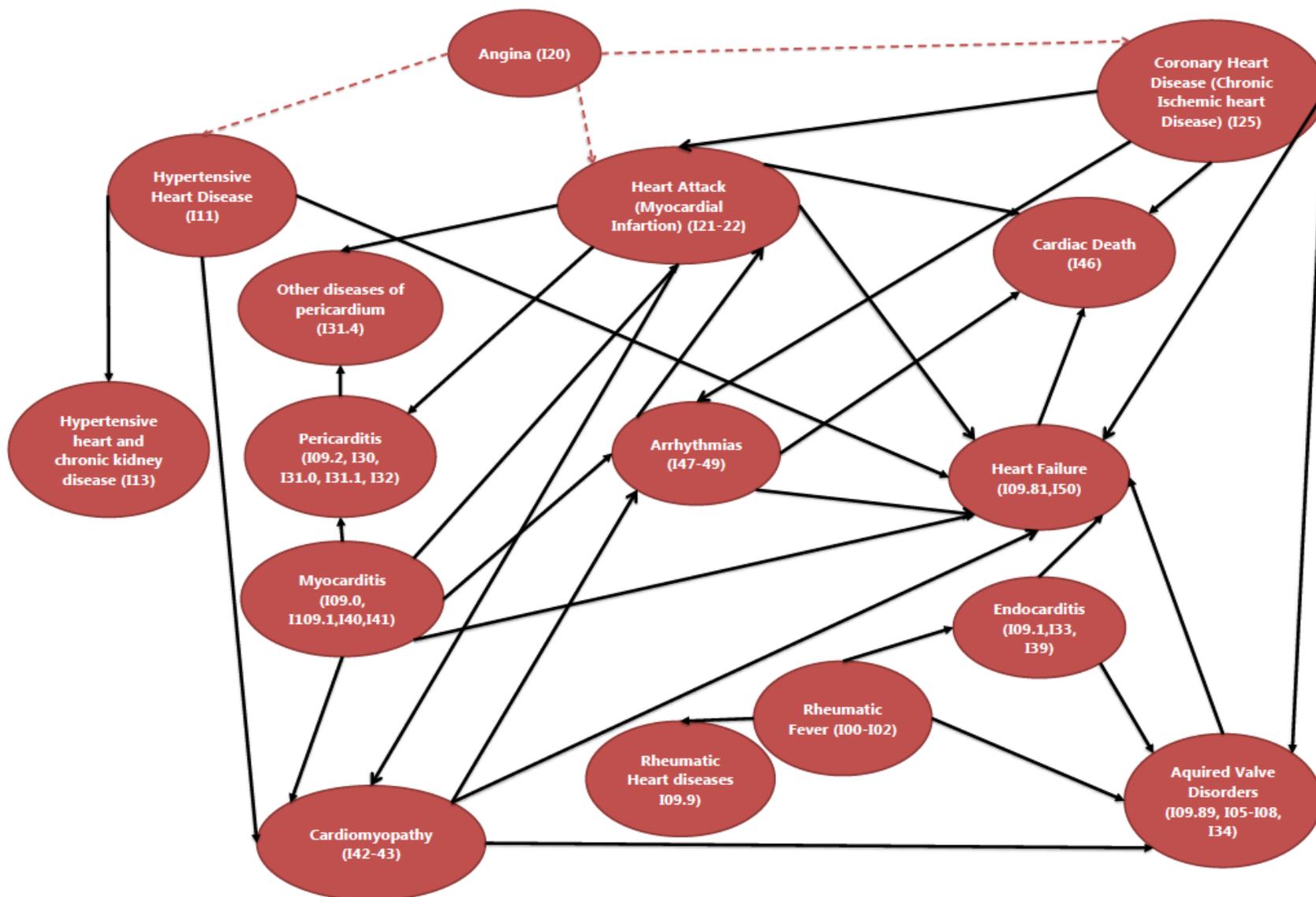
For the purpose of this report, definitions for the three major categories of CVD are defined using ICD-10 codes. In this section, heart disease is represented in red tones, vascular disease is represented in orange tones, and cerebrovascular disease is represented as shades of black and gray. The ICD code for each disease in this section is listed in parenthesis after the condition.

Heart Disease Conditions, as defined by ICD-10

Heart disease is a large complex group of interrelated conditions. These conditions all affect the heart and its structures. Having a heart disease diagnosis may mean a diagnosis with any one of the conditions. However, some conditions can increase the risk for developing other related heart disease conditions.

Figure 1 shows how these conditions are interconnected. A solid line from a disease to another heart disease condition indicates a risk factor relationship. The directionality of the relationship is shown by the arrowhead. A dashed line shows a symptom relationship from a heart disease condition to another heart disease condition. Specifically, angina is a symptom of other heart disease conditions but not a risk factor; hypertensive heart disease is a risk factor for hypertensive heart and chronic kidney disease, cardiomyopathy, and heart failure.

FIGURE 1. RELATIONSHIPS AMONG HEART DISEASE CONDITIONS



Source: Delaware Department of Health and Social Services, Division of Public Health, Diabetes and Heart Disease Prevention and Control Program, 2015.

Rheumatic Fever and Rheumatic Heart Disease (I00-I09)

Rheumatic fever (I00-I02) can occur as a complication of strep throat or scarlet fever, caused by group A streptococcus, when not properly treated. Rheumatic fever is an inflammatory disease that can last a few weeks to several months. Permanent damage to the heart from rheumatic fever is called **rheumatic heart disease (I05-I09)**, resulting in valve stenosis, valve regurgitation, and damage to the heart muscle.

Hypertensive Heart Disease and Hypertensive Heart and Renal Disease (I11, I13)

Hypertensive heart disease and hypertensive heart and renal disease are caused by chronic hypertension. While many heart disease conditions are often included in **hypertensive heart disease (I11)**, for the purposes of ICD, the definition is restricted to hypertensive heart disease with or without heart failure. **Hypertensive heart and renal disease (I13)** includes the addition of chronic kidney disease.

Ischemic Heart Diseases (I20-I25)

Angina (I20) is chest pain or discomfort because the heart muscle is not receiving enough blood. It is a symptom of coronary heart disease, hypertensive heart disease, and heart attack. There are two forms of angina: stable and unstable. Stable angina happens during exercise or under mental or emotional stress. Unstable angina happens without reason, even when resting, and is considered a medical emergency.

Angina is the most common symptom of **coronary heart disease (CHD) (I25)**, also known as coronary artery disease (CAD). The cause of CHD is restricted blood flow to the heart, which weakens the heart and deprives the heart muscle of oxygen. This can lead to heart failure, arrhythmia, and heart attack.

Heart attack (I21-I22), or myocardial infarction, occurs when the heart does not receive enough blood flow. The reduced or blocked blood flow can cause damage to or death of the heart muscle. Individuals can survive heart attacks with prompt medical attention.

Other Forms of Heart Disease (I26-I51)

Pericarditis (I30-I32) is the inflammation of the membrane surround the heart, the pericardium. Most cases are acute, with a sudden onset and spontaneously resolving quickly. However, persistent cases are considered chronic. Severe cases may need to be treated with medications, and in some extreme cases, surgery. Most cases of pericarditis are either from an idiopathic cause or from a viral infection. Other causes include autoimmune inflammatory disorders, trauma, kidney failure, AIDS, tuberculosis, cancer, or certain medications.

Myocarditis (I40, I41) is the inflammation of the middle layer of the heart wall, known as the myocardium. Myocarditis can affect both muscle cells, reducing the heart's ability to pump and the electrical system of the heart causing irregular heart rhythms (arrhythmias). In severe cases of myocarditis, clots can form in the heart, leading to heart attack or stroke. It is usually caused by a viral infection, but bacterial, parasitic, or fungal infections can also lead to myocarditis. Other causes include

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allergic or toxic reactions from medications or illegal drugs, chemicals or radiations, and other non-infectious diseases.

Cardiomyopathy (I42-I43) occurs when normal heart muscle becomes thickened, stiffened, thinned, or filled with non-heart substances. Reduced ability to pump blood can lead to arrhythmias resulting in a backup of blood into the lungs or other areas of the body and heart failure. Cardiomyopathy can occur as a result of coronary heart disease or heart attack, autoimmune disease, disease that damages the heart, endocrine disease, infections of the heart, muscle diseases, pregnancy, and alcohol or drug abuse.

Cardiac death (I46) is the sudden loss of heart function because the electrical system of the heart malfunctions, stopping the blood flow throughout the body and to the brain. The brain needs a constant and uninterrupted source of oxygen since the brain lacks a reserve of oxygen-rich blood. As a result of the loss of blood flow, brain damage occurs and death almost always results within eight minutes. Those who survive cardiac death may have varying levels of brain damage based on the length of time the brain was oxygen deprived.

Arrhythmias (I47-49) are a group of heart rhythm problems caused by improperly working electrical impulses. Symptoms can include fast or slow heart beats. There are two main types of arrhythmias: tachycardia and bradycardia. A resting heartbeat of more than 100 beats per minute is tachycardia. A resting heartbeat of fewer than 60 beats per minute is bradycardia. In addition, these types can affect two separate structures of the heart: the atria (the upper chambers), or ventricles (the lower chambers).

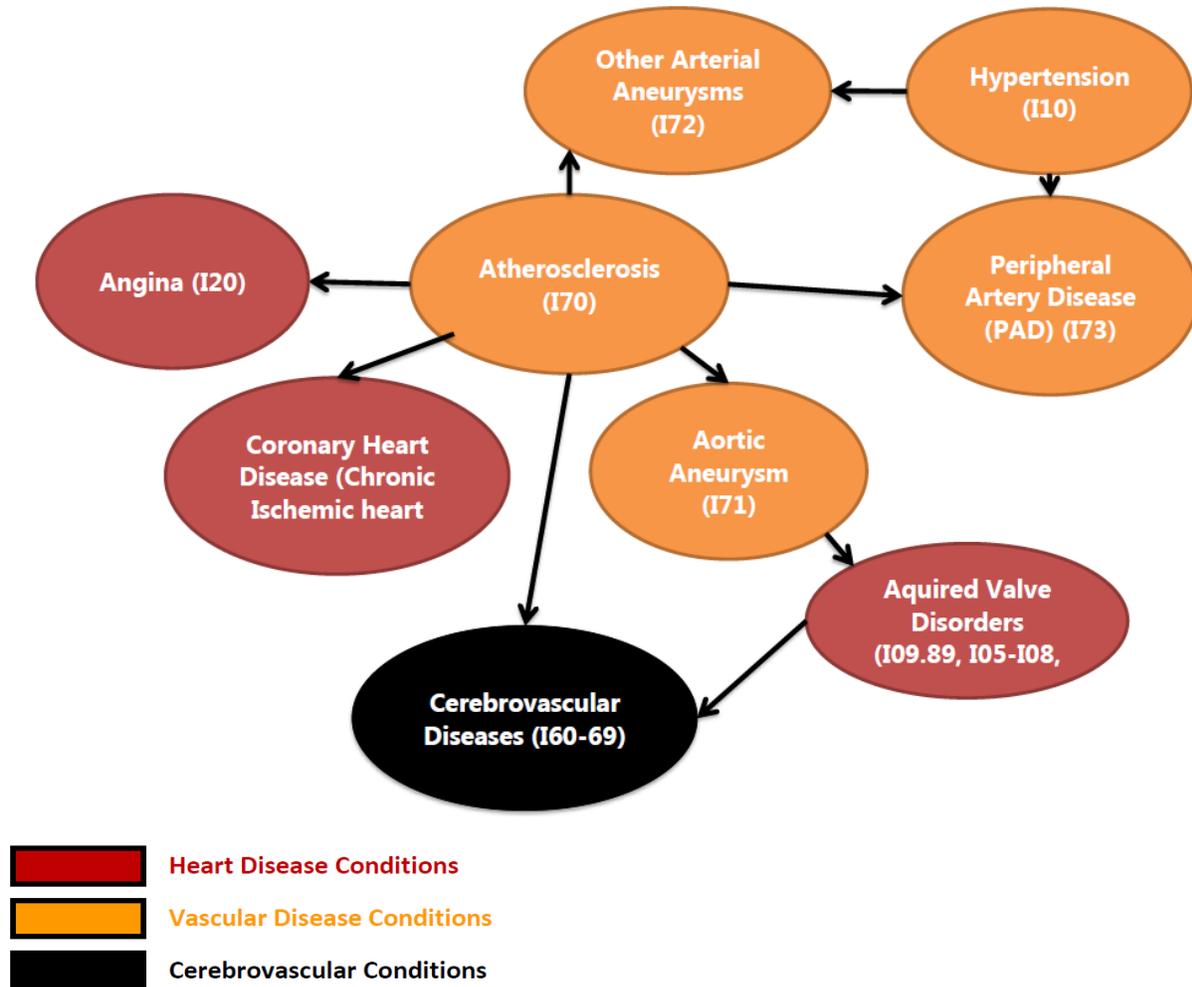
Specific arrhythmias are of particular significance because of the complications or the occurrence of death. **Atrial fibrillation** is a rapid heart rate caused by chaotic electric impulses in the atria. While some episodes may be temporary, other episodes may need medical treatment to regain a regular rhythm. **Atrial flutter** is similar to atrial fibrillation, although heartbeats are organized and electrical impulses are more rhythmic. Both atrial fibrillation and atrial flutter can lead to serious complications including heart failure, heart attack, or stroke. **Ventricular tachycardia** is caused by abnormal electrical signals in the ventricles, resulting in the rapid heartbeat. This condition is often a medical emergency. As a result, the ventricles do not fill and contract efficiently. This condition can worsen into **ventricular fibrillation** if not treated promptly. In ventricular fibrillation, the ventricles quiver instead of pumping blood to the body. It can be fatal within minutes if normal rhythm is not restored.

Heart failure (I50) is a condition where the heart cannot pump enough blood and oxygen to support the organs in your body. However, despite the name, it does not mean the heart has stopped beating. Symptoms include shortness of breath during regular activities, trouble breathing while laying down, weight gain with swelling in the feet, legs, ankles, or stomach; or general fatigue. **Congestive heart failure** is the term used to describe heart failure accompanied by fluid retention in extremities, lungs, and other organs.

Vascular Disease Conditions (I10, I12, I70-78)

Vascular disease refers to a group of diseases affecting the circulatory system. These conditions include atherosclerosis, aortic aneurysm, peripheral artery disease, and hypertension. The relationship among vascular diseases is illustrated in Figure 2. Vascular diseases are shown in orange, heart disease conditions are shown in red, and cerebrovascular diseases are shown in black. The directionality of the relationship as a risk factor is shown by the arrowhead.

FIGURE 2. RELATIONSHIPS AMONG VASCULAR CONDITIONS



Source: Delaware Department of Health and Social Services, Division of Public Health, Diabetes and Heart Disease Prevention and Control Program, 2015.

Essential Hypertension and Hypertensive Renal Disease (I10, I12)

When the force of blood against artery wall is high enough to cause damage, it is called **hypertension (I10)** or high blood pressure. Hypertension can cause damage to blood vessels and the heart. If left uncontrolled, hypertension can lead to heart attack and stroke. It is a major risk factor for almost every heart disease condition. **Hypertensive Renal Disease (I12)** is caused by hypertension or renovascular diseases leading to hardening of the kidney(s) due to infiltration of fibrous connective tissue.

Atherosclerosis (I70)

Atherosclerosis (I70) is the hardening and narrowing of the arteries caused by plaque deposits. In the beginning stages of atherosclerosis, the endothelium, the thin layer of cells responsible for keeping arteries toned and smooth, is damaged by high blood pressure, smoking, or high cholesterol. When bad cholesterol, low-density lipoprotein (LDL), crosses the damaged endothelium, it enters the wall of the artery. As a result, white blood cells also enter the wall of the artery to digest the LDL. Over time, the LDL and cells become plaque in the artery wall. The plaque creates a bump on the artery wall, and as atherosclerosis progresses, the bump grows, eventually causing a blockage. Atherosclerosis can cause several different conditions. If the blockage continues to grow, it can cause angina, coronary heart disease, peripheral artery disease, or aortic aneurysm.

Aortic aneurysm and dissection (I71)

Aortic aneurysm (I71) is a bulge in the aorta. Aortic aneurysm can lead to a dissection or rupture of the aorta. In an **aortic dissection**, the force of the blood flow can split the layers of the artery wall, causing a leak. In an **aortic rupture**, the aneurysm bursts completely, causing internal bleeding. **Other atrial aneurysms** include aneurysms (bulges) in arteries other than the heart.

Other Diseases of the Arteries, Arterioles, and Capillaries (I72-78)

Peripheral arterial disease (PAD) (I73) happens when the arteries supplying blood to the arms and legs become narrow or stiff, usually caused by atherosclerosis.

Cerebrovascular Disease Conditions (I60-69)

Cerebrovascular diseases include conditions specific to circulation of blood to the brain. They include non-traumatic subarachnoid and intracranial hemorrhage, cerebral infarction (also known as stroke), and occlusion and stenosis of cerebral and precerebral arteries.

Recovery after stroke is specific to the individual. Some can fully recover within just weeks; for others, recovery can take years. Some may experience long-term disabilities. According to the CDC, lasting problems can include paralysis and/or weakness on one side of the body, trouble with cognitive abilities, speech difficulties, issues with controlling or expressing emotion, numbness, pain in hands or feet, trouble chewing or swallowing, bladder or bowel control issues, and depression.

There are two types of hemorrhagic stroke: **Subarachnoid hemorrhage (I60) and intracerebral hemorrhage (I61-62)**. **Subarachnoid hemorrhage** is bleeding into the intracranial or spinal subarachnoid space. This is usually caused from an intracranial aneurysm, and can occur after traumatic injuries. However, those subarachnoid hemorrhages caused by syphilis are not included in this definition. **Intracerebral hemorrhage** is the bleeding into a single or both cerebral hemispheres, and is the most common type of hemorrhagic stroke. Intracerebral hemorrhage can be caused by hypertension, aging blood vessels, and trauma.

Cerebral infarction (I63) is an ischemic stroke caused by a blood clot blocking the flow of blood to the brain. There are two types of cerebral infarctions: embolic stroke and thrombotic stroke. Embolic stroke occurs when a blood clot or plaque travels to the brain and causes a blockage. Atrial fibrillation is a risk factor for this type of stroke. Thrombotic stroke occurs when the clot forms inside one of the arteries supplying blood to the brain.

Non-stroke cerebrovascular diseases (I65-69) include occlusion and stenosis of precerebral arteries, cerebral aneurysm, atherosclerosis and dissections, hypertensive encephalopathy, Moyamoya disease, and subcortical dementia.

Transient Ischemic Attack (TIA) (G45)

A **TIA** occurs when blood flow to a part of the brain stops for a short time. TIA is often called a mini-stroke, but is different from a hemorrhagic or ischemic stroke, both resulting in permanent damage to the brain. Symptoms of a TIA are similar to stroke; however, symptoms usually resolve within 24 hours of onset without permanent damage. Having a TIA is a risk factor for having a stroke.

Prevalence of Selected Cardiovascular Diseases and TIA

The BRFs asks questions about only a few heart diseases. Therefore, prevalence (number of people in a population who have a particular disease at a given point in time) based on BRFs responses is presented for only these diseases. For the purpose of this section, prevalence will describe the number of people in Delaware with heart disease (or specific heart disease condition) during 2015. Some trends will show year-specific prevalence between 2011 and 2015.

Hypertension

In 2015, 34.5 percent (more than 255,000 people) of Delaware residents age 18 and older reported they were told by a health care professional that they have high blood pressure, also known as hypertension.

Hypertension is a condition caused by increased force of blood in the arteries pushing against the artery walls. When blood pressure remains high over extended periods, it can damage the heart and cause other health problems. Hypertension is known as the “silent killer” because there usually are no symptoms. In some rare cases, it can cause headaches and vomiting. However, the only way to know if someone has hypertension is to have a health professional measure blood pressure over time.

Table 1. Trend in Adult Hypertension Prevalence in Delaware 2011, 2013, and 2015

| 2011 | 2013 | 2015 |
|---|-------------|-------------|
| 34.8% | 35.6% | 34.5% |
| <i>Source: Delaware Department of Health and Social Services, Division of Public Health, Behavioral Risk Factor Survey (BRFS), 2011, 2013, 2015</i> | | |

The BRFs asks questions about hypertension awareness in odd-numbered years. Prevalence has remained steady since the 2011 BRFs. There is no difference in prevalence between men (35.9 percent) and women (33.2 percent). In 2015, non-Hispanic African-American adults (39.9 percent) had a slightly

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(but not significantly) higher prevalence of reported hypertension than non-Hispanic Caucasian adults (35 percent).

Hypertension prevalence increases with age. Of those Delaware adults who reported being told by a health professional they had hypertension:

- 14.2 percent were 18-44 years old
- 36.5 percent were 45-54 years old
- 51 percent were 55-64 years old
- 61.1 percent were 65 years or older

As education and income increases, the prevalence of hypertension decreases (Table 2.)

Table 2. Hypertension Prevalence among Education and Income Groupings in Delaware, 2015.

| Educational Level | Hypertension Prevalence | Income Level | Hypertension Prevalence |
|----------------------------------|--------------------------------|----------------------|--------------------------------|
| Less than a high school diploma | 35.5% | <\$15,000 - \$24,999 | 40.1% |
| High school diploma or GED | 38.6% | \$25,000-\$34,999 | 35.5% |
| Some college or technical school | 33.0% | \$35,000-\$50,000 | 38.6% |
| College degree | 30.7% | \$50,000+ | 31.1% |

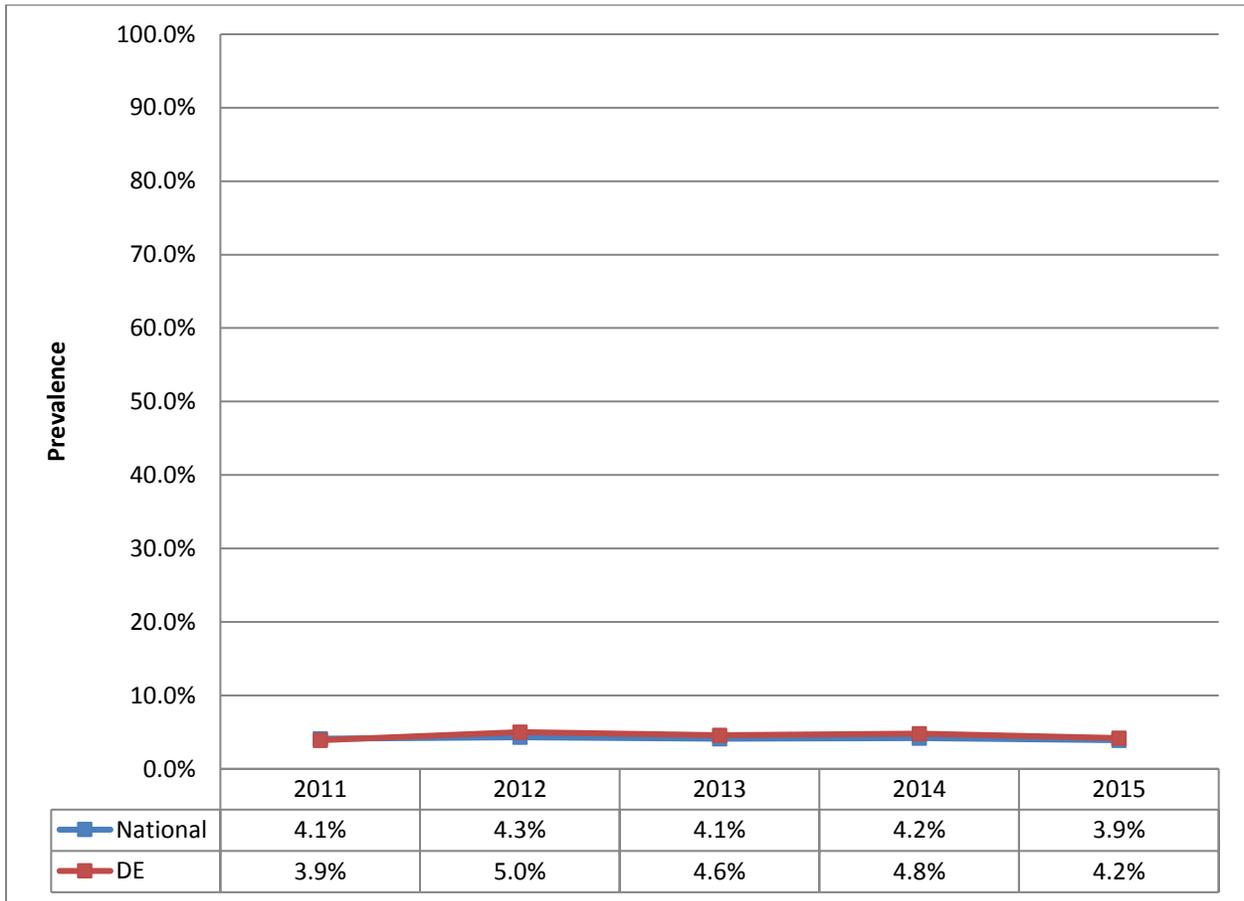
Source: Delaware Department of Health and Social Services, Division of Public Health, Behavioral Risk Factor Survey (BRFS), 2015

Risk factors for hypertension include diabetes, poor diet, high sodium (salt intake), physical inactivity, obesity, alcohol consumption, tobacco use, family history, and genetics.

Coronary Heart Disease and Angina

The CDC reports a 2015 adult national median for having coronary heart disease or angina as 3.9 percent among all states and Washington, DC. There was no significant change over the previous five years. According to the 2015 BRFSS, about the same percentage (4.2 percent) of Delaware's adult population (18 years and older) were diagnosed with coronary heart disease or angina.

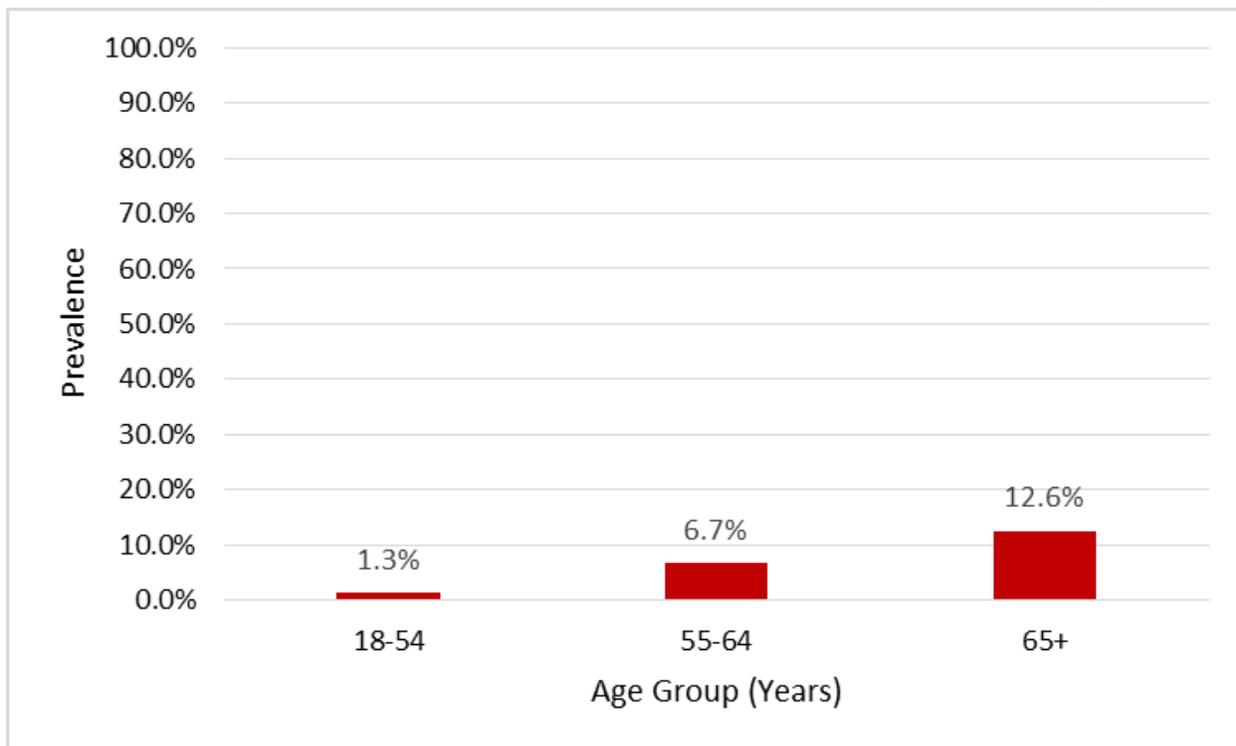
FIGURE 3. PREVALENCE TRENDS OF DIAGNOSED CORONARY HEART DISEASE OR ANGINA IN THE UNITED STATES AND DELAWARE, 2011-2015



Source: Centers for Disease Control and Prevention and Delaware Division of Public Health, Behavioral Risk Factor Surveillance System, 2011-2015.

The prevalence of coronary heart disease and angina for Delaware adults age 18 years and older was within a percentage point of the national median during the period 2011-2015. There was very little fluctuation in prevalence during these years, with the highest prevalence of 5.0 percent in 2012 and the lowest prevalence of 3.9 percent in 2011 (Figure 3).

FIGURE 4. DELAWARE CORONARY HEART DISEASE OR ANGINA PREVALENCE BY AGE GROUP, 2011-2015



Source: Delaware Department of Health and Social Services, Division of Public Health, Behavioral Risk Factor Survey (BRFS), 2011-2015.

As age increases, so does the risk of developing coronary heart disease or angina. Five years of data were combined to show the stepwise increase in prevalence by age group (Figure 4). Only 1.3 percent of adults ages 18-54 reported they were diagnosed with coronary heart disease or angina between 2011 and 2015. In the same period in Delaware, almost 7 percent of adults ages 55-64 and 12.6 percent of adults ages 65 and older reported they were diagnosed with coronary heart disease or angina. These increases were statistically significant.

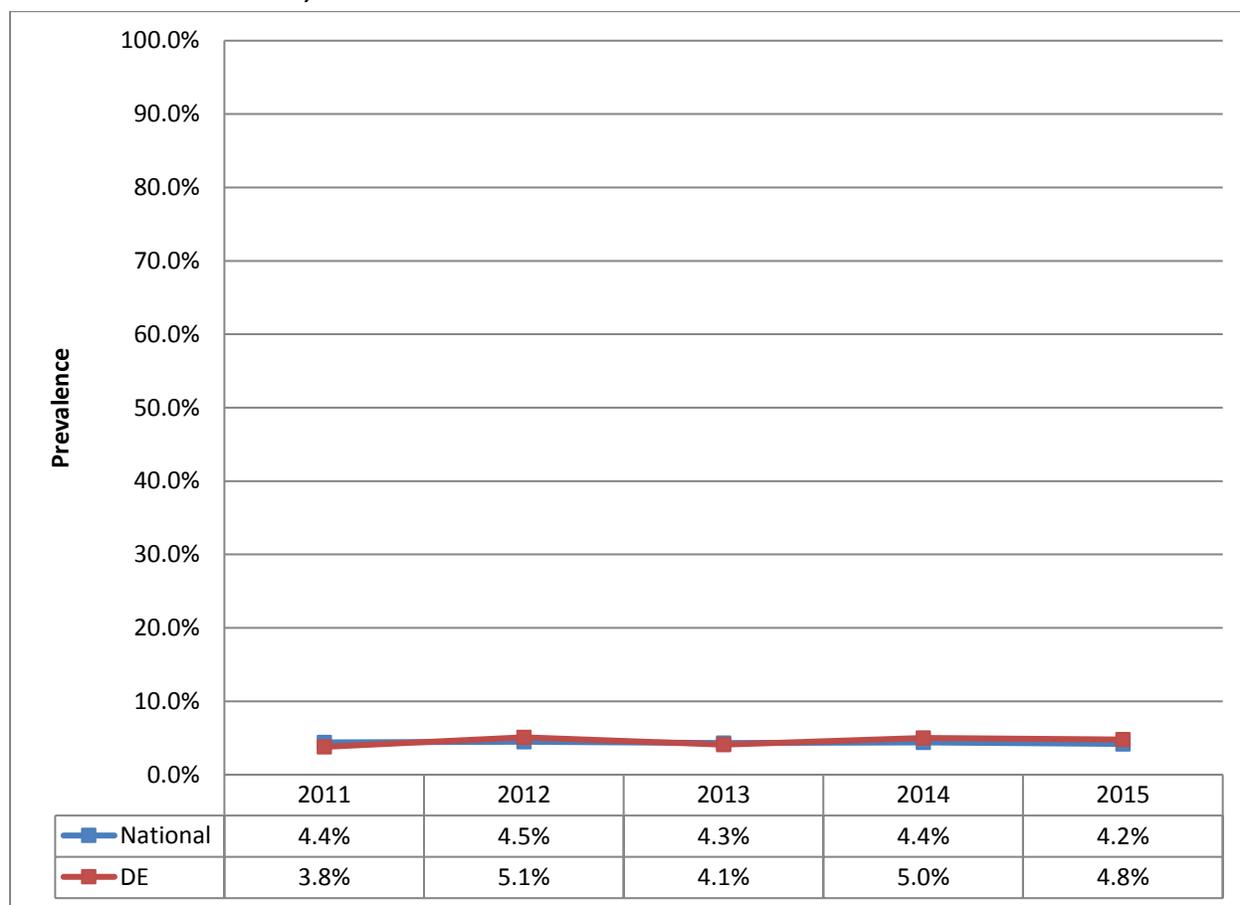
In addition to age, other demographic variables were consistently positively associated with coronary heart disease and angina during the period 2011-2015. Program staff performed a logistic regression to control for age, sex, race, education attainment, annual household income, county of residence, and disability status. In addition, in odd-numbered years (2011, 2013, and 2015) when hypertension and cholesterol questions were included in the BRFS, the model included hypertension and high cholesterol. When controlling for these above-listed demographic variables and risk factors (when available), age, sex, and disability status were consistently associated with coronary heart disease and angina in Delaware during all years from 2011 to 2015. High blood pressure was associated with coronary heart disease and angina in Delaware during included years (2011, 2013, and 2015). Adult males were more likely to report having coronary heart disease or angina than adult females. Adults with a disability were more likely to report having coronary heart disease or angina than adults without a disability. Adults

who reported having high blood pressure were also more likely to report having coronary heart disease or angina, compared to adults who reported having normal blood pressure.

Heart Attack (Myocardial Infarction)

In 2015, the CDC reports a median of 4.2 percent among all states and Washington, DC for adults reporting ever having had a heart attack. There has been no significant change over the previous five years. According to the 2015 BRFSS, about the same percentage (4.8 percent) of Delaware’s adult population (18 years and older) reported surviving a heart attack. Figure 5 illustrates the national and state level reporting for 2011-2015 for ever having a heart attack prevalence trends.

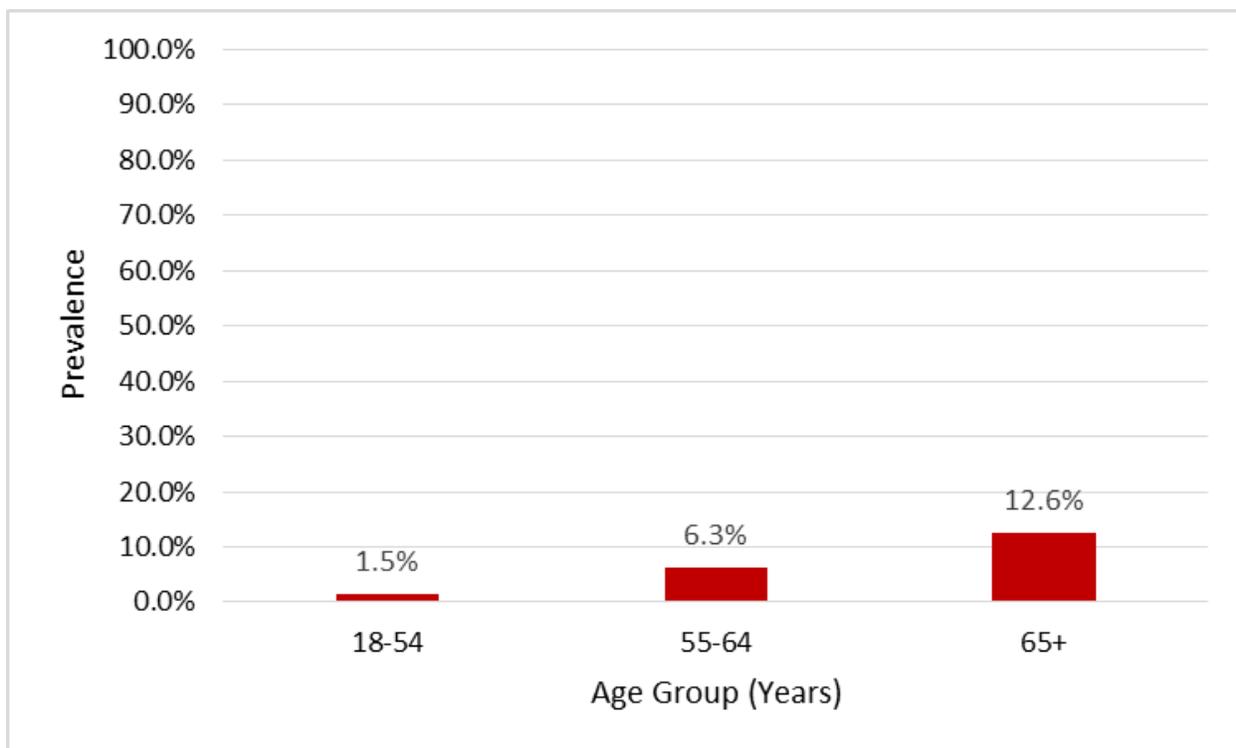
FIGURE 5. PREVALENCE TRENDS OF REPORTING EVER HAVING A HEART ATTACK IN THE UNITED STATES AND DELAWARE, 2011-2015



Source: Centers for Disease Control and Prevention and Delaware Division of Public Health, Behavioral Risk Factor Surveillance System, 2011-2015.

Between 2011 and 2015, there was minimal fluctuation in the prevalence of reporting ever having a heart attack, ranging from a low of 3.8 percent in 2011 to a high of 5.1 percent in 2012. These changes in prevalence are not statistically significant. The prevalence of reporting ever having a heart attack in Delaware differs less than a percentage point from the national median.

FIGURE 6. PREVALENCE OF REPORTING EVER HAVING A HEART ATTACK IN DELAWARE BY AGE GROUP, 2011-2015



Source: Delaware Department of Health and Social Services, Division of Public Health, Behavioral Risk Factor Survey (BRFS), 2011-2015.

As age increases, so does the risk of reporting ever having a heart attack. The prevalence of reporting having a heart attack is the highest for Delaware adults age 65 and older at 12.6 percent, compared to 6.3 percent for age 55-64, and 1.5 percent for ages 18-54. These differences observed among age groups were statistically significant.

In addition to age, other demographic variables were consistently positively associated with reporting ever having a heart attack consistently during the period 2011-2015. A logistic regression was performed to control for age, sex, race, education attainment, annual household income, county of residence, and disability status. In addition, in odd-numbered years (2011, 2013, and 2015) when hypertension and cholesterol questions were included in the BRFS, the model included hypertension and high cholesterol.

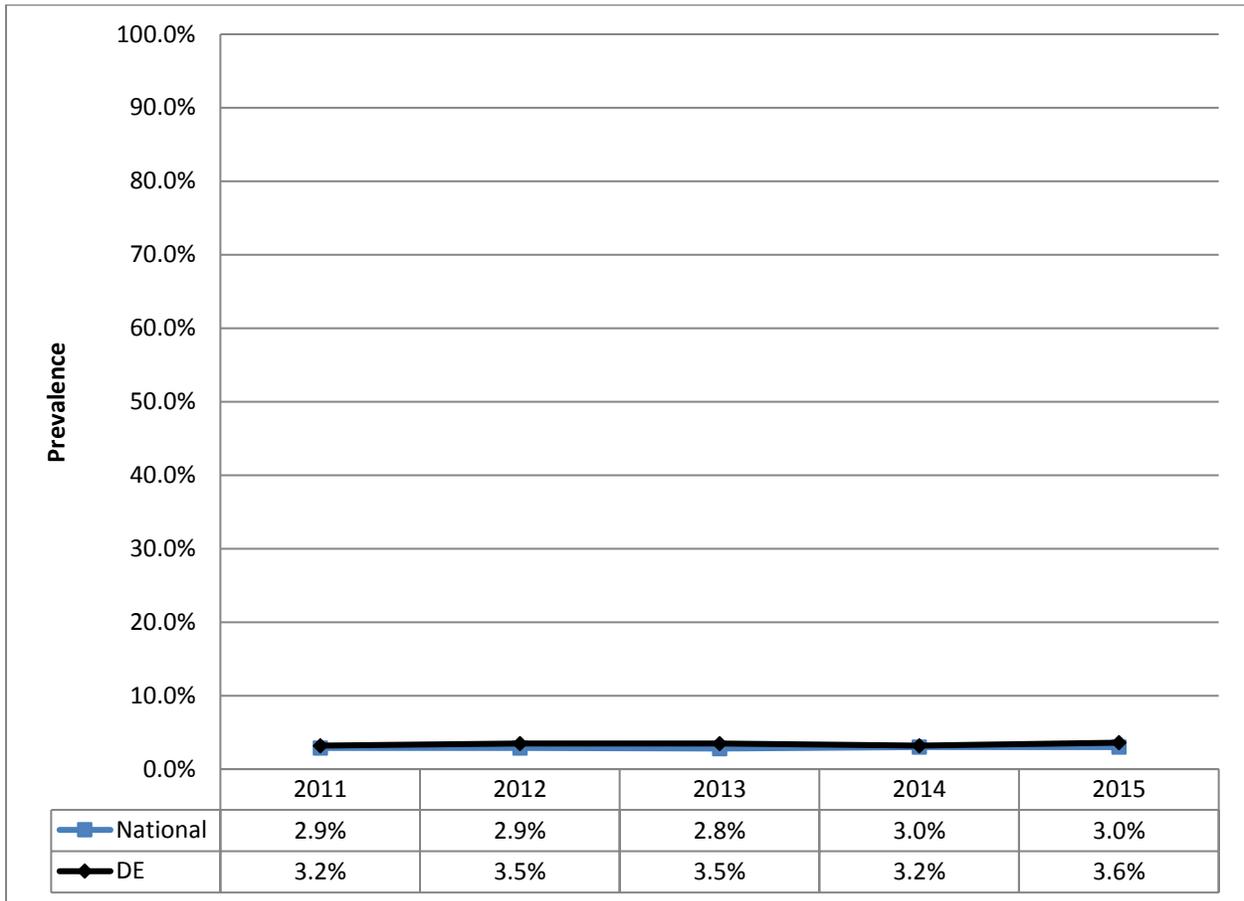
When controlling for these demographic variables and risk factors (when available), age, disability status, and blood pressure were all associated with Delaware adults reporting ever having a heart attack from 2011 to 2015. As age increases, so does the likelihood of reporting ever having a heart attack. Adults with a disability were more likely to report ever having a heart attack, compared to Delaware adults without a disability. Delaware adults reporting having high blood pressure were more

likely to report ever having a heart attack, compared to Delaware adults reporting normal blood pressure.

Stroke

From 2011 through 2015, there is little difference between the national median for stroke prevalence and Delaware's prevalence of stroke. Prevalence has also stayed approximately the same, fluctuating between 2.8 percent and 3.0 percent for the national median, and between 3.2 percent and 3.6 percent in Delaware. According to the CDC, nationally, stroke is the fifth leading cause of death and is a major cause of adult disability. It is estimated that approximately 16 percent of all strokes are fatal. It is important to note, because of the high mortality caused by stroke, this section only includes adults who had a stroke and did not sustain a disability severe enough to exclude them from taking a telephone survey.

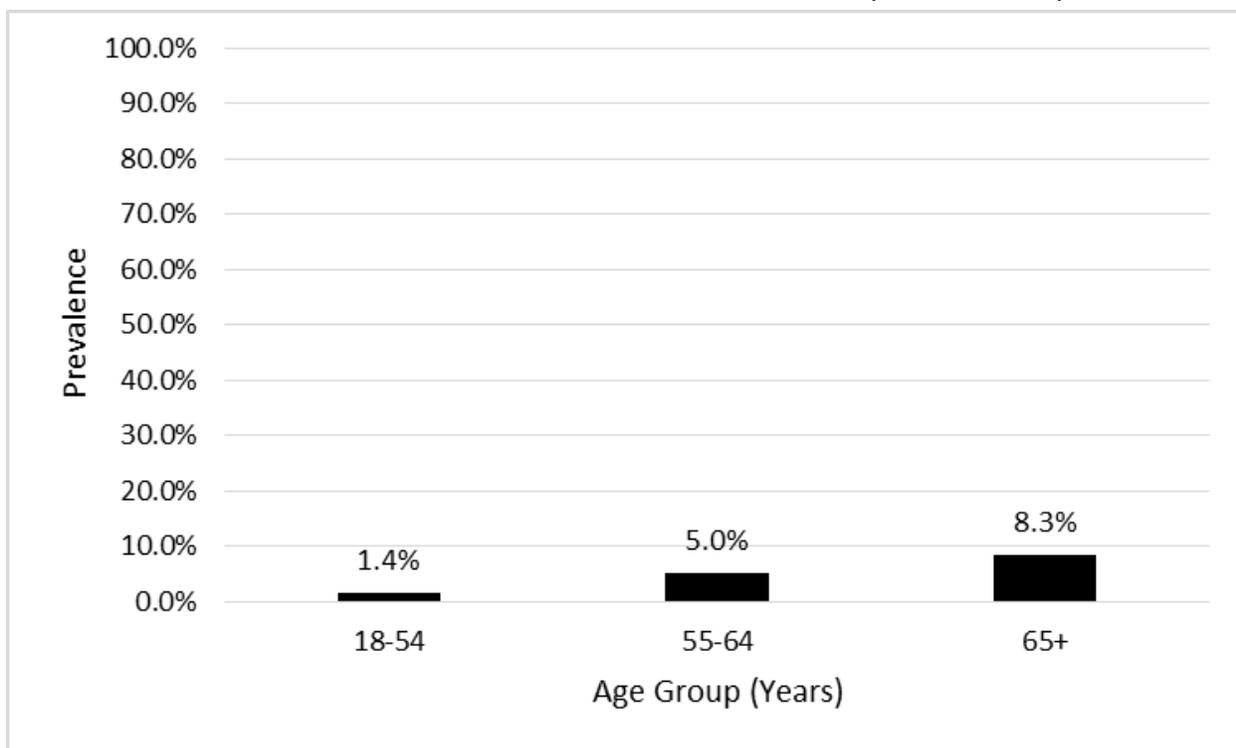
FIGURE 7. PREVALENCE TRENDS OF REPORTING EVER HAVING A STROKE IN THE UNITED STATES AND DELAWARE, 2011-2015



Source: Centers for Disease Control and Prevention and Delaware Division of Public Health, Behavioral Risk Factor Surveillance System, 2011-2015.

From 2011 to 2015, the state prevalence of reporting ever having a stroke remained consistent to the national prevalence, fluctuating only less than half a percentage point during those five years. In addition, the state prevalence of reporting ever having a stroke remained close to the national median, fluctuating less than a percentage point during that period from a low of 3.2 percent in 2011 to a high of 3.6 percent in 2015 (Figure 7).

FIGURE 8. PREVALENCE OF REPORTING EVER HAVING A STROKE BY AGE, IN DELAWARE, 2011-2015



Source: Centers for Disease Control and Prevention and Delaware Division of Public Health, Behavioral Risk Factor Surveillance System, 2011-2015.

According to the BRFSS, Figure 8 shows as age increases, so does the prevalence of reporting ever having a stroke from 2011-2015. Delaware adults age 65 and older had the highest prevalence of reporting ever having a stroke: 8.3 percent. Five percent of Delaware adults ages 55-64 reported ever having a stroke, and only 1.4 percent of Delaware adults ages 18-54 reported ever having a stroke.

In addition to age, other demographic variables were consistently positively associated with reporting ever having a stroke from 2011 to 2015. A logistic regression was performed to control for age, sex, race, education attainment, annual household income, county of residence, and disability status. In addition, in odd-numbered years (2011, 2013, and 2015) when hypertension and cholesterol questions were included in the BRFSS, the model included hypertension and high cholesterol.

When controlling for the demographic characteristics and risk factors (when available), age, disability status, and high blood pressure were associated with reporting ever having a stroke. Delaware adults with a disability were more likely to report ever having a stroke, compared to Delaware adults without a disability. It is important to note the directionality of the association cannot be determined using BRFSS. Delaware adults who reported having hypertension were more likely to report ever having a stroke, compared to Delaware adults who reported having normal blood pressure.

Emergency Department Visits

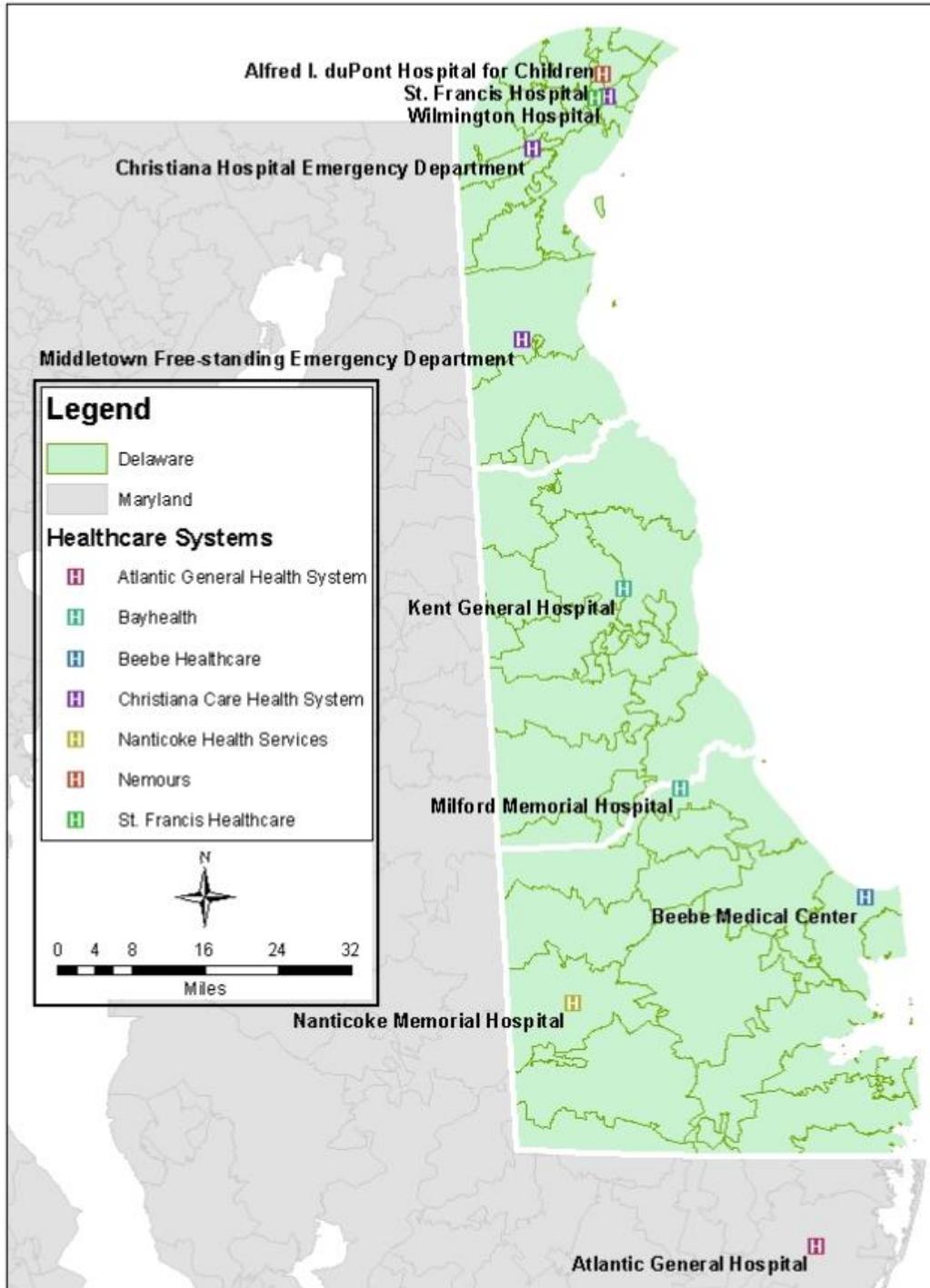
Reporting chief complaints to DPH began in 2009. At that time, only a few hospitals reported these data. As of January 2015, all Delaware hospitals with emergency departments plus Atlantic General Hospital (located in Maryland but only reporting Delaware residents) report emergency department chief complaints to DPH. Therefore, to show the most comprehensive picture of the burden of cardiovascular disease and TIA on emergency departments, only 2015 data are used in this section.

Delaware-based health care systems include A. I. duPont Hospital for Children, Bayhealth, Beebe Medical Center, Christiana Care Health System, Nanticoke Health Systems, and St. Francis Healthcare. The locations of the emergency departments reporting chief complaint data to DPH are displayed in Figure 9.

Three emergency departments are located in Wilmington, Delaware's northernmost city: A. I. duPont Hospital for Children, St. Francis Hospital, and Wilmington Hospital, which is part of Christiana Care Health System (CCHS). CCHS operates another two emergency departments in suburban New Castle County: the Christiana Hospital Emergency Department and the Middletown Free-standing Emergency Department. Bayhealth operates the two reporting emergency departments located in Kent County: Kent General Hospital and Milford Memorial Hospital. Two separate health systems operate in Sussex County. Nanticoke Health Services operates Nanticoke Memorial Hospital in Seaford, and Beebe Healthcare operates Beebe Medical Center in Lewes. Atlantic General Hospital operates in Berlin, Maryland, but reports chief complaint data to DPH.

Emergency department chief complaints are concise statements describing the reason for a medical encounter. Chief complaints are recorded as text and do not have a diagnosis code. Emergency department visits may be discharged after medical attention, or if needed, result in hospitalization. Analysis, known as syndromic surveillance, can be applied to the text to group chief complaints into larger, clinically relevant categories. It is important to note each chief complaint represents a single encounter, but a single person may have multiple encounters within a month. Therefore, it is important to interpret chief complaints as visits and not as persons.

FIGURE 9. LOCATIONS OF EMERGENCY DEPARTMENTS REPORTING TO THE DELAWARE DIVISION OF PUBLIC HEALTH, 2015

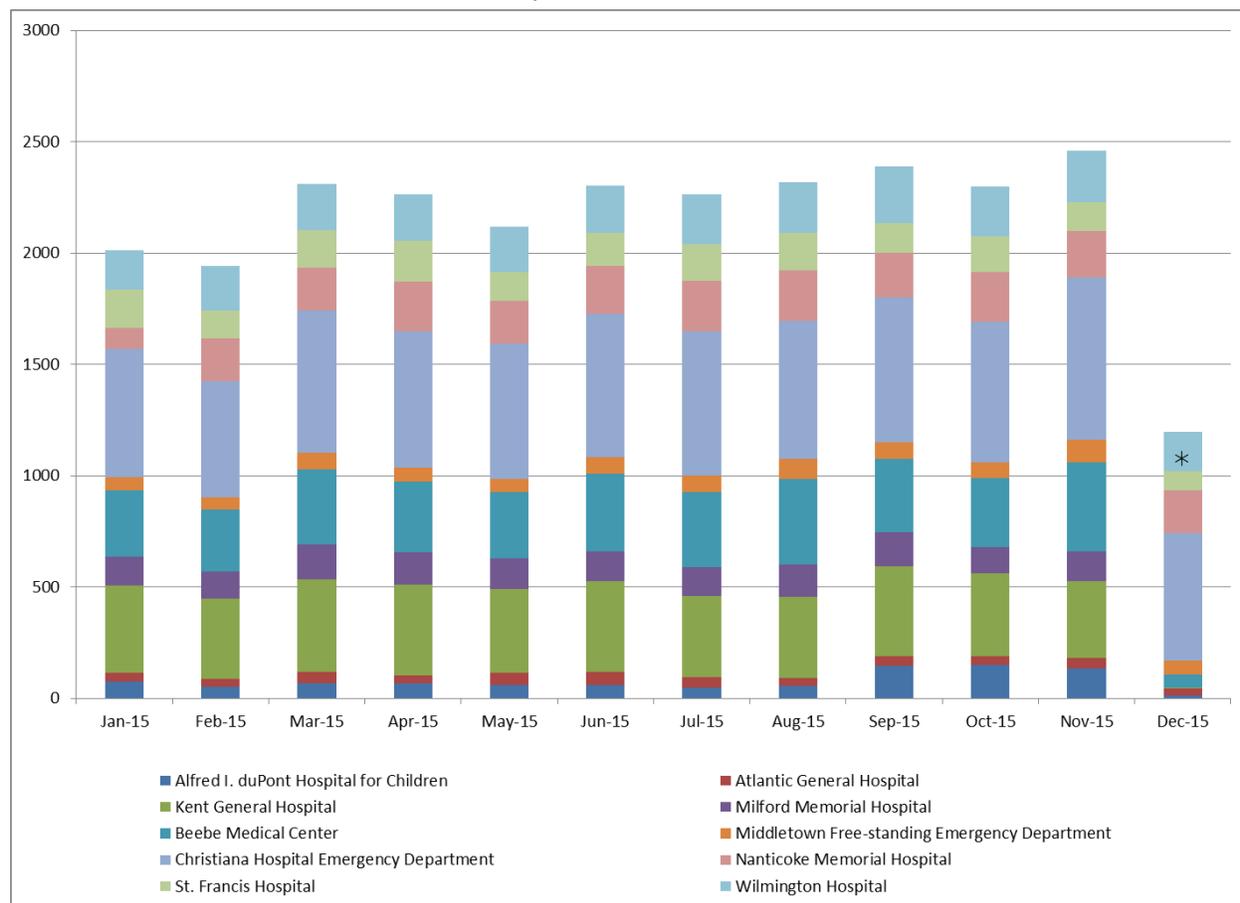


Source: Delaware Department of Health and Social Services, Division of Public Health

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Figure 10 shows the number of chief complaints of emergency department visits with a chief complaint of “cardiac syndrome” by hospital and by month. The cardiac syndrome for this analysis is defined as any chief complaint which included text with the key words “cardiac,” “stress test,” “chest pain,” “myocardial infarction,” “angina,” “arrhythmias,” or “fibrillation.”

FIGURE 10. DELAWARE EMERGENCY DEPARTMENT VISITS WITH A CHIEF COMPLAINT OF “CARDIAC SYNDROME” BY HOSPITAL AND BY MONTH, 2015

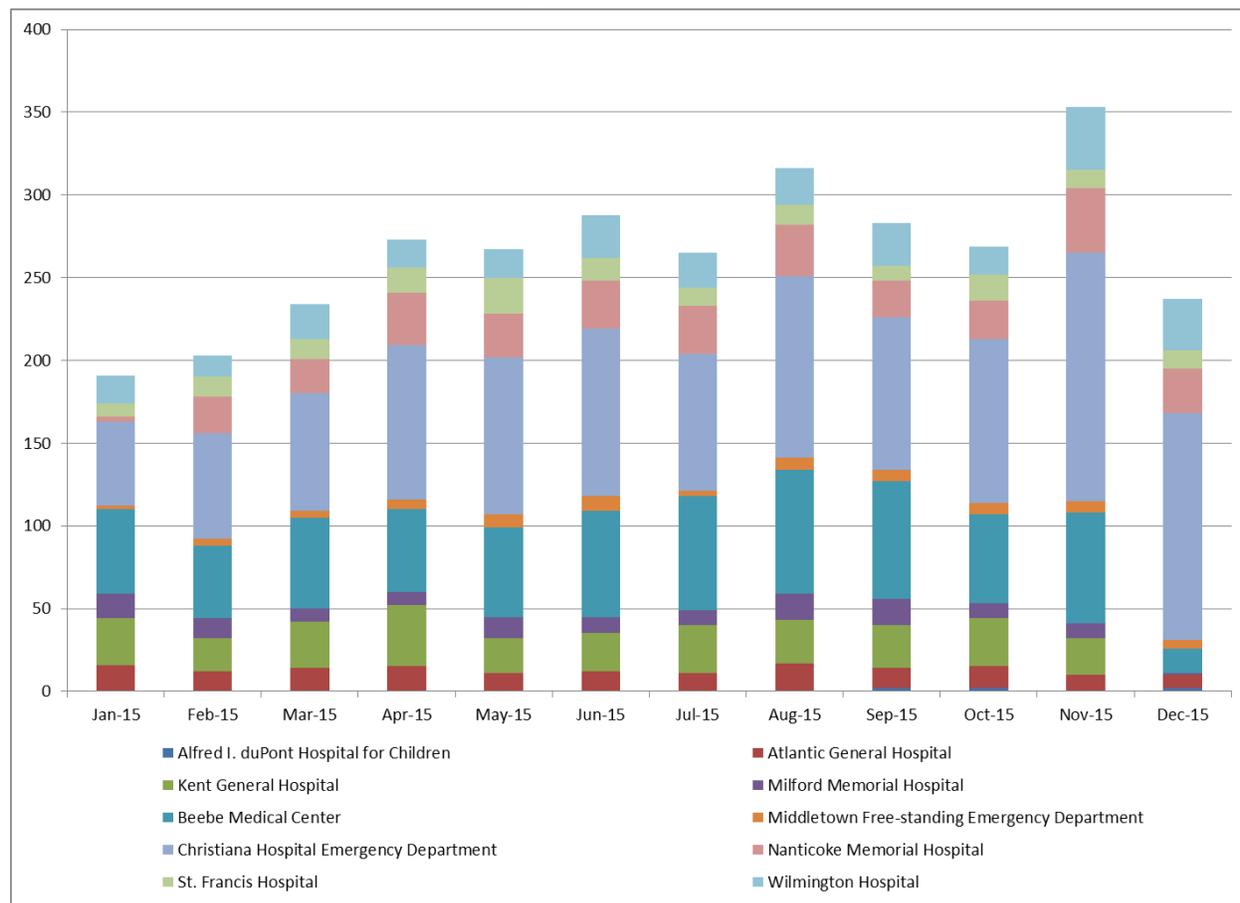


*Reporting issue Bayhealth

Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Electronic Reporting Surveillance System, Chief Complaint Data, 2015.

During 2015, there were more than 25,000 emergency department visits to Delaware hospitals with the chief complaint of “cardiac syndrome” (Figure 10). This includes chest pain, tachycardia, bradycardia, and other arrhythmias. CCHS saw the largest number of emergency department visits: almost 10,000 during 2015. Bayhealth, which includes Kent General Hospital and Milford Memorial Hospital, reported over 5,700 emergency department visits that same year. The total for the health system is likely higher however, as a reporting issue in December resulted in just 5 percent of the total expected number of visits being submitted that month. Beebe Medical Center reported over 3,700 visits in 2015. The remaining reports of emergency department visits were from A. I. duPont Hospital for Children (932), Atlantic General (506), Nanticoke Hospital (2,401), and St. Francis Hospital (1,770).

FIGURE 11. DELAWARE EMERGENCY DEPARTMENT VISITS WITH A CHIEF COMPLAINT OF “STROKE SYNDROME” BY HOSPITAL AND BY MONTH, 2015



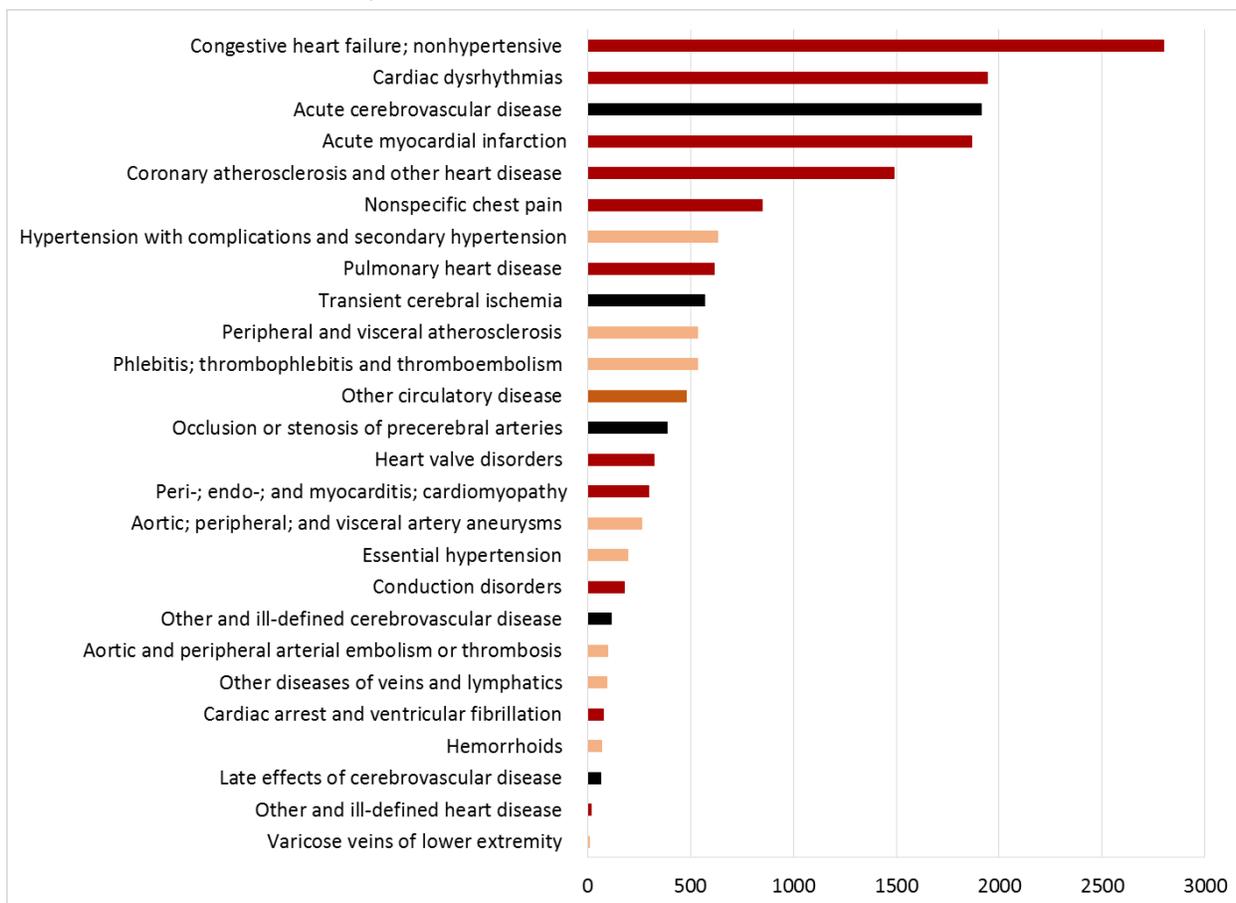
Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Electronic Reporting Surveillance System, Chief Complaint Data, 2015.

Figure 11 shows the number of emergency department visits with a chief complaint of “stroke syndrome” by hospital and month. “Stroke syndrome” was defined as any chief complaint that included “stroke,” “cerebrovascular attack (CVA),” “cerebrovascular,” or “transient ischemic attack (TIA).” There were over 3,100 emergency department visits to Delaware hospitals for the chief complaint of “stroke syndrome” during 2015. Christiania Care Health System saw the most emergency department visits (1,481 visits or 46.6 percent of all visits) for “stroke syndrome” during 2015. Bayhealth’s Dover and Milford campuses accounted for a combined 415 visits (13.1 percent). In 2015, Beebe Medical Center had 669 visits (21.0 percent) for “stroke syndrome,” Nanticoke had 304 visits (9.6 percent), St. Francis Hospital had 153 visits (4.8 percent), Atlantic General Hospital had 151 visits (4.7 percent), and A.I. duPont Hospital for Children had six visits (0.2 percent) (Figure 11).

Hospital Discharges

At the time of writing this report, the most recent data published by the Delaware Health Statistics Center was 2011 data. That year, there were 16,419 hospital discharges for “diseases of the circulatory system,” accounting for 14.9 percent of all CCS diagnostic code discharges. “Diseases of the circulatory system” was the largest CCS diagnostic coded discharge category.

FIGURE 12. NUMBER OF HOSPITAL DISCHARGES FOR CLINICAL CATEGORY SOFTWARE GROUPINGS FOR “DISEASES OF THE HEART,” 2011

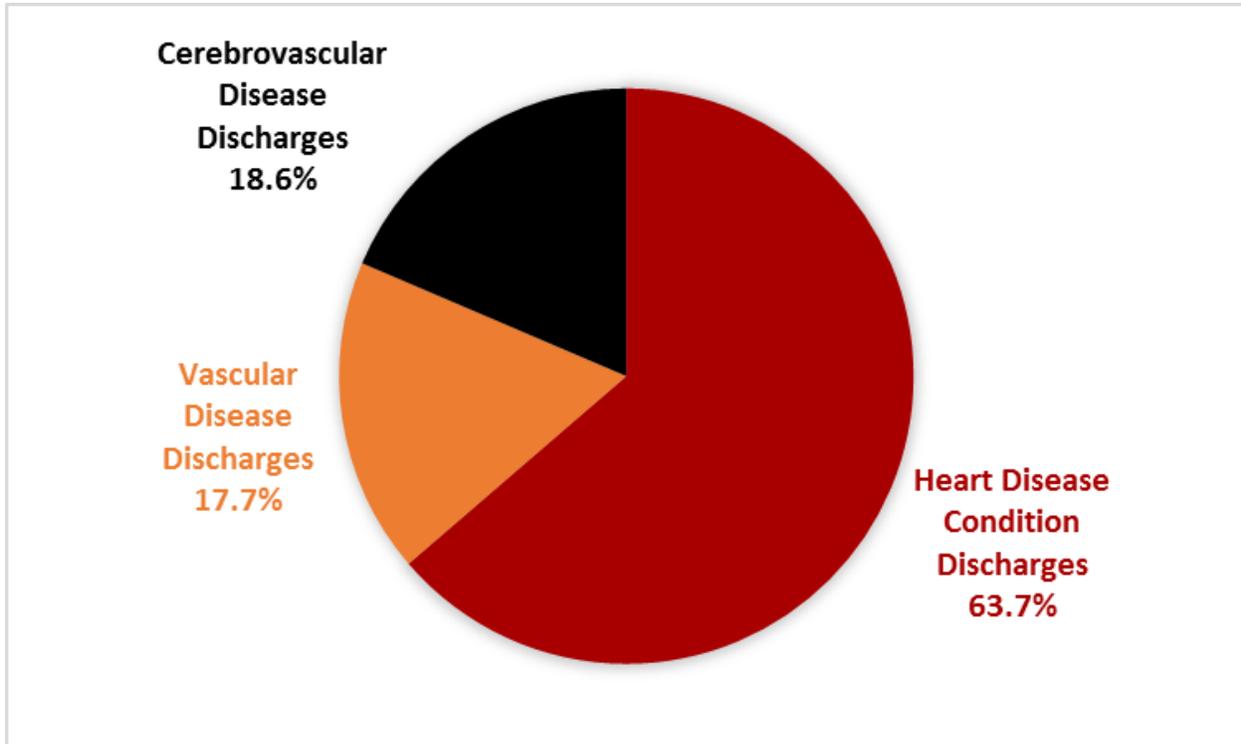


Source: Delaware Department of Health and Social Services, Delaware Health Statistics Center, Delaware Hospital Discharge Report, 2011

Of 2011 hospital discharges for “diseases of the circulatory system,” the largest number of discharges were for non-hypertensive congestive heart failure, accounting for 2,798 discharges or 17 percent of total “disease of the circulatory system” (Figure 12). Cardiac dysrhythmias were responsible for 1,944 hospital discharges, and acute cerebrovascular disease was responsible for 1,914 hospital discharges. Acute myocardial infarction was responsible for 1,865 hospital discharges. There were 1,489 hospital discharges due to coronary atherosclerosis and other heart disease. In contrast, varicose veins of lower extremity (n = 9), other and ill-defined heart disease (n = 20), late effects of cerebrovascular disease (n =

65), and hemorrhoids (n = 69) accounted for just about 1 percent of all “diseases of the circulatory system” (Figure 12).

FIGURE 13. PERCENTAGE OF “DISEASES OF THE CIRCULATORY SYSTEM” BY HEART DISEASE, VASCULAR DISEASE, AND CEREBROVASCULAR DISEASE /TIA” IN DELAWARE 2011

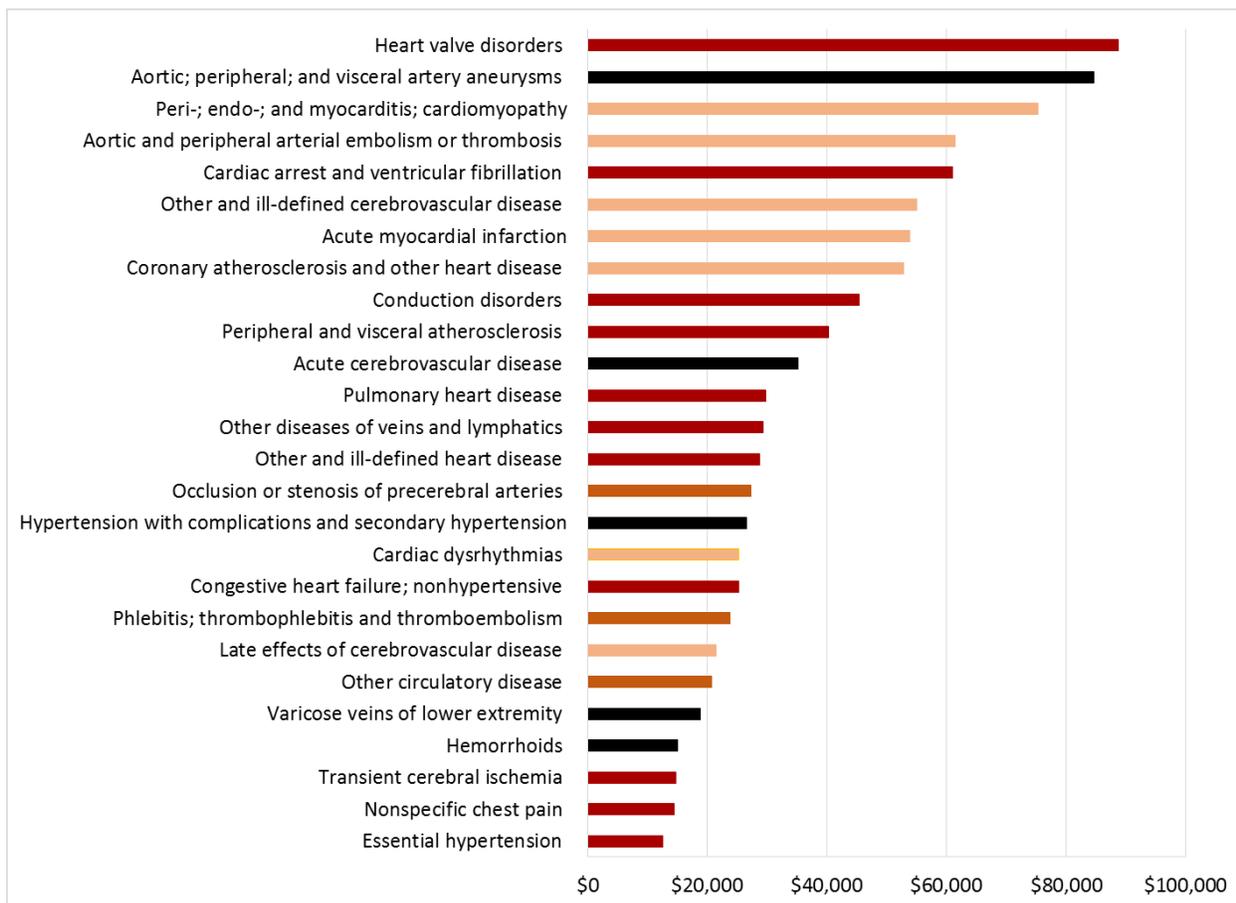


Source: Delaware Department of Health and Social Services, Delaware Health Statistics Center, Delaware Hospital Discharge Report, 2011

Heart disease conditions are the largest contributor (63.7 percent) of hospital discharges to “diseases of the circulatory system.” The remainder of the hospital discharges were almost evenly distributed between cerebrovascular diseases/TIA (17.7 percent) and vascular diseases (18.6 percent) (Figure 13).

While a grouping may be responsible for many hospitalizations, other less common groupings are more expensive to treat. Heart valve disorders were the most expensive, with an average total charge of \$88,782. There were only 324 hospital discharges for heart valve disorders in 2011. Similarly, aortic, peripheral, and visceral artery aneurysms were almost as expensive, with an average total charge of \$84,651. There were only 265 hospital discharges for those conditions in 2011. In contrast, essential hypertension was the least costly, with an average total charge of \$12,638 (Figure 14).

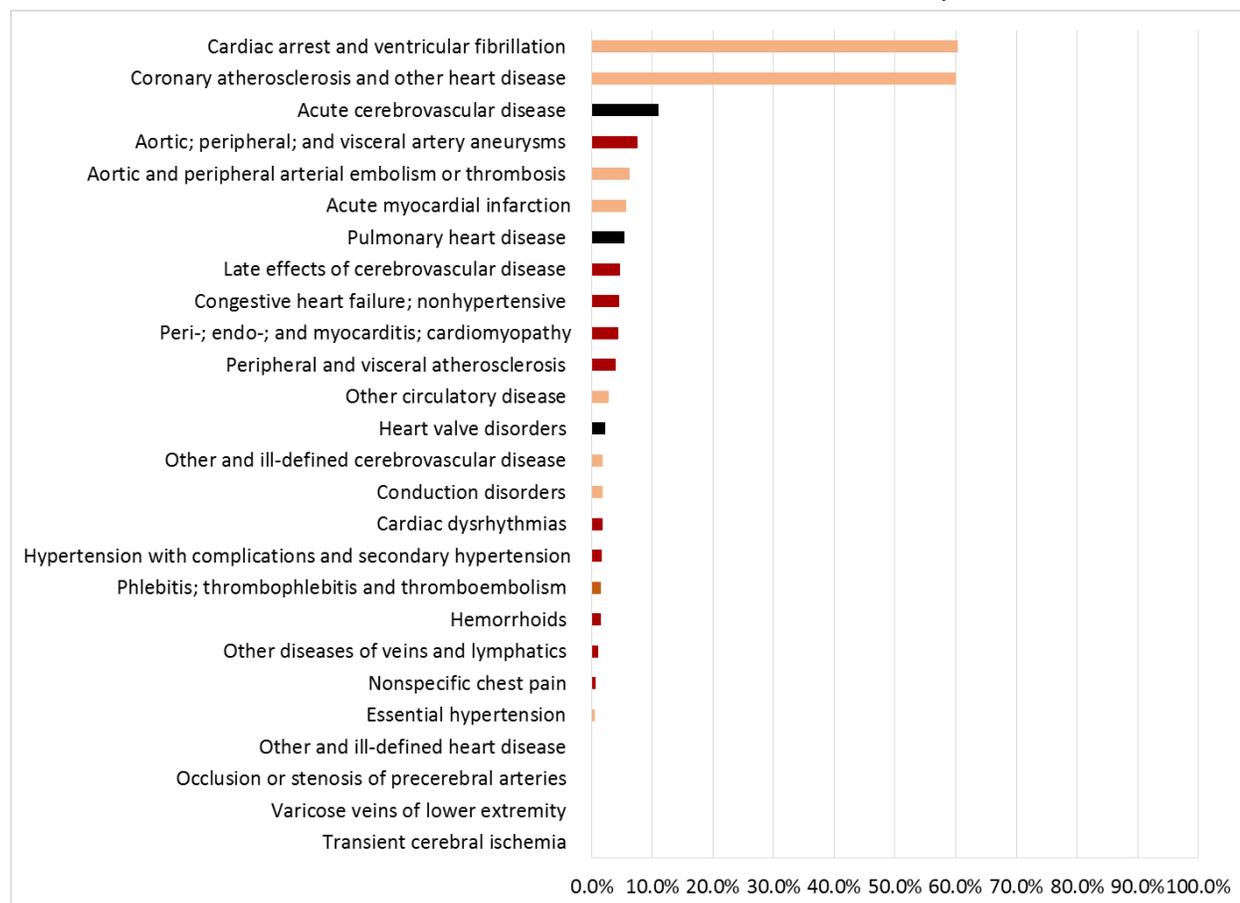
FIGURE 14. AVERAGE TOTAL CHARGES FOR EACH OF THE “DISEASE OF THE CIRCULATORY SYSTEM” GROUPINGS IN DELAWARE, 2011



Source: Delaware Department of Health and Social Services, Delaware Health Statistics Center, Delaware Hospital Discharge Report, 2011

Of all the hospital discharges categorized as “diseases of the circulatory system,” only two groupings resulted in a high mortality percentage – more than 50 percent – shown in Figure 15. Most “diseases of the circulatory system” groupings have a minimal number resulting in death – less than 10 percent of all hospital discharges.

FIGURE 15. PATIENT MORTALITY PERCENTAGE BY GROUPINGS IN DELAWARE, 2011.



Source: Delaware Department of Health and Social Services, Delaware Health Statistics Center, Delaware Hospital Discharge Report, 2011

Cardiac arrest and ventricular fibrillation (60.3 percent) and coronary atherosclerosis and other heart disease (60.0 percent) were the leading causes of death to patients who passed away while in the hospital. Only 10.9 percent of patients died due to acute cerebrovascular disease. The rest of the groupings had a mortality percentage of less than 10 percent.

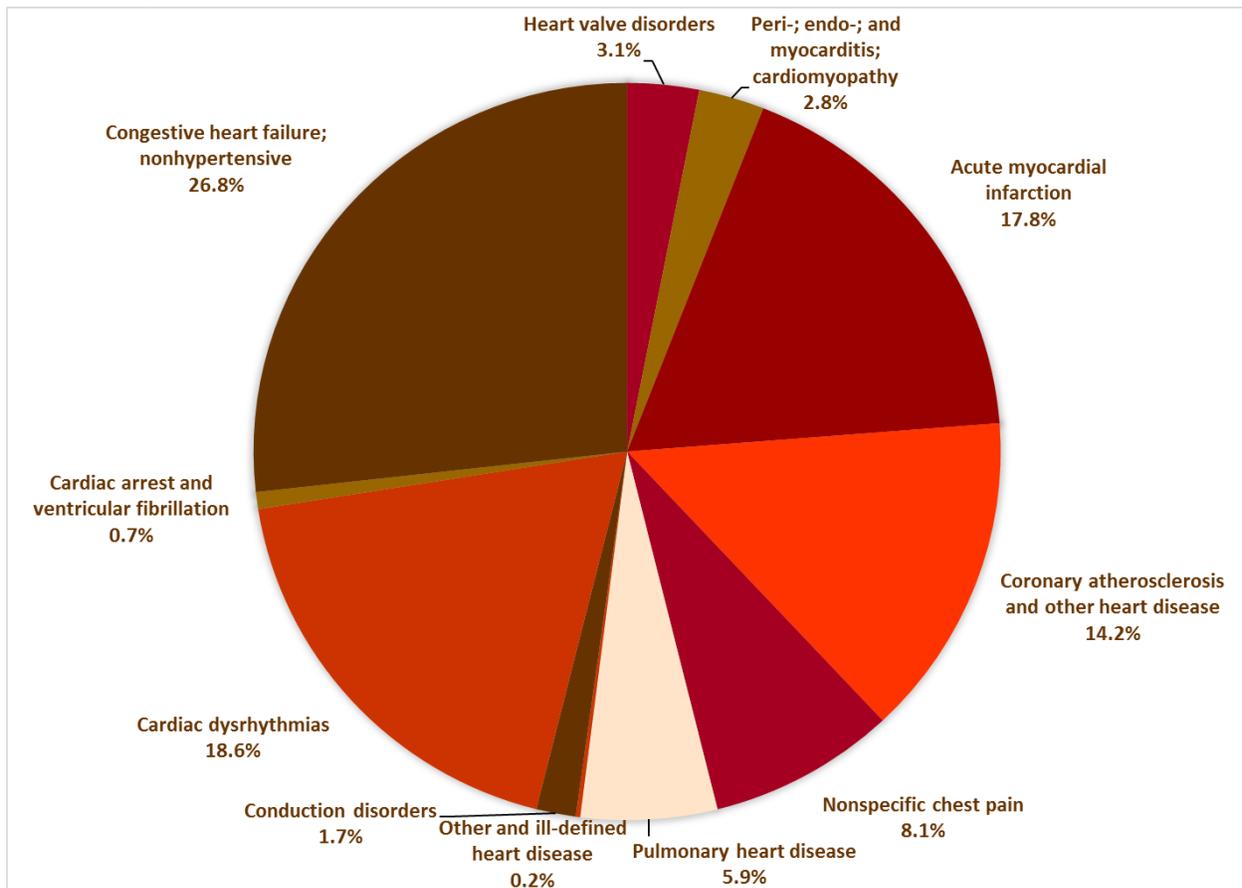
“Diseases of the circulatory system” groupings can be loosely reassigned to the broader categories: heart disease, vascular disease, and cerebrovascular/TIA disease. While groupings are not usually done for Delaware’s Health Statistics Center *Hospital Discharge Summary Reports*, creating other intermediate categories aligned with the definitions presented in the beginning of the report provides insight into the burden of each category, as well as the larger burden.

Heart Disease Hospital Discharges

Heart disease comprises the largest percentage of all “diseases of the circulatory system” hospital discharges. In 2011, there were 10,458 hospital discharges of Delawareans. There are 11 groupings (Figure 16):

1. Congestive heart failure, non-hypertensive (26.8 percent)
2. Acute myocardial infarction (17.8 percent)
3. Cardiac dysrhythmias (18.6 percent)
4. Coronary atherosclerosis and other heart disease (14.2 percent)
5. Nonspecific chest pain (8.1 percent)
6. Pulmonary heart disease (5.9 percent)
7. Heart valve disorders (3.1 percent)
8. Peri-endo- and myocarditis; cardiomyopathy (2.8 percent)
9. Conduction disorders (1.7 percent)
10. Cardiac arrest and ventricular fibrillation (0.7 percent)
11. Other and ill-defined heart disease (0.2 percent)

FIGURE 16. DISTRIBUTION OF HOSPITAL DISCHARGES FOR HEART DISEASE BY GROUPINGS IN DELAWARE, 2011



Source: Delaware Department of Health and Social Services, Delaware Health Statistics Center, Delaware Hospital Discharge Report, 2011

Figure 16 shows the distribution hospital discharges for heart disease groupings. Non-hypertensive congestive heart failure was responsible for 26.8 percent of all heart disease hospital discharges, closely followed by cardiac dysrhythmias (18.6 percent), and acute myocardial infarction (17.8 percent). In contrast, other and ill-defined heart disease (0.2 percent) and cardiac arrest and ventricular fibrillation (0.8 percent) comprise only 1 percent of all heart disease hospital discharges.

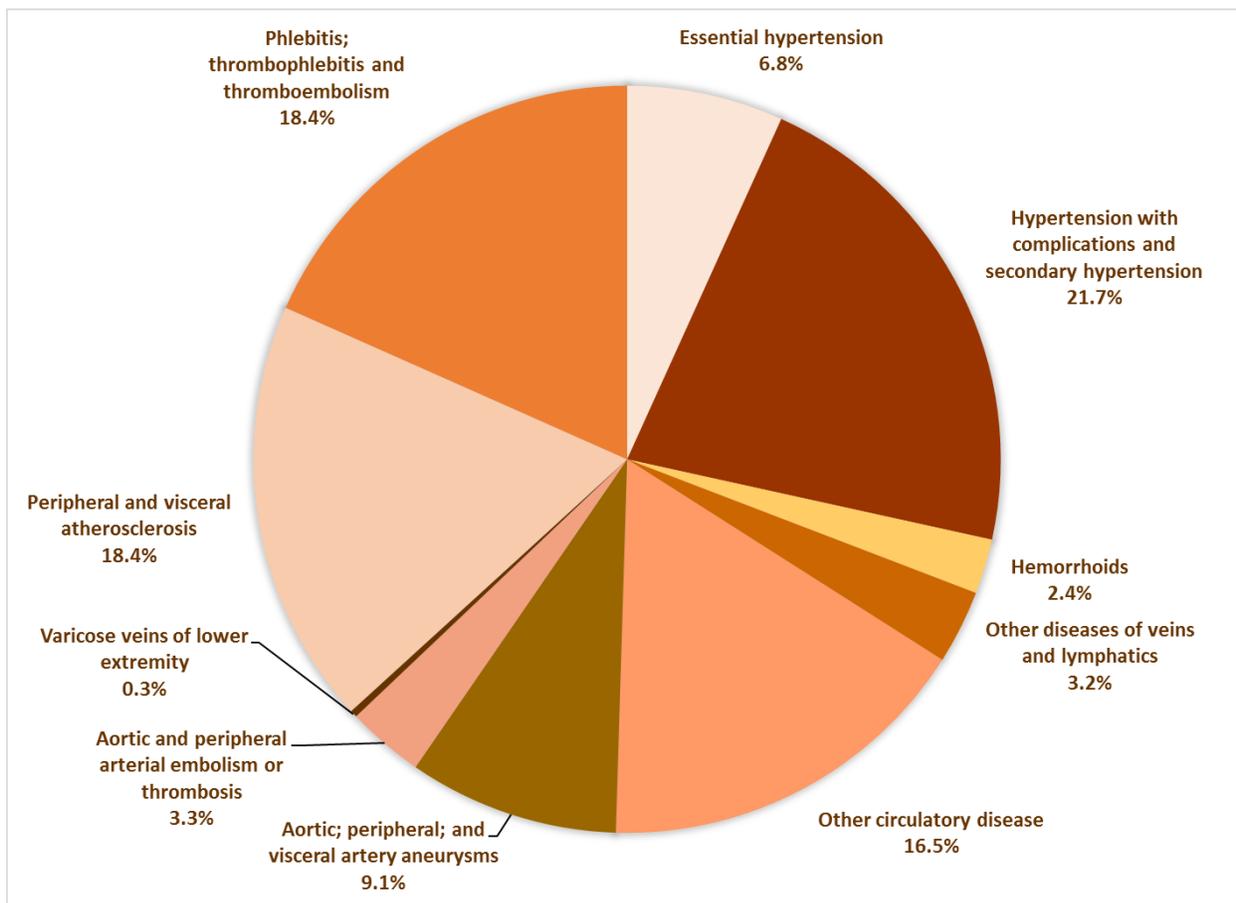
Vascular Disease Hospital Discharge

Vascular disease comprises just under 18 percent of all “diseases of the circulatory system” hospital discharges. In 2011, there were 2,910 vascular disease hospital discharges, organized in 10 groupings (Figure 17):

1. Hypertension with complications and secondary hypertension (21.7 percent)
2. Peripheral and visceral atherosclerosis (18.4 percent)
3. Phlebitis; thrombophlebitis and thromboembolism (18.4 percent)
4. Other circulatory disease (16.5 percent)
5. Aortic; peripheral; and visceral artery aneurysms (9.1 percent)
6. Essential hypertension (6.8 percent)
7. Aortic and peripheral arterial embolism or thrombosis (3.3 percent)
8. Other diseases of veins and lymphatics (3.2 percent)
9. Hemorrhoids (2.4 percent)
10. Varicose veins of lower extremity (0.3 percent)

Hypertension with complications and secondary hypertension (21.7 percent), peripheral and visceral atherosclerosis (18.4 percent) and phlebitis, thrombophlebitis, and thromboembolism (18.4 percent) were responsible for the majority of vascular disease hospital discharges in 2011. Other circulatory diseases accounted for another 16.5 percent of hospital discharges in 2011. In contrast, varicose veins of lower extremity (0.3 percent), hemorrhoids (2.4 percent), other diseases of veins and lymphatics (3.2 percent), and aortic and peripheral arterial embolism or thrombosis (3.3 percent) just shy of 10 percent of all vascular disease hospital discharges.

FIGURE 17. DISTRIBUTION OF HOSPITAL DISCHARGES FOR VASCULAR DISEASE BY GROUPINGS IN DELAWARE, 2011



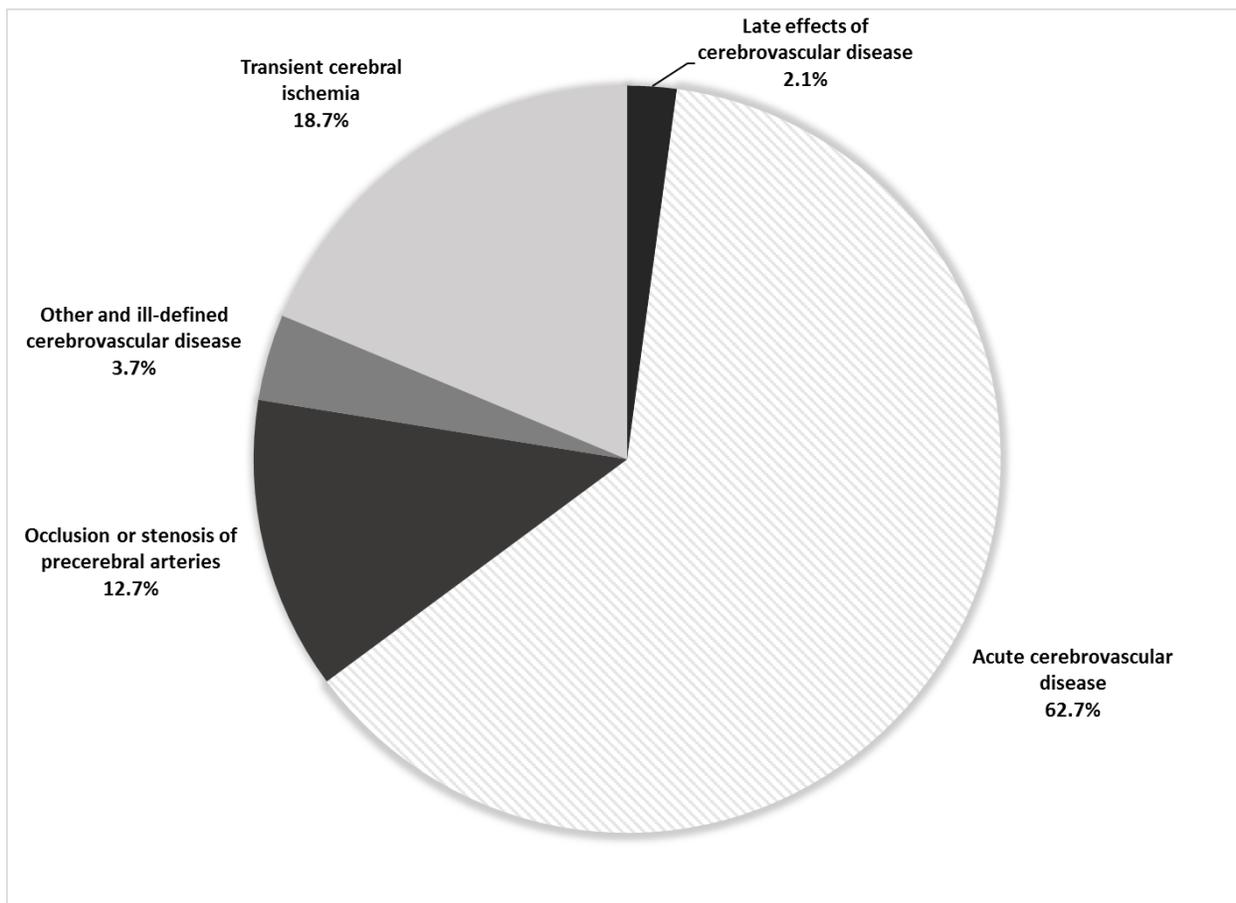
Source: Delaware Department of Health and Social Services, Delaware Health Statistics Center, Delaware Hospital Discharge Report, 2011

Cerebrovascular Disease/TIA Hospital Discharge

Cerebrovascular Disease and TIA were responsible for slightly more than 18 percent of all “diseases of the circulatory system” or 3,051 hospital discharges in Delaware in 2011. There are only five groupings included in this category:

1. Acute cerebrovascular disease (62.7 percent)
2. Occlusion or stenosis of precerebral arteries (12.7 percent)
3. Other and ill-defined cerebrovascular disease (3.7 percent)
4. Transient cerebral ischemia (18.7 percent)
5. Late effects of cerebrovascular disease (2.1 percent)

FIGURE 18. DISTRIBUTION OF HOSPITAL DISCHARGES FOR CEREBROVASCULAR DISEASE AND TRANSIENT ISCHEMIC ATTACK BY GROUPINGS IN DELAWARE, 2011



Source: Delaware Department of Health and Social Services, Delaware Health Statistics Center, Delaware Hospital Discharge Report, 2011

Acute cerebrovascular disease contributed to the majority - 62 percent - of all cerebrovascular disease hospital discharges. TIA were responsible for 571 hospital discharges. Occlusion or stenosis of precerebral arteries were responsible for 387 hospital discharges, and other and ill-defined cerebrovascular disease were responsible for 114 hospital discharges. Late effects of cerebrovascular disease were responsible for 65 hospital discharges in 2011.

Mortality

This section describes the cardiovascular diseases as a leading cause of death, also known as mortality. Analysis for mortality is presented in two ways: counts of death and age-adjusted mortality rate. Counts of death presents the raw number of deaths in a single year or over a period of time due to a particular cause of death. Counts of death are useful when conveying the magnitude of the health problem, prevention, and health care needed. Age-adjusted mortality rates presents an estimate minimizing the effects of different age distributions allowing for comparisons between different populations. Because age is a known confounder for mortality, age-adjustment is particularly useful with these diseases.

Counts of Death for Cardiovascular Disease

Cardiovascular disease mortality is presented as four smaller cardiovascular disease groups: “Diseases of the heart” (defined earlier as heart disease), cerebrovascular disease (also known as stroke), other diseases of the circulatory system (included earlier as vascular disease), and essential hypertension and hypertensive renal disease (included earlier as vascular disease). Between 2011 and 2015, these four leading causes of death were responsible for 12,048 deaths – just shy of 30 percent of all deaths – in Delaware.

TABLE 3. TWENTY LEADING CAUSES OF DEATH IN DELAWARE, 2011-2015

| | Top Twenty Leading Causes of Death | 2011 | 2012 | 2013 | 2014 | 2015 | Total |
|----|---|--------------|--------------|--------------|--------------|--------------|---------------|
| 1 | Malignant neoplasms | 1,898 | 1,934 | 1,903 | 1,972 | 2,011 | 9,718 |
| 2 | Diseases of heart | 1,796 | 1,787 | 1,864 | 1,917 | 1,930 | 9,294 |
| 3 | Chronic lower respiratory diseases | 458 | 423 | 483 | 458 | 507 | 2,329 |
| 4 | Cerebrovascular diseases | 419 | 403 | 409 | 439 | 469 | 2,139 |
| 5 | Accidents (unintentional injuries) | 331 | 371 | 403 | 436 | 457 | 1,998 |
| 6 | Dementia | 443 | 513 | 422 | 464 | 456 | 2,298 |
| 7 | Alzheimer's disease | 203 | 214 | 192 | 188 | 266 | 1,063 |
| 8 | Diabetes mellitus | 223 | 242 | 218 | 226 | 212 | 1,121 |
| 9 | Influenza and pneumonia | 130 | 121 | 150 | 156 | 193 | 750 |
| 10 | Nephritis, nephrotic syndrome and nephrosis | 161 | 139 | 178 | 172 | 175 | 825 |
| 11 | Septicemia | 114 | 121 | 157 | 136 | 146 | 674 |
| 12 | Intentional self-harm (suicide) | 105 | 125 | 122 | 126 | 122 | 600 |
| 13 | Chronic liver disease and cirrhosis | 91 | 76 | 82 | 110 | 111 | 470 |
| 14 | Other diseases of respiratory system | 115 | 107 | 96 | 115 | 96 | 529 |
| 15 | Parkinson's disease | 79 | 71 | 83 | 82 | 83 | 398 |
| 16 | Other diseases of circulatory system | 62 | 66 | 60 | 83 | 74 | 345 |
| 17 | Pneumonitis due to solids and liquids | 50 | 44 | 51 | 59 | 73 | 277 |
| 18 | Certain conditions originating in the perinatal period | 59 | 56 | 39 | 65 | 67 | 286 |
| 19 | Assault | 51 | 64 | 52 | 57 | 66 | 290 |
| 20 | Essential (primary) hypertension and hypertensive renal disease | 47 | 43 | 69 | 48 | 63 | 270 |
| | All causes | 7,816 | 7,873 | 7,967 | 8,252 | 8,580 | 40,488 |

Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Health Statistics Center, 2015

Table 3 shows the 20 leading causes of death in Delaware from 2011 through 2015. “Diseases of the heart” were consistently the second leading cause of the death during this timeframe, closely following only malignant neoplasms. There were 9,294 deaths – 23 percent – caused by “diseases of the heart” in this period. The number of Delaware deaths varied from a low of 1,898 deaths in 2011 to a high of 2,011 deaths in 2015 – a range of 113 deaths. Cerebrovascular disease was the fifth leading cause of death from 2011 through 2014, and the fourth leading cause of death in 2015, and was responsible for 2,139 deaths – 5.2 percent – in Delaware during this five-year period. The number of deaths per year

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ranged from a low of 403 deaths in 2012 to a high of 469 deaths in Delaware in 2015 – a change of 66 deaths during this five-year interval.

Vascular disease conditions are presented as two separate leading causes of death: “other diseases of the circulatory system” and “essential hypertension and hypertensive renal disease.” Combined, these two leading causes of death were responsible for 615 deaths in Delaware from 2011 to 2015. “Other diseases of the circulatory system” were responsible for 345 deaths in Delaware during the same five-year period. “Other diseases of the circulatory system” were the sixteenth leading cause of death in 2011, 2012, and 2015; the seventeenth leading cause of death in 2013; and the fifteenth leading cause of death in 2014. The number of deaths from “other diseases of the circulatory system” ranged from 60 deaths in 2013 to 83 deaths in 2014 – a difference of 23 deaths. Lastly, “essential hypertension and hypertensive renal disease” was the twentieth leading cause of death in the periods 2011-2012 and 2014-2015, and the sixteenth leading cause of death in 2013. During this five-year period, the number of deaths from “essential hypertension and hypertensive renal disease” ranged from 43 deaths in 2012 to 69 deaths in 2013 – a difference of 26 deaths.

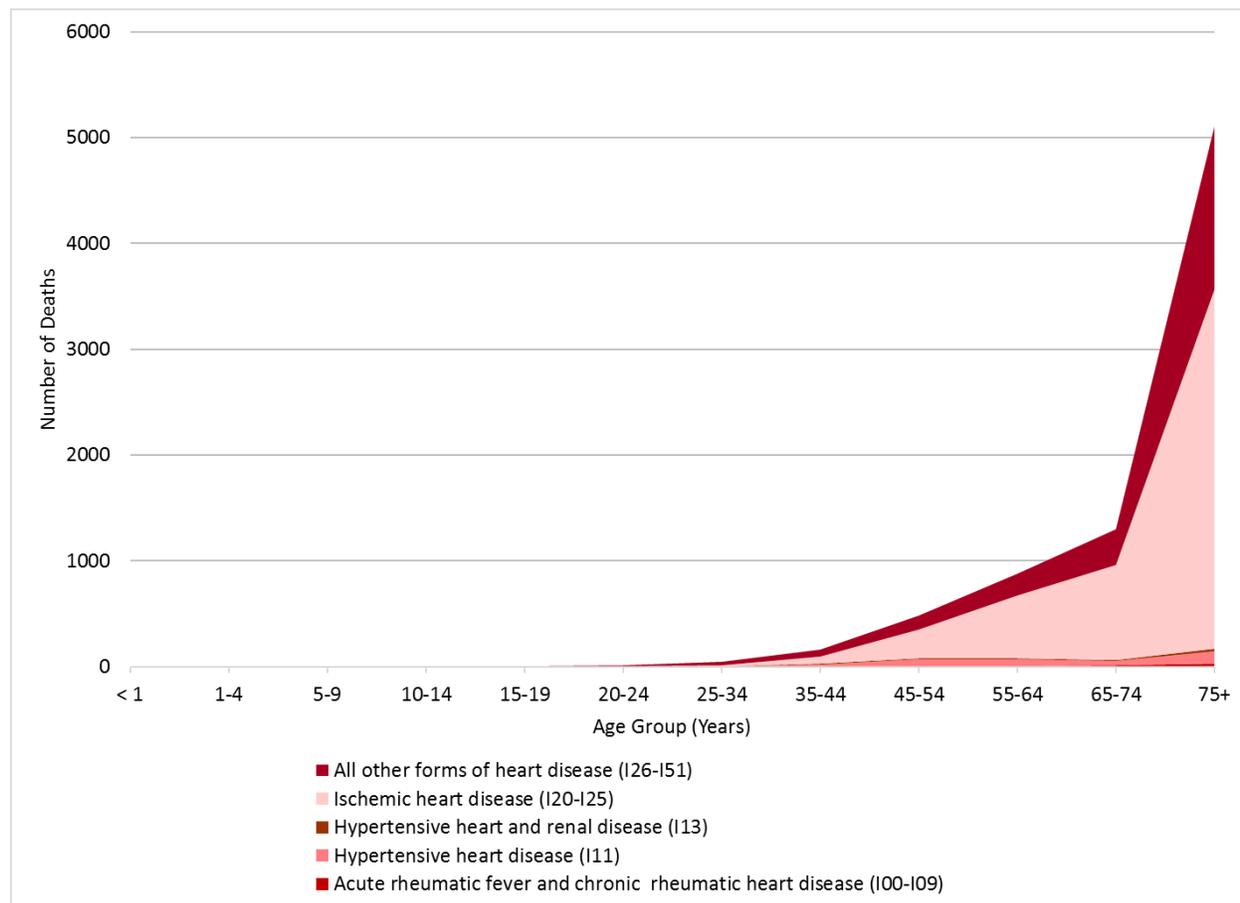
Heart Disease Mortality

Heart disease is an inclusive category for all diseases affecting the heart. Mortality of heart disease is classified as “diseases of the heart” and in the next section, heart diseases with the highest mortality counts are shown as subcategories. The majority of deaths from “diseases of the heart” can be attributed to ischemic heart disease. From 2011 through 2015, 7,995 Delaware residents died from “diseases of the heart.”

Counts of Death

In Delaware, “diseases of the heart” was the second leading cause of death for all five years from 2011 through 2015. During this period, ischemic heart disease was responsible for 5,256 “diseases of the heart” deaths (65.7 percent). The catch-all category “all other forms of heart disease” – which includes 25 individual ICD-10 codes – was the leading cause of death for another 2,328 Delaware residents, or 29 percent of “diseases of the heart” deaths. Hypertensive heart disease contributed another 326 deaths (4 percent of “diseases of the heart” deaths), and acute rheumatic fever and chronic rheumatic heart disease and hypertensive heart and renal disease were responsible for 85 deaths (1 percent of all “diseases of the heart” deaths) in Delaware.

FIGURE 19. “DISEASES OF THE HEART” DEATHS BY CHAPTER HEADING AND AGE GROUP IN DELAWARE, 2011-2015



Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Health Statistics Center, 2011-2015

Age is a well-documented confounder for heart disease. As age increases, so does the risk of being diagnosed and dying of a heart disease condition (Figure 20). From 2011 through 2015, 91.1 percent of deaths due to the conditions listed under “diseases of the heart” occurred in Delawareans age 55 and older; 63.9 percent occurred among ages 75 and older, 16.2 percent of deaths occurred among ages 65-74, and 11 percent of deaths occurred among ages 55-64.

Age-Adjusted Mortality

Age-adjustment is important when comparing groups with non-uniform age distributions. Without age-adjustment, presenting only counts can misrepresent the burden when comparing two or more groups. Therefore, five-year age adjusted mortality is presented for the years covered by the report for race, race-sex, and county (Tables 4 and 5).

TABLE 4. FIVE-YEAR AGE-ADJUSTED MORTALITY RATE FOR “DISEASES OF THE HEART” BY COUNTY AND RACE IN DELAWARE, 2011-2015

| LEADING CAUSES OF DEATH | AREA | | | | RACE | |
|--|-------|-------|-------|--------|-----------|------------------|
| | DE | Kent | NCC | Sussex | Caucasian | African American |
| Diseases of the heart | 158.8 | 193.9 | 152.6 | 153.8 | 156.4 | 181.1 |
| Rates per 100,000, adjusted to U.S. 2000 population. | | | | | | |
| Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Health Statistics Center, 2011-2015 | | | | | | |

The statewide age-adjusted mortality rate for 2011-2015 was 158.8 per 100,000 persons (Table 4). During that five-year period, Kent County had the highest mortality rate of 193.9 deaths per 100,000 persons; Sussex County’s mortality rate was 153.8 percent per 100,000 persons; and New Castle County’s mortality rate was 152.6 percent per 100,000 persons. From 1995 to 2015, all three counties saw decreases in “diseases of the heart” age-adjusted mortality rates. Kent County (38.0 percent) has the smallest decrease, followed by New Castle County (44.8 percent), and Sussex County with the largest decrease (35.9 percent). Kent County consistently had a higher age-adjusted mortality rate compared to the statewide age-adjusted mortality rate, while New Castle County and Sussex County consistently had lower age-adjusted mortality rates compared to the statewide age-adjusted mortality rate from 1995-2015.

Table 4 also presents the age-adjusted mortality rates for Caucasians and African Americans. In the period 2011-2015, Caucasians had an age-adjusted mortality rate of 156.4 deaths per 100,000 persons. African Americans had an age-adjusted mortality rate of 181.1 deaths per 100,000 persons. The difference between these two rates is 24.7 deaths per 100,000 persons, meaning that African Americans have an age-adjusted mortality rate that is 15.8 percent higher than Caucasians. Over the past two decades, the age-adjusted mortality rates between African Americans and Caucasians have declined in tandem. There was a 43.8 percent decrease among Caucasian Delawareans and a 43.7 percent decrease among African American Delawareans.

TABLE 5. FIVE-YEAR AGE-ADJUSTED MORTALITY RATES FOR “DISEASES OF THE HEART” OF DEATH BY RACE-SEX COMBINATION IN DELAWARE, 2011-2015

| LEADING CAUSES OF DEATH | RACE-SEX COMBINATION | | | |
|--|----------------------|-------------------|------------------------|--------------------------|
| | Caucasian Males | Caucasian Females | African American Males | African American Females |
| Diseases of the heart | 201.8 | 119.8 | 217.5 | 154.5 |
| Rates per 100,000, adjusted to U.S. 2000 population. | | | | |
| Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Health Statistics Center, 2011-2015 | | | | |

Table 5 explores the differences between race-sex combinations. Both African American and Caucasian males have higher age-adjusted mortality rates compared to African American and Caucasian females.

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African American males had the highest age-adjusted mortality rate (217.5 deaths per 100,000 persons) followed by Caucasian males with an age-adjusted mortality rate of 201.8 deaths per 100,000 persons. African American females had a higher age-adjusted mortality rate (154.5 deaths per 100,000 persons) compared to Caucasian females (119.8 deaths per 100,000 persons). The age-adjusted mortality rate dropped between 1995-1999 and 2011-2015 for all race-sex combinations. The percent decrease is approximately the same for all race-sex combinations.

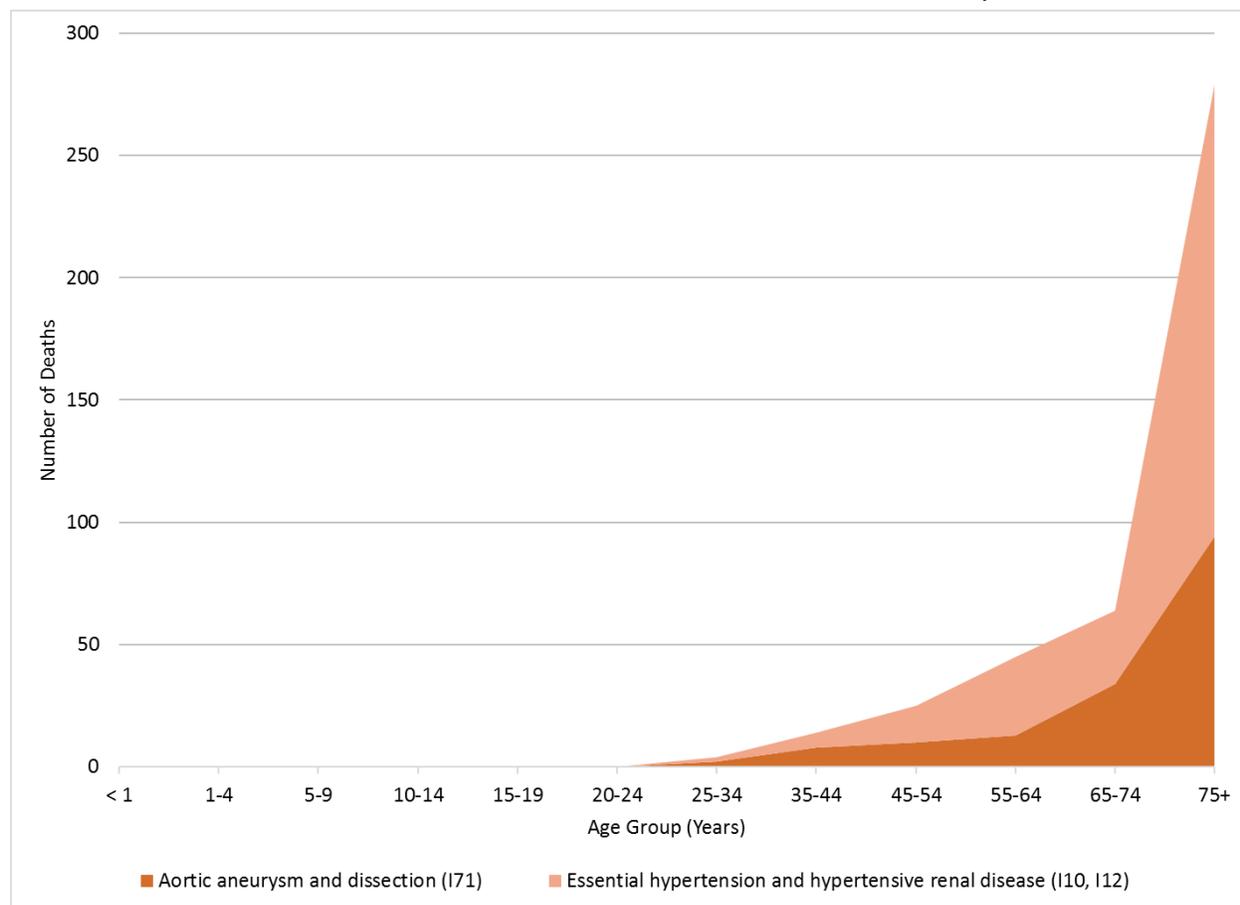
Vascular Disease Mortality

Vascular disease mortality includes all diseases of the circulatory system. The two major vascular diseases are essential hypertension and hypertensive renal diseases and aortic aneurysm and dissection.

Counts of Death

Vascular disease contributes to a relatively small number of deaths, compared to heart disease and cerebrovascular disease. Between 2011 and 2015 in Delaware, there were only 431 deaths from essential hypertension and hypertensive renal disease and aortic aneurysm and dissection. There was very little fluctuation in the number of deaths among these years. The highest number of deaths for essential hypertension and hypertensive renal disease was in 2013 (69 deaths), and the lowest number of deaths was in 2012 (43 deaths). The highest number of deaths for aortic aneurysm and dissection was 37 deaths in 2015; the lowest number of deaths, 30 deaths, occurred in both 2013 and 2014.

FIGURE 20. SELECTED VASCULAR DISEASE DEATHS BY AGE GROUP IN DELAWARE, 2011-2015



Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Health Statistics Center, 2011-2015

Age is a well-documented confounder for vascular disease. As age increases, so does the risk of being diagnosed and ultimately dying of a vascular disease condition (Figure 20). From 2011 through 2015, two vascular disease conditions: 1.) aortic aneurysm and dissection; and 2.) essential hypertension and hypertensive renal disease, caused 90 percent of deaths in Delawareans age 55 and older. Almost 65 percent of deaths due to the two conditions occurred in Delawareans age 75 and older, almost 15 percent occurred among ages 65-74, and just more than 10 percent occurred among ages 55-64. The remaining 10 percent of deaths due to the two conditions occurred in Delaware adults ages 25-54. No deaths occurred in Delawareans under the age of 25 due to those vascular disease conditions.

Age-Adjusted Mortality

Age-adjustment is important when comparing groups with non-uniform age distributions. Without age-adjustment, presenting only counts can misrepresent the burden when comparing two or more groups. Therefore, five-year age adjusted mortality is presented for the years covered by the report for race, race-sex, and county.

TABLE 6. FIVE-YEAR AGE-ADJUSTED MORTALITY RATE FOR SELECTED VASCULAR DISEASE BY COUNTY AND RACE IN DELAWARE, 2011-2015

| LEADING CAUSES OF DEATH | AREA | | | | RACE | |
|---|------|------|-----|--------|-----------|------------------|
| | DE | Kent | NCC | Sussex | Caucasian | African American |
| Essential Hypertension and Hypertensive Renal Disease | 4.5 | 6.7 | 4.1 | 4.1 | 4.0 | 7.3 |
| Aortic Aneurysm and Dissection | 2.9 | 4.2 | 2.8 | 2.4 | 2.9 | 3.0 |

Rates per 100,000, adjusted to U.S. 2000 population.
 Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Health Statistics Center, 2011-2015

Between 2011 and 2015, the statewide five-year age-adjusted mortality rate for essential hypertension and hypertensive renal disease was 4.5 deaths per 100,000 persons. During this period, Kent County had a slightly higher age-adjusted mortality rate (6.7 deaths per 100,000 persons) than the statewide rate, compared to New Castle County and Sussex County, which each had a slightly lower age-adjusted mortality rate of 4.1 deaths per 100,000 persons. African Americans had a higher age-adjusted mortality rate than Caucasians, at 7.3 African American deaths per 100,000 persons, compared to 4.0 Caucasian deaths per 100,000 persons (Table 6).

During this same period, the statewide five-year age-adjusted mortality rate for aortic aneurysm and dissection was 2.9 deaths per 100,000 persons. Kent County had a slightly higher age-adjusted mortality rate (4.2 deaths per 100,000 persons) compared to the statewide rate. Likewise, with low age-adjusted mortality rates and a low number of deaths from these diseases, rates are more variable from time interval to time interval. There was almost no difference between African Americans and Caucasians when comparing age-adjusted mortality rates for aortic aneurysm and dissection.

TABLE 7. FIVE-YEAR AGE-ADJUSTED MORTALITY RATES FOR SELECTED VASCULAR DISEASES BY RACE-SEX COMBINATION IN DELAWARE, 2011-2015

| LEADING CAUSES OF DEATH | RACE-SEX COMBINATION | | | |
|---|----------------------|-------------------|------------------------|--------------------------|
| | Caucasian Males | Caucasian Females | African American Males | African American Females |
| Essential Hypertension and Hypertensive Renal Disease | 3.8 | 4.0 | 7.5 | 4.9 |
| Aortic Aneurysm and Dissection | 3.8 | 2.2 | ---- | ---- |

Rates per 100,000, adjusted to U.S. 2000 population.
 "----" indicates rate does not meet standards of reliability or precision; based on fewer than 20 deaths in the numerator.
 Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Health Statistics Center, 2011-2015

African American males and African American females had fewer than 20 deaths due to essential hypertension and hypertensive renal disease and aortic aneurysm and dissection between 2011 and 2015; therefore, mortality rates did not meet the standards for validity and reliability (Table 7). In this same period, Caucasian males had the lowest age-adjusted mortality rate (3.8 deaths per 100,000

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persons) due to those conditions, followed closely by Caucasian females (4.0 deaths per 100,000 persons). African American females had an age-adjusted mortality rate of 4.9 deaths per 100,000 persons to those conditions between 2011 and 2015, compared to African American males, who had the highest age-adjusted mortality rate for race-sex combination (7.5 deaths per 100,000 persons). Caucasian females had a lower age-adjusted mortality rate of aortic aneurysm and dissection (2.2 deaths per 100,000 persons) compared to Caucasian males (3.8 deaths per 100,000 persons). With low age-adjusted mortality rates and a low number of deaths from these diseases, rates are more variable between five-year periods.

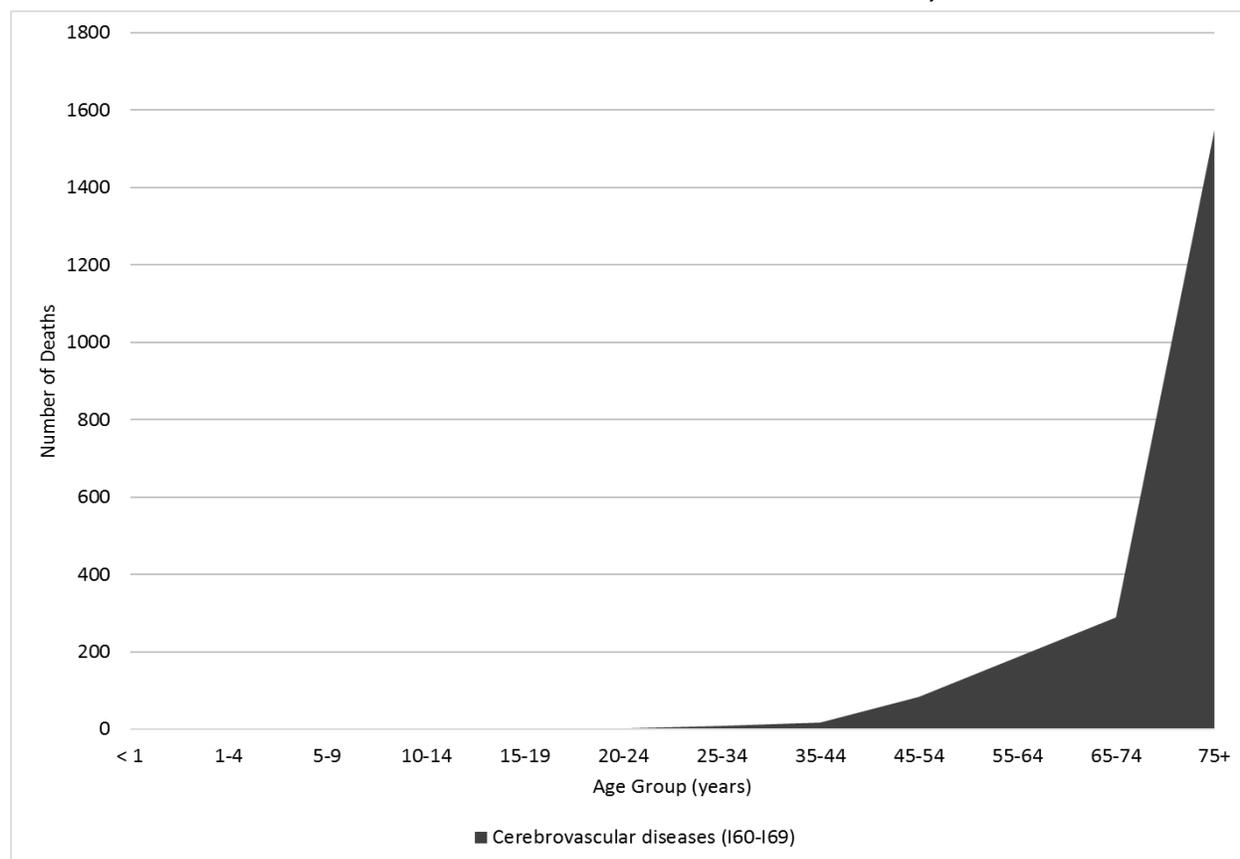
Cerebrovascular Disease Mortality

This section only includes cerebrovascular disease, and does not include TIA. By definition, TIAs usually resolve within 24 hours, and therefore does not lead to mortality.

Counts of Death

Cerebrovascular disease was responsible for 2,139 deaths from 2011 through 2015 in Delaware. There was very little fluctuation in the number of deaths by year: the highest number of deaths, 469 deaths, were observed in 2015 and the lowest number of deaths, 403 deaths, were observed in 2012. (Figure 21.)

FIGURE 21. CEREBROVASCULAR DISEASE MORTALITY BY AGE IN DELAWARE, 2011-2015



Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Health Statistics Center, 2011-2015

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Age is a well-documented confounder for cerebrovascular disease. As age increases, so does the risk of having a cerebrovascular attack, with approximately 18 percent of strokes ending in death (Figure 21). From 2011 through 2015, there were 2,139 deaths from cerebrovascular diseases. Of those, 97 percent of cerebrovascular disease deaths occurred in Delawareans age 55 and older: 72.4 percent of deaths occurred in Delawareans age 75 and older, 13.5 percent occurred among ages 65-74, and 8.7 percent occurred in Delawareans ages 55-64. The remaining 3 percent of deaths occurred in Delawareans ages 45-54, and only three deaths occurred in a children under the age of 1.

Age-Adjusted Mortality

Age-adjustment is important when comparing groups with non-uniform age distributions. Without age-adjustment, presenting only counts can misrepresent the burden when comparing two or more groups. Therefore, five-year age adjusted mortality rates are presented for 2011 through 2015 for race, race-sex, and county.

TABLE 8. FIVE-YEAR AGE-ADJUSTED MORTALITY RATE FOR CEREBROVASCULAR DISEASES BY COUNTY AND RACE IN DELAWARE, 2011-2015

| LEADING CAUSES OF DEATH | AREA | | | | RACE | |
|--|------|------|------|--------|-----------|------------------|
| | DE | Kent | NCC | Sussex | Caucasian | African American |
| Cerebrovascular diseases | 36.1 | 39.5 | 41.6 | 26.7 | 34.1 | 47.2 |
| Rates per 100,000, adjusted to U.S. 2000 population. | | | | | | |
| Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Health Statistics Center, 2011-2015 | | | | | | |

In 2011-2015, the statewide age-adjusted mortality rate for cerebrovascular diseases was 36.1 deaths per 100,000 persons. New Castle County and Kent County had a higher age-adjusted mortality rate for cerebrovascular diseases than the statewide prevalence. The five-year age-adjusted mortality rates for 2011-2015 was 41.6 deaths per 100,000 persons in New Castle County and 39.5 deaths per 100,000 persons in Kent County. In contrast, Sussex County's five-year age-adjusted mortality rate for 2011-2015 was 26.7 deaths per 100,000 persons. Over the last two decades, Sussex County has seen the largest decrease (41.3 percent) in age-adjusted mortality. Kent County saw a 37.7 percent decrease during the same period and New Castle County saw the smallest percent decrease (16.8 percent).

Delaware African Americans had a higher age-adjusted mortality rate compared to Delaware Caucasians for that period. In 2011-2015, the age-adjusted mortality rate for cerebrovascular diseases for African Americans was 47.2 deaths per 100,000 persons, compared to the rate for Caucasians, 34.1 deaths per 100,000 persons. Age-adjusted mortality in the last two decades decreased 33.5 percent among African Americans and 29.0 percent among Caucasians.

TABLE 9. FIVE-YEAR AGE-ADJUSTED MORTALITY RATES FOR CEREBROVASCULAR DISEASES BY RACE-SEX COMBINATION IN DELAWARE, 2011-2015

| LEADING CAUSES OF DEATH | RACE-SEX COMBINATION | | | |
|--------------------------|----------------------|-------------------|------------------------|--------------------------|
| | Caucasian Males | Caucasian Females | African American Males | African American Females |
| Cerebrovascular Diseases | 34.9 | 33.4 | 54.4 | 42.6 |

Rates per 100,000, adjusted to U.S. 2000 population.
 Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Health Statistics Center, 2011-2015

For five-year age-adjusted mortality rates for cerebrovascular diseases for race-sex, Caucasian females have the lowest rate for selected causes of death, followed by Caucasian males, African American females, and African American males (Table 9). All race-sex combinations have seen a decrease in five-year age-adjusted mortality over the last decade. However, even with the decrease, Caucasian females continue to have the lowest five-year age-adjusted mortality rate, followed by Caucasian males, African American females, and African American males. There is a difference of 21 deaths per 100,000 persons between Caucasian females and African American males; 20 years ago, the difference was higher at 34.7 deaths per 100,000 persons.

Risk Factors for Cardiovascular Disease Conditions and TIA

Major Risk Factors Common to Many Cardiovascular Conditions

Heart Disease Conditions

As illustrated earlier in Figure 1, many heart diseases have complex relationships. In addition to the complex relationships these diseases have with each other, many of these conditions are also risk factors for having a stroke. For example, coronary heart disease, heart attack, arrhythmias, heart valve defects, and enlarged heart chambers are all risk factors for stroke.

High Cholesterol

In 2015, 39.1 percent of Delaware residents age 18 and older reported they had been diagnosed with high cholesterol. That means more than 235,547 Delawarean adults know they have high cholesterol, according to the 2015 BRFSS. Cholesterol is a waxy, fat-like substance found in the blood. The body needs it to build healthy cells, but when there is too much cholesterol in the blood, it can build up in the arteries, causing a narrowing of the space for blood to flow. This can cause less blood to flow through the arteries to the heart and other organs.

TABLE 10. TREND IN ADULT HIGH CHOLESTEROL PREVALENCE IN DELAWARE, 2011, 2013, AND 2015

| 2011 | 2013 | 2015 |
|--------------|--------------|--------------|
| 40.6 percent | 40.6 percent | 39.1 percent |

Source: Delaware Department of Health and Social Services, Division of Public Health, Behavioral Risk Factor Survey (BRFS), 2011, 2013, 2015

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The BRFSS asks questions about cholesterol awareness in odd-numbered years. Prevalence has remained steady since 2011.

The prevalence of high cholesterol increases by age. In 2015, Delaware adults who reported having high cholesterol are: 21.8 percent (ages 18-44), 39.4 percent (ages 45-54), 48.7 percent (ages 55-64), and 55.4 percent (65 years and older). These increases are statistically significant.

According to the 2015 BRFSS, women have a lower prevalence of high cholesterol than men. In 2015, 36.9 percent of Delaware adult women reporting having high cholesterol, compared to 41.5 percent of adult men. Non-Hispanic Caucasian Delaware adults reported having a slightly higher prevalence of high cholesterol (40.8 percent), compared to non-Hispanic African American Delaware adults (36.9 percent) and Hispanic Delaware adults (43.9 percent). However, these differences were not statistically significant.

Delaware adults with a high school education or less have a higher prevalence of high cholesterol than their counterparts who have some post-high school education or a college degree. However, when adjusting for other demographic characteristics and risk factors, differences among educational groups were not significant.

Adults in Delaware with an income of less than \$15,000 annually have the highest prevalence of high cholesterol (56.4 percent). In contrast, adults with an annual income of \$50,000 or more have the lowest prevalence of high cholesterol (35 percent). When adjusting for other demographic characteristics and risk factors, Delaware adults in the lowest income bracket were almost twice as likely to have high cholesterol, compared to Delaware adults making at least \$50,000 annually.

Hypertension

There are a number of risk factors for hypertension. These include diabetes, poor diet, physical inactivity, obesity, tobacco use, alcohol consumption, and family history and genetics.

Diabetes

In 2015, 11.5 percent of Delaware residents age 18 and older reported that they had been diagnosed with diabetes. That means more than 84,000 Delaware adults know they have diabetes, according to the Delaware BRFSS. This prevalence rate does not include gestational diabetes. Although the BRFSS question does not distinguish between type 1 and type 2 diabetes, the National Diabetes Information Clearinghouse estimates that between 90 and 95 percent of people with diabetes have type 2.

Diabetes becomes more prevalent with age. Only 1.9 percent of 25-34 year-olds have diabetes, but the prevalence rises to 13.8 percent among adults ages 45-54, 18.8 percent for ages 55-64, and 21.6 percent among those 65 and older. There is no statistically significant difference between men (12.2 percent) and women (10.8 percent) in the 2015 survey results. In 2015, diabetes was more prevalent among

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non-Hispanic African American adults (15.1 percent) than among non-Hispanic Caucasian adults (11.0 percent). About 6.9 percent of Hispanic adults report having been diagnosed with diabetes.

As education and income increase, the prevalence of diabetes decreases. Seventeen percent of Delaware adults with less than a high school diploma or GED report having been diagnosed with diabetes, compared to 9.3 percent of Delaware college graduates. Likewise, 18.0 percent of Delaware adults with an annual household income of less than \$15,000 report having been diagnosed diabetes, compared to 7.3 percent of Delaware adults with an annual household income of \$75,000 or more. These differences are statistically significant.

For additional detailed information regarding diabetes, read the Delaware Diabetes and Heart Disease Prevention and Control Program's report, *Burden of Diabetes in Delaware, 2014 Update*, at <http://www.dhss.delaware.gov/dhss/dph/dpc/diabetes.html>. Planned prevention measures are covered in the Delaware Diabetes Coalition's strategic plan, *A Plan to Prevent and Control Diabetes in Delaware: A Coordinated Response for 2013-2018*. It can be found at the same link.

Tobacco Use

There was a slight decrease in both the U.S. median and Delaware's prevalence of current smokers since 2011 according to the BRFSS. The national median for current smoking was 21.2 percent in 2011 and dropped to 17.5 percent in 2015. Similarly, Delaware's prevalence of current smokers dropped from 21.8 percent in 2011 to 17.4 percent in 2015.

In 2015, 17.4 percent of Delaware adults reported being a current smoker. That means more than 124,000 Delaware adults are current smokers, according to the BRFSS. In 2015, there are no differences in current smoking prevalence except for Delaware adults age 65 and older, who had a significantly lower prevalence (8.8 percent) than all other age groups. Among Delaware adults in 2015 regarding current smoking prevalence, there is no difference between non-Hispanic Caucasians (17.9 percent) and non-Hispanic African Americans (17.2 percent). The sample size for Delaware Hispanic adults is too small to report. Men are significantly more likely to be current smokers than women. In 2015, 20.9 percent of Delaware men reported that they currently smoke, compared to 14.2 percent of Delaware women.

Significant differences are also observed among educational attainment levels and income levels. Current smoking decreases as education increases. Delaware adults who hold college degrees have a lower smoking prevalence, only 9 percent, than Delaware adults without college degrees. Of Delaware adults with less than a high school diploma, 27.8 percent are current smokers; 22.2 percent of adults with a high school diploma currently smoke; and 17.5 percent of Delaware adults with some college education currently smoke. Regarding annual household income, 32.1 percent of Delaware adults earning less than \$15,000 reported currently smoking, compared to 9.9 percent of Delaware adults earning \$75,000 or more.

Unhealthy Diet

The U.S. Department of Health and Human Services and the U.S. Department of Agriculture’s joint document *Dietary Guidelines for Americans* recommends that half of one's average meal consist of a variety of vegetables and fruits to avoid saturated fats and/or sugars and refined carbohydrates. The BRFSS asks questions about vegetable and fruit consumption in odd-numbered years.

One frequent suggestion is for adults to eat at least five vegetables and fruits every day. In 2015, according to the BRFSS, only 15.2 percent of Delaware adults reported eating at least five fruits and/or vegetables daily. More women (18.0 percent) ate at least five fruits and/or vegetables per day than men (12.1 percent). This difference was significant.

As education level increases, so does the prevalence of those who meet dietary suggestions. Only 10.5 percent of Delawareans with a high school diploma or less reported consuming at least five fruits and/or vegetables per day, compared to 16.6 percent of Delawareans with some post-high school education and 20.6 percent of college graduates. No other differences were observed among race/ethnicity, age groups, income levels, or counties.

Physical Inactivity

Approximately 200,000 Delaware adults (29.4 percent) reported having no physical activity in the previous 30 days other than their regular job. Men had a slightly lower prevalence of inactivity (27.7 percent) compared to women (30.9 percent), but this difference was not statistically significant. There were also no significant differences reported among race/ethnicity groups. As age increases, so does inactivity.

TABLE 11. PHYSICAL INACTIVITY BY AGE GROUP IN DELAWARE, 2015

| Age group | Physical Inactivity Prevalence |
|---|--------------------------------|
| 18-24 | 22.0% |
| 25-34 | 27.4% |
| 35-44 | 26.1% |
| 45-54 | 28.2% |
| 55-64 | 33.7% |
| 65 and older | 34.5% |
| <i>Source: Delaware Department of Health and Social Services, Division of Public Health, Behavioral Risk Factor Survey (BRFS), 2015</i> | |

The prevalence of physical inactivity also decreases as educational attainment increases. This decrease is significant. Forty-eight percent of Delaware adults who have less than a high school diploma or GED are inactive. In comparison, 35.9 percent of Delaware high school graduates, 25.5 percent with some post high school education, and 17.9 percent of college graduates are physically inactive. Likewise, as annual household income increases, physical inactivity decreases: 17.9 percent of adults with an annual

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income of \$75,000 or more reported having no physical activity in the previous 30 days, compared to 51.0 percent of adults with an annual income of less than \$15,000.

Obesity

Delaware's adult obesity prevalence has been close to the national BRFSS median for several years. In 2015, Delaware's adult obesity prevalence was 29.7 percent, compared to the national median of 29.8 percent. In 2015, African American females reported having the highest prevalence of obesity in Delaware: 40.7 percent. In contrast, 30 percent of Caucasian males, 28.6 percent of Caucasian females, and 23.9 percent of African American males reported being obese in 2015. The differences between African American females and Caucasian females, and African American females and males, were statistically significant.

Delaware adults ages 45-54 have the highest prevalence of obesity (36.6 percent), followed closely by ages 55-64 (33.7 percent), and ages 35-44 (30.3 percent). Obesity prevalence decreases with education and income. Thirty-six percent of Delaware adults with less than a high school diploma or GED reported in 2015 that they were obese, compared to 25.6 percent of Delaware adult college graduates. Likewise, 26 percent of Delaware adults with an annual household income of \$75,000 or more reported they were obese, compared to 40.6 percent of adults with an annual household income of \$15,000 to \$24,999.

Alcohol Consumption

Too much alcohol can raise blood pressure and increases triglyceride levels, both risk factors for heart disease. The CDC recommends women should not have more than one alcoholic drink per day, and men should not have more than two alcoholic drinks per day. According to the 2015 BRFSS, 5.3 percent of Delaware adults reported exceeding CDC recommendations. No differences between sexes or among race/ethnicities, age groups, education, or income were observed.

Family History

Heart disease can cluster in families. According to the CDC, family history can play an important role when identifying risk for heart disease. Specific disorders such as hypercholesterolemia and hypertension are risk factors for developing heart disease. A family history of these risk factors, combined with other modifiable risk factors, can increase an individual's risk of heart disease, stroke, and cardiac arrest.

Risk Factors Unique to Stroke

Many of the risk factors for stroke are the same for heart disease. These risk factors include high blood pressure, high cholesterol, diabetes, an unhealthy diet, physical inactivity, obesity, alcohol consumption, tobacco use, family history, age, sex, and race/ethnicity. However, certain risk factors for stroke differ from heart disease, including previous stroke, obstructive sleep apnea, and sickle cell disease.

Previous Stroke

Having a stroke or TIA increases the risk of having another stroke.

Obstructive Sleep Apnea

Obstructive sleep apnea is the most common type of sleep apnea. During sleep, the airway becomes blocked or collapses, causing shallow breathing or pauses during breathing. Being overweight or obese can increase the risk for obstructive sleep apnea.

Sickle cell disease

Sickle cell disease (SCD) is a group of genetic disorders affecting red blood cells, and it is inherited from one or both parents. Individuals with SCD have hard and sticky sickle-shaped (c-shaped) red blood cells. As a result, these abnormal blood cells can become stuck in small blood vessels and block the flow of blood. Many complications can arise from this condition, including stroke.

Conclusions

Cardiovascular disease and TIA are a complex group of conditions affecting the heart and circulatory system. These conditions are often interrelated and become risk factors for other cardiovascular disease conditions. Other risk factors also contribute to the overall risk of developing cardiovascular disease and TIA, creating a cumulative risk.

The BRFSS captures only a few cardiovascular disease conditions: angina, coronary heart disease, myocardial infarction, hypertension, and stroke. These are just three of 44 ICD-10 coded heart disease conditions. The prevalence of these selected cardiovascular disease conditions has remained consistent from 2011-2015. However, while prevalence remains stable, these conditions continue to affect many Delaware adults.

- Approximately 52,000 Delaware adults report having angina, coronary heart disease, or report ever having a heart attack.
- Approximately 26,000 Delaware adults report ever having a stroke or TIA.
- Hypertension is the only vascular disease condition covered by the BRFSS; there are 10 ICD-10 conditions coded as vascular disease. More than 255,000 Delaware adults report having hypertension.

Cardiovascular disease and TIA are major contributors to the number of emergency department visits. In 2015, there were more than 28,000 emergency department visits for cardiac and stroke symptoms (about 76 visits daily) in Delaware. Christiana Care Health System saw the majority of emergency department visits, representing approximately one-third of all visits. In addition to having a substantial impact on emergency departments, there were over 16,000 hospital discharges from Delaware hospitals for cardiovascular disease in 2015.

Cardiovascular disease is the leading cause of death in Delaware when all cardiovascular disease conditions are combined into a single cardiovascular disease grouping; it is responsible for 10,565 deaths of Delaware residents from 2011 through 2015. The majority of these deaths (91.7 percent) are of Delaware residents age 55 and older, illustrating the strong association between advancing age and cardiovascular disease death.

While age is a strong risk factor positively associated with cardiovascular disease death, many other well-documented risk factors are associated with cardiovascular disease. These risk factors include other heart conditions, high cholesterol, diabetes, tobacco use, unhealthy diet, physical inactivity, obesity, heavy alcohol consumption, and family history. Many of these risk factors are also interrelated, and with the acquisition of each additional risk factor, the risk of developing cardiovascular disease increases. Many of these risk factors have a high prevalence in Delaware. Approximately 30 percent or more of Delaware adults have hypertension, high cholesterol, and obesity. Approximately 85 percent of Delaware adults do not consume at least five fruits and/or vegetables per day.

The Burden of Cardiovascular Diseases and Transient Ischemic Attack in Delaware, 2011-2015

Therefore, to reduce the risk of developing, and reducing the overall mortality from, cardiovascular disease, it is important to understand the relationship among cardiovascular disease conditions and the associated modifiable risk factors. Because of the strong association with age, prevention measures to reduce risk factors should target youth and younger adults, while raising awareness among those most at risk.

DPH works diligently to address a number of cardiovascular disease conditions and associated risk factors. Under the newly awarded CDC-1815 cooperative agreement, a systems approach is taken to address hypertension and diabetes in Delaware. In addition, DPH offers a number of self-management programs free to the public. These self-management programs are tailored specifically for adults who have diabetes and other chronic diseases, as well as pain management. The Physical Activity, Nutrition, and Obesity (PANO) Prevention program within DPH takes a systems approach to address these risk factors within the Delaware adult population. PANO partners with Delaware's Department of Education to implement appropriate nutrition and physical activity guidelines for school-age children. Lastly, DPH's Tobacco Prevention Program has worked successfully to reduce the prevalence of cigarette use within the past two decades. However, a new challenge faces DPH with the advent of other tobacco products now being marketed such as JUUL and other brands of e-cigarettes, snus, hookah, and little cigars. Continued funding to these programs is imperative in the fight to lower prevalence of and mortality from cardiovascular disease and transient ischemic attack.

Resources

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