

5.4.8 Disease Outbreak

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the disease outbreak hazard in Westchester County.

5.4.8.1 Profile

Hazard Description

An outbreak or an epidemic occurs when new cases of a certain disease, in a given population, substantially exceed what is expected. An epidemic may be restricted to one locale, or it may be global, at which point it is called a pandemic. Pandemic is defined as a disease occurring over a wide geographic area and affecting a high proportion of the population. A pandemic can cause sudden, pervasive illness in all age groups on a local or global scale. A pandemic is a novel virus to which humans have no natural immunity that spreads from person-to-person. A pandemic will cause both widespread and sustained effects and is likely to stress the resources of both the State and Federal government (NJOEM 2019).

Most disease outbreaks occur due to respiratory viruses. A respiratory virus with pandemic potential is a highly contagious respiratory virus that spreads easily from person to person and for which there is little human immunity. This hazard includes pandemic influenza. This hazard strains the healthcare system, requires school closures, causes high rates of illness and absenteeism that undermine critical infrastructure across the city, and decreases community trust due to social distancing measures interfering with personal movement and being perceived as being ineffectual. Previous events that exemplify this hazard include the 1918 (“Spanish flu”) and 2009 (“Swine flu”) influenza pandemics and the 2003 SARS outbreak, which had pandemic potential (NYC Emergency Management 2019).

In addition to respiratory viruses, diseases with new or emerging features can challenge control. Emerging diseases are difficult to contain or treat and present significant challenges to risk communication since mechanics of transmission, laboratory identification, and effective treatment protocols may be unknown (NYC Emergency Management 2019).

Of particular concern in Westchester County are arthropod-borne viruses (arboviruses), which are viruses that are maintained in nature through biological transmission between susceptible hosts (mammals) and blood-feeding arthropods (mosquitos and ticks). These infections usually occur during warm weather months, when mosquitoes and ticks are active (NYS Department of Health 2017a).

Mosquito-borne diseases are diseases that are spread through the bite of an infected female mosquito. West Nile Virus (WNV) is the most common mosquito-borne disease recently impacting Westchester County. These diseases rely on mosquitos to spread. They become infected by feeding on birds carrying the virus; and then spread to humans and other animals when the mosquito bites them (NYS Department of Health 2017a).

Tick-borne diseases are bacterial illnesses that spread to humans through infected ticks. These types of diseases rely on ticks for transmission. Ticks become infected by micro-organisms when feeding on small infected mammals (mice and voles). Different tick-borne diseases are caused by different micro-organisms, and it is possible to be infected with more than one tick-borne disease at a time. Anyone who is bitten by an infected tick may get a tick-borne disease. People who spend a lot of time outdoors have a greater risk of becoming infected. The three types of ticks in New York that may carry disease-causing micro-organisms are the Blacklegged Tick (*Ixodes scapularis*) (also known as Deer Tick), Lone Star Tick (*Amblyomma americanum*), and the American dog tick (*Dermacentor variabilis*) (NYS Department of Health 2019a).

For the purpose of this HMP update, the following diseases will be discussed in further detail: West Nile Virus, Lyme Disease, Influenza, and Coronavirus.

West Nile Virus

West Nile Virus (WNV) is the leading cause of mosquito-borne disease in the United States. It is most commonly spread to people who are bitten by an infected mosquito. WNV is usually diagnosed during mosquito season, starting in the summer months and continues through the fall (CDC, West Nile Virus 2021). WNV was first found in New York State in 1999. Since 2000, 490 human cases and 37 deaths of WNV have been reported statewide (NYSDOH, West Nile Virus (WNV) Disease 2017). The symptoms of severe infection (West Nile encephalitis or meningitis) can include headache, high fever, neck stiffness, muscle weakness, stupor, disorientation, tremors, seizures, paralysis, and coma. WNV can cause serious illness, and in some cases, death. Usually, symptoms occur from 3 to 14 days after being bitten by an infected mosquito (NYSDOH, West Nile Virus (WNV) Disease 2017).

Lyme Disease

Lyme disease is the most common vector-borne disease in the United States. It is an illness caused by infection with the bacterium *Borrelia burgdorferi*, which is carried by ticks. Typical symptoms include fever, headache, fatigue, and skin rash. If left untreated, symptoms can be severe. Lyme disease is spread to people by the bite of an infected tick (CDC, Lyme Disease 2021). In New York, the commonly infected tick is the deer tick. Immature ticks become infected by feeding on infected white-footed mice and other small mammals. Deer ticks can also spread other tick-borne diseases. Anyone who is bitten by a tick carrying the bacteria can become infected (NYSDOH, Lyme Disease and Other Diseases Carried by Ticks 2019).

Influenza

Influenza (the flu) is a contagious virus that affects the nose, throat, latches, and other parts of the body. It can quickly spread from one person to another, causing mild to severe illness and can lead to death. Symptoms include: fever, cough, sore throat, runny or stuffy nose, muscle or body aches, headache, and tiredness (NYSDOH, What You Should Know About the Flu 2021).

The risk of a global influenza pandemic has increased over the last several years. This disease is capable of claiming thousands of lives and adversely affecting critical infrastructure and key resources. An influenza pandemic has the ability to reduce the health, safety, and welfare of the essential services workforce; immobilize core infrastructure; and induce fiscal instability. Pandemic influenza is different from seasonal influenza (or "the flu") because outbreaks of seasonal flu are caused by viruses that are already among people. Pandemic influenza is caused by an influenza virus that is new to people and is likely to affect many more people than seasonal influenza. In addition, seasonal flu occurs every year, usually during the winter season, while the timing of an influenza pandemic is difficult to predict. Pandemic influenza is likely to affect more people than the seasonal flu, including young adults. A severe pandemic could change daily life for a time, including limitations on travel and public gatherings (Barry-Eaton District Health Department 2013).

Coronavirus

Coronavirus disease (COVID-19) is an infectious disease first identified in 2019. The virus rapidly spread into a global pandemic by spring of 2020. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness (WHO 2020). With the virus being relatively new, information regarding transmission and symptoms of the virus is still new. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. Reported illnesses have ranged from mild symptoms to severe illness

and death. Reported symptoms include difficulty breathing and shortness of breath, fever or chills, cough, fatigue, muscle or body aches, loss of smell or taste, sore throat, congestion, and nausea or vomiting. Emergency symptoms that require immediate medical attention include trouble breathing, persistent pain or pressure in the chest, confusion or inability to wake or stay awake, and bluish lips or face. Symptoms may appear 2-14 days after exposure to the virus (based on the incubation period of MERS-CoV viruses) (CDC, COVID-19 2021).

As of October 30, 2021, Westchester County has 144,409 positive cases of COVID-19 (GIS 2021).

Extent

The exact size and extent of an infected population depends on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more densely populated areas. The transmission rate of infectious diseases will depend on the mode of transmission of a given illness.

The extent and location of disease outbreaks depends on the preferred habitat of the species, as well as the species' ease of movement and establishment. The magnitude of disease outbreaks species ranges from nuisance to widespread. The threat is typically intensified when the ecosystem or host species is already stressed, such as periods of drought. The already weakened state of the ecosystem causes it to more easily be impacted to an infestation. The presence of disease-carrying mosquitoes and ticks has been reported throughout most of New York and Westchester County.

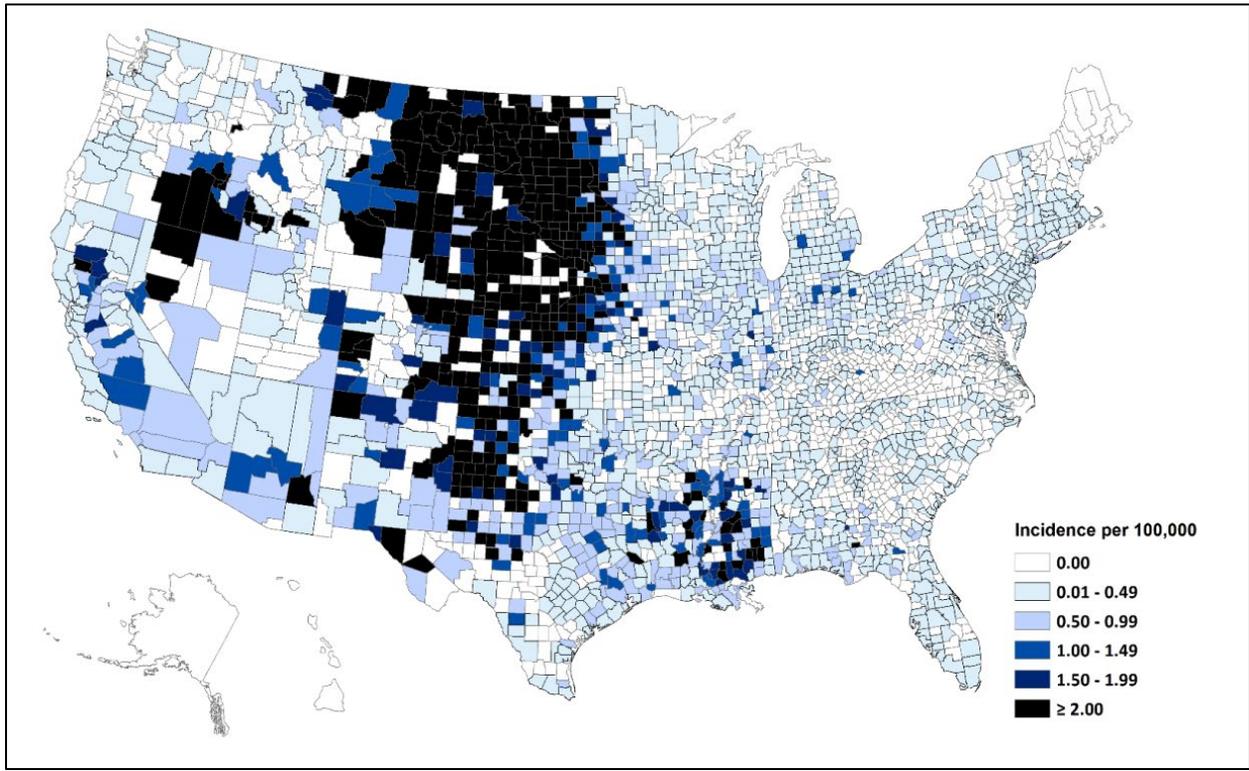
West Nile Virus

Since it was discovered in the western hemisphere, WNV has spread rapidly across North America, affecting thousands of birds, horses and humans. WNV swept from the New York City region in 1999 to almost all of the continental U.S., seven Canadian provinces and throughout Mexico and parts of the Caribbean by 2004. illustrates WNV activity in the U.S. from 1999-2019. Figure 5.4.8-1 shows the average annual WNV incidence in the United States. The figure shows that Westchester County has between 0.01 and 0.49 incidence per 100,000 (CDC, Final Cumulative Maps & Data for 1999–2019 2021).

Lyme Disease

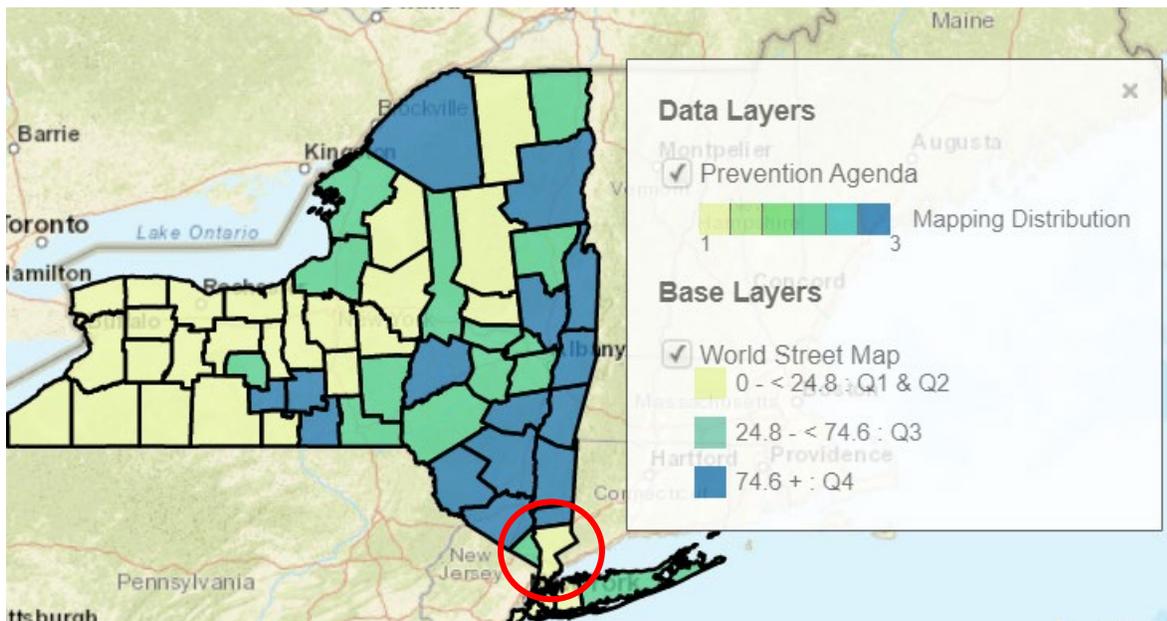
Lyme disease is the most commonly reported vector borne illness in the U.S. Between 2000 and 2018, there were 4,697 confirmed cases of Lyme disease in Westchester County, including 746 cases in 2004 alone (Check 2021). Figure 5.4.8-2 shows the risk of Lyme disease in New York State. The figure indicates that Westchester County has some of the lowest incidence of the disease, with a rate of 31.5 persons per 100,000 people between 2014-2016.

Figure 5.4.8-1. Average Annual Incidence of West Nile Virus Neuroinvasive Disease Reported to CDC by County, 1999-2019



Source: CDC 2021

Figure 5.4.8-2. Lyme Disease Incidence Rate per 100,000 people, 2014-2016



Source: Health Data NY
Note: The red circle indicates the approximate location of Westchester County.

Influenza and Coronavirus

As noted above, the exact size and extent of an infected population depends on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more densely populated areas. The transmission rate of infectious diseases will depend on the mode of transmission of a given illness. The severity and length of the next pandemic cannot be predicted; however, experts expect that its effect on the United States could be severe.

In 1999, the WHO Secretariat published guidance for pandemic influenza and defined the six phases of a pandemic. Updated guidance was published in 2005 to redefine these phases. This schema is designed to provide guidance to the international community and to national governments on preparedness and response for pandemic threats and pandemic disease. Compared with the 1999 phases, the new definitions place more emphasis on pre-pandemic phases when pandemic threats may exist in animals or when new influenza virus subtypes infect people but do not spread efficiently. Because recognizing that distinctions between the two inter-pandemic phases and the three pandemic alert phases may be unclear, the WHO Secretariat proposes that classifications be determined by assessing risk based on a range of scientific and epidemiological data (WHO 2009). The WHO pandemic phases are outlined in Table 5.4.8-1.

Table 5.4.8-1. WHO Global Pandemic Phases

Phase	Description
Preparedness	
Phase 1	No viruses circulating among animals have been reported to cause infections in humans.
Phase 2	An animal influenza virus circulating among domesticated or wild animals is known to have caused infection in humans and is therefore considered a potential pandemic threat.
Phase 3	An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks. Limited human-to-human transmission may occur under some circumstances, for example, when there is close contact between an infected person and an unprotected caregiver. However, limited transmission under such restricted circumstances does not indicate that the virus has gained the level of transmissibility among humans necessary to cause a pandemic.
Response and Mitigation Efforts	
Phase 4	Human infection(s) are reported with a new subtype, but no human-to-human spread or at most rare instances of spread to a close contact.
Phase 5	is characterized by human-to-human spread of the virus into at least two countries in one WHO region. While most countries will not be affected at this stage, the declaration of Phase 5 is a strong signal that a pandemic is imminent and that the time to finalize the organization, communication, and implementation of the planned mitigation measures is short.
Phase 6	the pandemic phase is characterized by community level outbreaks in at least one other country in a different WHO region in addition to the criteria defined in Phase 5. Designation of this phase will indicate that a global pandemic is under way.

Source: WHO 2009

In New York, activities to be undertaken by pandemic period, use the World Health Organization’s classification system. The Pandemic Influenza Plan describes activities which are designated as to whether they are the role of the state health department, local health department and/or providers and public health partners (NYS Department of Health 2006).

Between 2017 and 2021, there were 22,142 laboratory confirmed cases on influenza in Westchester County (NYSDOH, NYS Health Connector 2021). Those most vulnerable to influenza include young children and the elderly, although anyone can become infected.

Location

Westchester County’s geographic and demographic characteristics make it particularly vulnerable to importation and spread of infectious diseases. In terms of pandemic influenza, all counties may experience pandemic influenza outbreak caused by factors such as population density and the nature of public meeting areas. Densely populated areas will spread diseases quicker than less densely populated areas. There are some densely populated municipalities in the County, leading to the spread of influenza and mumps more quickly than less densely populated communities.

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with disease outbreak events throughout New York and Westchester County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

FEMA Major Disasters and Emergency Declarations

Between 1954 and 2021, the State of New York was included in two disease outbreak-related emergency (EM) declarations; one for West Nile Virus and one for the coronavirus pandemic. The State was also included in a disaster (DR) declaration for the coronavirus pandemic. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Westchester County was included in both of these declarations (FEMA 2021).

Table 5.4.8-2. Disease Outbreak-Related FEMA Declarations for Westchester County, 1954 to 2021

Date(s) of Event	FEMA Declaration Number (if applicable)	Westchester County Designated?	Incident Type	Declaration Title
May 22-November 1, 2000	EM-3155	Yes	Other	West Nile Virus
January 20, 2020 – ongoing	DR-4480	Yes	Biological	COVID-19 Pandemic

Source: FEMA 2021

USDA Declarations

Between 2012 and 2021, Westchester County has not been included in any disease-related disaster events, as declared by the USDA.

Previous Events

For this 2021 HMP update, known disease outbreak events that have impacted Westchester County between 2014 and 2021 are identified in Table 5.4.8-3, below.

Table 5.4.8-3. Major Disease Outbreaks in Westchester County, NY, 2014 – 2021

Date(s) of Event	Disease Type	FEMA Declaration Number (if applicable)	Westchester County Designated?	Description
2014	Influenza	N/A	N/A	2,781 confirmed cases of influenza in Westchester County
2014	Lyme Disease	N/A	N/A	88 confirmed cases of Lyme disease in Westchester County

Date(s) of Event	Disease Type	FEMA Declaration Number (if applicable)	Westchester County Designated?	Description
2014	West Nile Virus	N/A	N/A	Two confirmed cases of WNV in Westchester County
2015	Influenza	N/A	N/A	2,215 confirmed cases of influenza in Westchester County
2015	Lyme Disease	N/A	N/A	153 confirmed cases of Lyme disease in Westchester County
2015	West Nile Virus	N/A	N/A	Three confirmed cases of WNV in Westchester County
2016	Influenza	N/A	N/A	4,049 confirmed cases of influenza in Westchester County
2016	Lyme Disease	N/A	N/A	97 confirmed cases of Lyme disease in Westchester County
2017	Influenza	N/A	N/A	4,972 confirmed cases of influenza in Westchester County
2017	Lyme Disease	N/A	N/A	108 confirmed cases of Lyme disease in Westchester County
2017	West Nile Virus	N/A	N/A	Three confirmed cases of WNV in Westchester County
2018	Influenza	N/A	N/A	8,172 confirmed cases of influenza in Westchester County
2018	Lyme Disease	N/A	N/A	119 confirmed cases of Lyme disease in Westchester County
2018	West Nile Virus	N/A	N/A	Four confirmed cases of WNV in Westchester County
2019	Influenza	N/A	N/A	7,451 confirmed cases of influenza in Westchester County
2020	Influenza	N/A	N/A	180 confirmed cases of influenza in Westchester County
2020-2021	Coronavirus	DR-4480	Yes	As of October 31, 2021, Westchester County had 144,477 confirmed cases of COVID-19. Of which, 2,349 fatalities resulted. The City of Yonkers has the highest number of confirmed cases, 32,637.

Source: Westchester County Department of Health 2021; Westchester County GIS 2021; NYS Health Connector 2021

Probability of Future Occurrences

It is difficult to predict when the next disease outbreak will occur and how severe it will be because viruses are always changing. The United States and other countries are constantly preparing to respond to pandemics. The Department of Health and Human Services and others are developing supplies of vaccines and medicines. In addition, the United States has been working with the WHO and other countries to strengthen detection of disease and response to outbreaks. Preparedness efforts are ongoing via the New York State Department of Health, and local health departments through Community Preparedness programs to empower local health departments and their community partners to promote local readiness, foster community resilience and to ensure comprehensive, coordinated, and effective responses (NYS Department of Health 2010).

In Westchester County, the probability for a future disease outbreak event is dependent on several factors. One factor that influences the spread of disease is population density. Populations that live close to one another are more likely to spread diseases. As population density increases in the County, so too will the probability of a disease outbreak event occurring. When there is a significant change in a circulating strain of a virus, more of the population is susceptible and the strain has the ability to rapidly spread from person to person (Management 2019).

As for mosquito-borne and tick-borne diseases, as long as mosquitoes and ticks are found in Westchester County, the risk of contracting WNV, Lyme disease, or other diseases carried by these insects exists. Instances of WNV have been generally decreasing throughout the northeast United States due to planning and eradication efforts. However, some scientists anticipate an increase in WNV and other mosquito-borne diseases due to changing climate conditions creating suitable habitats for mosquitoes (CDC, West Nile Virus in the United States 2013). Disease-carrying ticks will continue to inhabit Westchester County and the threat

of Lyme disease and other tick-borne diseases will continue. Similar to mosquitoes, there are eradication efforts in place to control the tick population and new methods of control are being developed (Steere, Coburn and Glickstein 2004). Therefore, based on all available information and available data regarding mosquito and tick populations, it is anticipated that mosquito- and tick-borne diseases will continue to be a threat to Westchester County.

In Section 5.3, the identified hazards of concern for Westchester County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for disease outbreaks in the County is considered ‘frequent’ (100-percent annual probability; a hazard event may occur multiple times per year, as presented in Section 5.3 [Hazard Ranking]).

Climate Change Impacts

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue growing. Impacts related to increasing temperatures and sea level rise are already being felt in the State. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the State’s vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2011).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Westchester County is part of Region 5, East Hudson and Mohawk River Valleys. Some of the issues in this region, affected by climate change, include: more frequent heat waves and above 90°F days, more heat-related deaths, increased frequency of heavy precipitation and flooding, decline in air quality, etc. (NYSERDA 2011).

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25° F per decade. Average annual temperatures are projected to increase across New York State by 2° F to 3.4° F by the 2020s, 4.1° F to 6.8° F by the 2050s, and 5.3° F to 10.1° F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the State (NYSERDA, Climate Change in New York State 2014).

Regional precipitation across New York State is projected to increase by approximately one to eight-percent by the 2020s, three to 12-percent by the 2050s, and four to 15-percent by the 2080s. By the end of the century, the greatest increases in precipitation are projected to be in the northern areas of the State (NYSERDA, Climate Change in New York State 2014).

In Region 5, it is estimated that temperatures will increase by 3.5°F to 7.1°F by the 2050s and 4.1°F to 11.4°F by the 2080s (baseline of 47.6°F). Precipitation totals will increase between 2 and 15% by the 2050s and 3 to 17% by the 2080s (baseline of 38.6 inches). Table 5.4.8-5 displays the projected seasonal precipitation change for the East Hudson and Mohawk River Valleys ClimAID Region (NYSERDA, 2014).

Table 5.4.8-4. Projected Seasonal Precipitation Change in Region 5, 2050s (% change)

Winter	Spring	Summer	Fall
+5 to +15	-5 to +10	-5 to +5	-5 to +10

Source: *NYSERDA 2011*

Warmer temperatures and changing rainfall patterns provide an environment where mosquitos can remain active longer, greatly increasing the risk for animals and humans. Lyme disease could also expand throughout the United States as temperatures warm, allowing ticks to move into new areas of the country. The changes in

climate can also allow tropical and subtropical insects to move from regions where diseases thrive into new places (Natural Resources Defense Council 2015).

An increase in temperature and humidity may also lead to a larger number of influenza outbreaks. Studies have shown that warmer winters led to an increase in influenza cases. During warm winters, fewer people contract influenza which causes a large number in population to remain vulnerable into the next season. This causes an early and strong occurrence of the virus (Spröss 2013).

5.4.8.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable to the identified hazard. The following discusses Westchester County’s vulnerability, in a qualitative nature, to the disease outbreak hazard.

Impact on Life, Health and Safety

The entire population of Westchester County is vulnerable to the disease outbreak hazard. Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and the potential impacts associated with this hazard. Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. Areas with a higher population density also have an increased risk of exposure or transmission of disease to do the closer proximity of population to potentially infected people.

Most recently with COVID-19, the Centers for Disease Control and Prevention have indicated that persons over 65 years and older, persons living in a nursing home or long-term care facility, and persons with underlying medical conditions such as diabetes, severe obesity, serious heart conditions, etc. are at a higher risk of getting severely ill (CDC 2020). Population data from the 2019 5-year American Community Survey indicates that there are 162,363 persons over 65 years old in Westchester County. This age group would be considered at risk for getting severely ill from the COVID-19 virus. While the statistics of this virus are subject to change during the publication of this HMP, the New York Department of Health dashboard shows that there is a higher percent of illnesses within the mentioned age group and that Westchester County is among the harder hit counties in the State in terms of total COVID-19 cases (New York State Department of Health 2020). The City of Yonkers has the highest number of positive cases, 32,637 cases, since the start of the pandemic (GIS 2021).

Impact on General Building Stock

No structures are anticipated to be directly affected by disease outbreaks.

Impact on Critical Facilities and Lifelines

No critical facilities are anticipated to be affected by disease outbreaks. Hospitals and medical facilities will likely see an increase in patients which may cause interruption of services, but it is unlikely that there will be damages to the facilities. Large rates of infection may result in an increase in the rate of hospitalization which may overwhelm hospitals and medical facilities and lead to decreased services for those seeking medical attention. The 2020-2021 coronavirus pandemic has led to overwhelmed hospitals in numerous locations across New York State, including Westchester County.

Impact on Economy

The impact disease outbreaks have on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with the activities and programs implemented to conduct surveillance and address disease outbreaks have not been quantified in available documentation. Instead, activities and programs

implemented by the County to address this hazard are described below, all of which could impact the local economy.

Within New York State, the Mid-Hudson Region, which includes Westchester County, was one of the hardest hit by the COVID-19 pandemic. The pandemic put closed businesses, strained the healthcare systems, stressed nonprofits and educational institutions, and stretched public budgets (Association 2020). This resulted in significant impacts and disruption to the County’s economy including loss of jobs, decrease in home sales, and disruption in tourism (Council 2020). Though the full scale of the economic fallout is yet to be quantified, the economic impact from disease outbreak was clearly felt in Westchester County.

Smaller-scale disease outbreaks can also cause negative economic impacts, though the extent of impact is variable. For example, an outbreak in mosquito or tick-borne diseases can impact Westchester County’s local economies associated with tourism and the use of parks and waterbodies.

Impact on Environment

Disease outbreaks may have an impact on the environment if the outbreaks are caused by invasive species. Invasive species tend to be competitive with native species and their habitat and can be the major transmitters of disease like Zika, dengue, and yellow fever (Placer Mosquito and Vector Control District 2019). Secondary impacts from mitigating disease outbreaks could also have an impact on the environment. Pesticides used to control disease carrying insects like mosquitos have been reviewed by the EPA and the New York Department of Environmental Conservation. If these sprays are applied in large concentrations, they could potentially leach into waterways and harm nearby terrestrial species. As a result, pesticides must be registered before they can be sold, distributed, or used in the state (New York Department of Environmental Conservation 2020).

Cascading Impacts on Other Hazards

There are no known cascading impacts that disease outbreaks can cause to other hazards of concern for Westchester County.

Future Changes that May Impact Vulnerability

Understanding future changes that may impact vulnerability in the county can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The county considered the following factors that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

As discussed in Section 4 (County Profile), areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the disease outbreak hazard because the entire planning area is exposed and vulnerable. Additional development of structures in areas with high population density are at an increased risk. Please refer to the specific areas of development indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan.

Projected Changes in Population

According to the 2019 American Community Survey 5-year population estimates, the population of the County has increased by approximately 2-percent since 2010. Changes in the density of population when households

move throughout the County could influence the number of persons exposed to disease outbreaks. Higher density jurisdictions are not only at risk of greater exposure to disease outbreak, density may also reduce available basic services provided by critical facilities such as hospitals and emergency facilities for persons that are not affected by a disease. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

As discussed earlier in this section, the relationship between climate change and increase in infectious diseases is difficult to predict with certainty, however there may be linkages between the two. Changes in the environment may create a more livable habitat for vectors carrying disease as suggested by the Centers for Disease Control and Prevention (CDC n.d.). Localized changes in climate and human interaction may also be a factor in the spread of disease.

The relationship between climate change and infectious diseases is somewhat controversial. The notion that rising temperatures will increase the number of mosquitoes that can transmit malaria among humans (rather than just shift their range) has been the subject of debate over the past decade. Some believe that climate change may affect the spread of disease, while others are not convinced. However, many researchers point out that climate is not the only force at work in increasing the spread of infectious diseases into the future. Other factors, such as expanded rapid travel and evolution of resistance to medical treatments, are already changing the ways pathogens infect people, plants, and animals. As climate change accelerates it is likely to work synergistically with many of these factors, especially in populations increasingly subject to massive migration and malnutrition (Harmon 2010).

Change of Vulnerability Since the 2015 HMP

This vulnerability assessment has been expanded on the 2015 plan to include the additional diseases in the profile. In addition the Ebola virus and pandemic influenzas, tick-borne diseases including Lyme and West Nile Virus as well as coronavirus are included in this section. Updated data regarding the extent of these diseases is included to provide a better understanding of the potential impacts caused by the disease outbreak hazard.