5.4.1 Disease Outbreak

This section provides a hazard profile and vulnerability assessment of the disease outbreak hazard for the Chenango County Hazard Mitigation Plan (HMP).

5.4.1.1 Hazard Profile

This section presents information regarding the description, extent, location, previous occurrences and losses, and probability of future occurrences for the disease outbreak 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 Chenango 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 Chenango 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). Tick-Borne diseases impacting Chenango County include Anaplasmosis, Babesiosis, Ehrlichiosis, Lyme Disease, and Spotted Fever Rickettsiosis (including Rocky Mountain Spotted Fever) (CDC, 2018). Not all tick-borne diseases are arboviruses. Lyme Disease is a bacterial infection and Babesiosis is a parasitic infection (NYS Department of Health 2017a).

For the purpose of this HMP update, the following diseases will be discussed in further detail: Mosquito borne: West Nile; Tick borne: Lyme Disease; Respiratory Viruses: Influenza, MERS-CoV, SARS, and Coronavirus.

West Nile Virus

West Nile Virus (WNV) encephalitis is a mosquito-borne viral disease, which can cause an inflammation of the brain. WNV is commonly found in Africa, West Asia, the Middle East and Europe. West Nile virus was first found in New York State in 1999. Since 2000, 490 human cases and 37 deaths of WNV have been reported statewide (NYS Department of Health 2019b). In a small number of cases, WNV has been spread by blood transfusion, which has resulted in the screening of blood donations for the virus in the US, or by organ transplantation. WNV can also be spread from mother to baby during pregnancy, delivery, or breast-feeding in a small number of cases. 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 (NYS Department of Health 2017c).

Lyme Disease

Lyme disease is an illness caused by infection with the bacterium *Borrelia burgdorferi*, which is carried by ticks. The infection can cause a variety of symptoms and, if left untreated, can be severe. Lyme disease is spread to people by the bite of an infected tick. 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 (NYS Department of Health 2017b).

Influenza

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

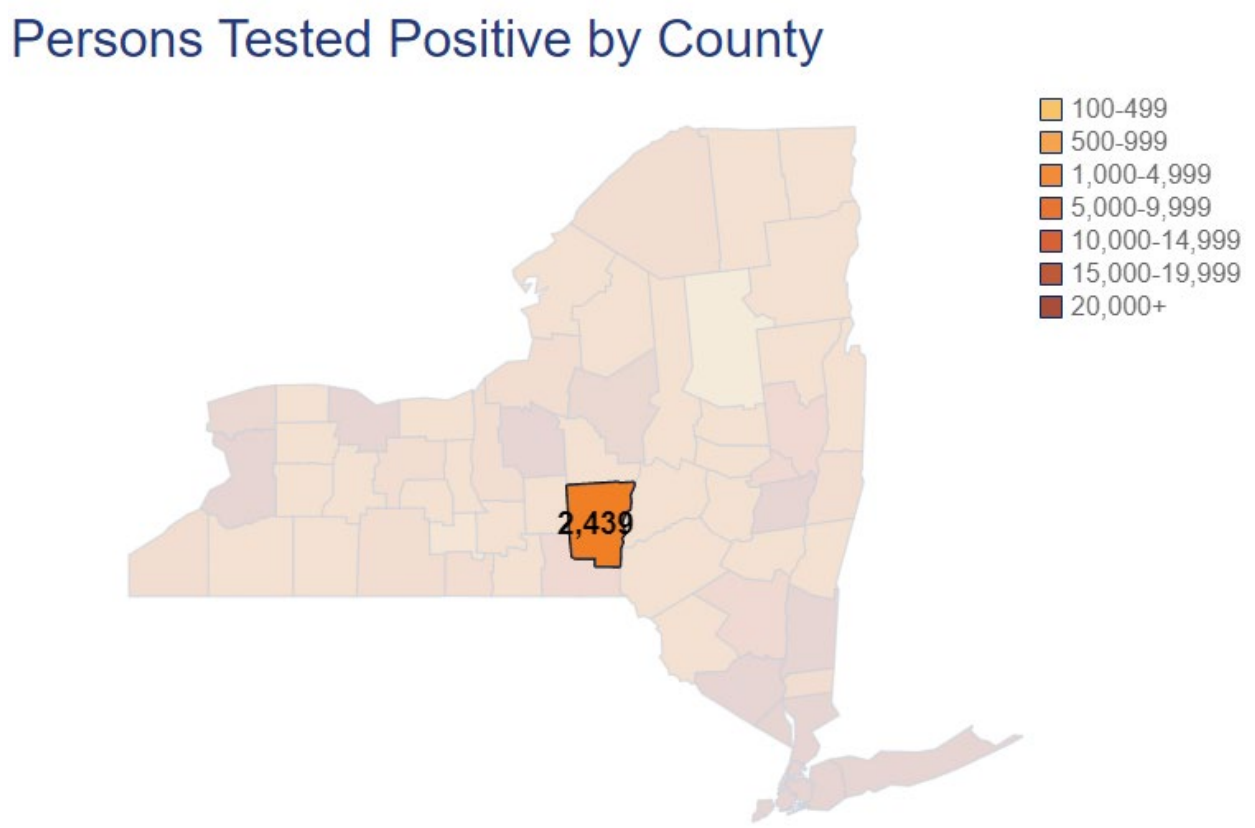
Coronavirus disease (COVID-19) is an infectious disease first identified in 2019. The virus rapidly spread into a global pandemic by spring of 2020. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely 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 2020)

In an effort to slow the spread of the virus, the federal government and states have urged the public to avoid touching of the face, properly wash hands often, wear a face mask, and use various social distancing measures. At the time of this plan update, there are no specific vaccines or treatments for COVID-19. However, there are many ongoing clinical trials evaluating potential treatments (WHO 2020).

As of February 28, 2021, Chenango County has 2,439 positive cases of COVID-19, as shown in Figure 5.4.1-1.

Figure 5.4.1-1. Positive Cases of COVID-19 in Chenango County



Extent

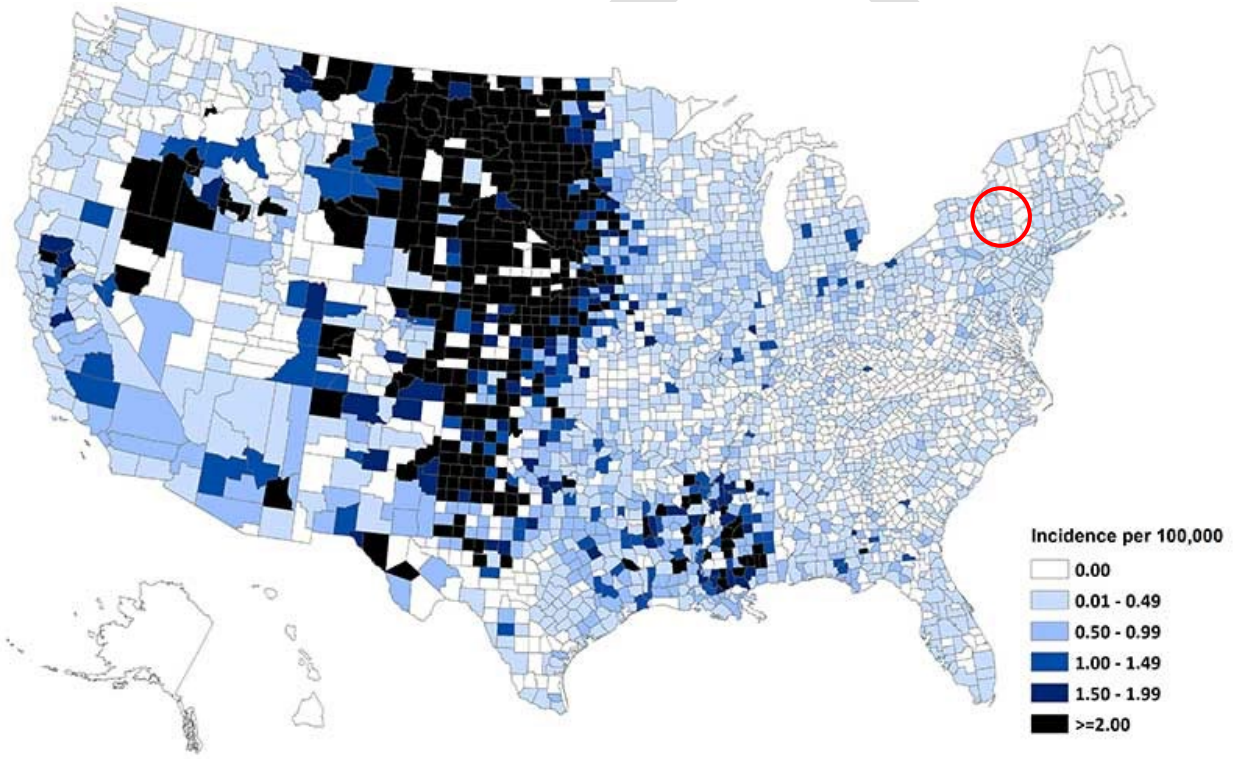
The exact size and extent of an infected population depends on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more densely populated areas. The transmission 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 Chenango 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 1999-2018.

Figure 5.4.1-2. Average Annual Incidence of West Nile Virus Neuroinvasive Disease Reported to CDC by County, 1999-2018



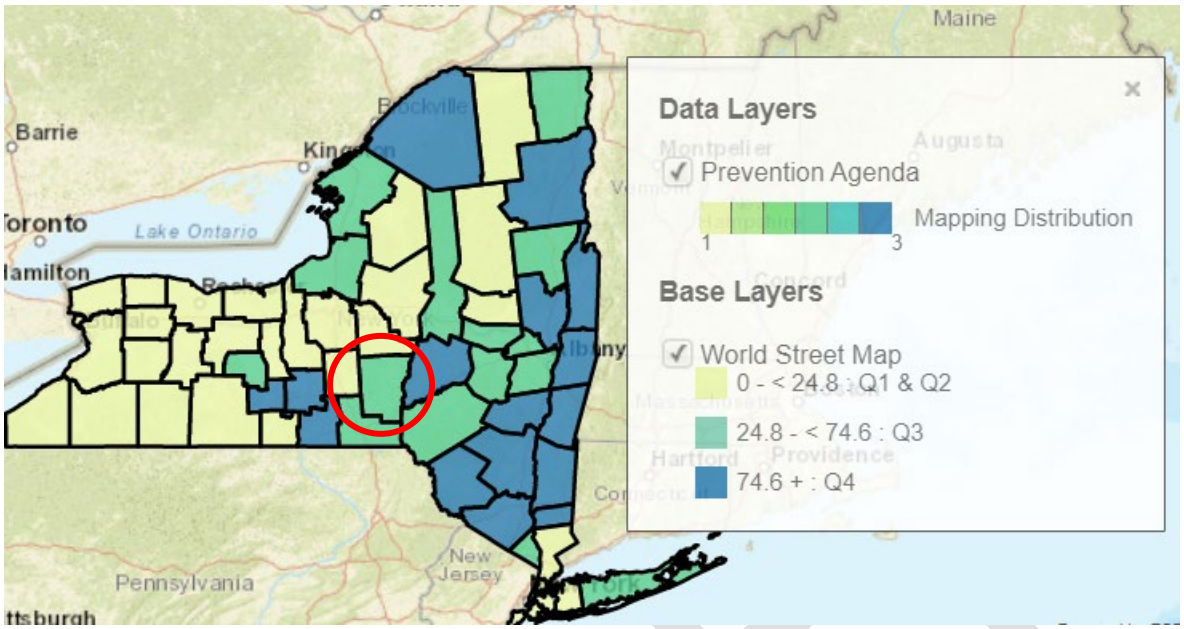
Source: CDC 2019

Note: The circle indicates the approximate location of Chenango County.

Lyme Disease

Lyme disease is the most commonly reported vector borne illness in the U.S. Between 2014 and 2018, there were 354 confirmed cases of Lyme disease in Chenango County, including 127 cases in 2017 alone (NYS Department of Health 2019c). Figure 5.4.1-3 shows the risk of Lyme disease in New York State. The figure indicates that Chenango County has some of the highest incidence of the disease, with a rate of 98.1 persons per 100,000 people between 2014-2016.

Figure 5.4.1-3. Lyme Disease Incidence Rate per 100,000 people, 2014-2016



Source: Health Data NY

Note: The red circle indicates the approximate location of Chenango 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 interpandemic 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 5.4.1-1.

Table 5.4.1-1. 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

Phase	Description
	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

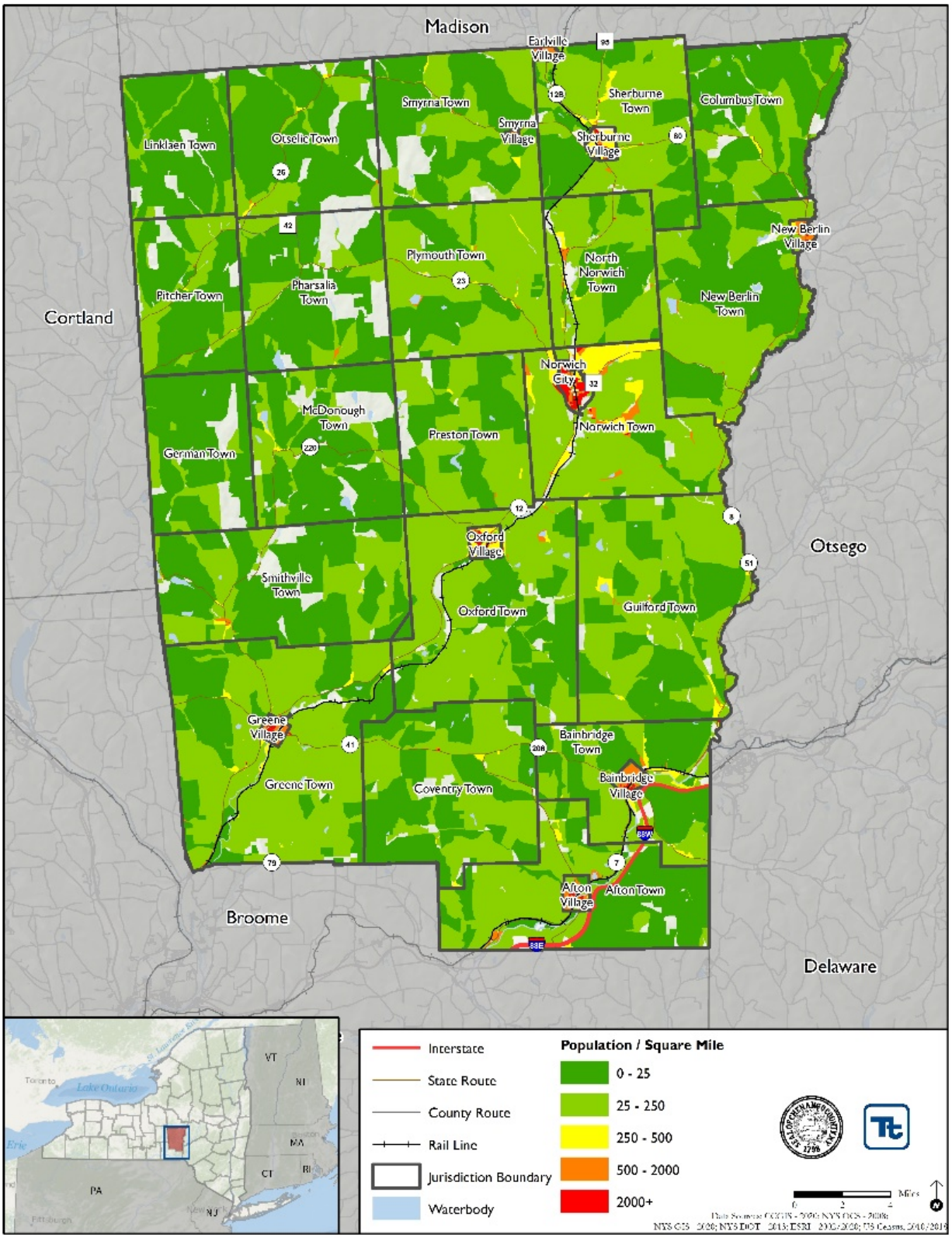
In New York, activities to be undertaken by pandemic period, use the World Health Organization's classification system. The Pandemic Influenza Plan describes activities which are designated as to whether they are the role of the state health department, local health department and/or providers and public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

Between 2014 and 2018, there were 1,765 laboratory confirmed cases on influenza in Chenango County (NYS Department of Health, 2019c). Those most vulnerable to influenza include young children and the elderly, although anyone can become infected.

Location

New York and Chenango 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. Figure 5.4.1-4. shows population density throughout the County. There are a few densely populated areas throughout the County, mainly in the City of Norwich, and Villages of Oxford, Greene, Bainbridge, and Afton. Additionally, much of the State can experience other diseases such as WNV due to the abundance of water bodies throughout the State and County, which provide a breeding ground for infected mosquitos.

Figure 5.4.1-4. Chenango County Population Density (United States Census, 2010)



Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with disease outbreak events throughout New York and Chenango 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 2020, 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. Chenango County was included in both of these declarations (FEMA 2020).

Table 5.4.1-2. Disease Outbreak-Related FEMA Declarations for Chenango County, 1954 to August 2018

Date(s) of Event	Disease Type	FEMA Declaration Number (if applicable)	Chenango County Designated?
May 22-November 11, 2000	West Nile Virus	EM-3155	Yes
January 20, 2020- Present	COVID-19 Pandemic	DR-4480/EM-3434	Yes

Source: New York Department of Health 2020; FEMA 2020, WHO 2020

USDA Declarations

Between 2012 and 2020, Chenango 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 Chenango County between 2014 and 2020 are identified in Table 5.4.1-3, below.

Table 5.4.1-3. Major Disease Outbreaks in Chenango County, NY, 2014 – 2020

Date(s) of Event	Disease Type	FEMA Declaration Number (if applicable)	Chenango County Designated?	Description
February 16, 2018	Influenza	N/A	No	The Chenango County Public Health Department issued a press release detailing surging numbers of influenza cases across the state. The New York State Health Department has reported 70,000 cases of laboratory-confirmed influenza and over 14,000 hospitalizations. According to the New York Department of Health, 553 cases of laboratory-confirmed Influenza were recorded in Chenango County in 2018.
January 20, 2020 – Present	COVID-19 Pandemic	DR-4480/EM-3434	Yes	A novel strain of coronavirus (COVID-19) first identified in Wuhan, Hubei Province, China spread throughout the world and was designated as a pandemic by the World Health Organization in March 2020. The virus caused severe impacts across New York State, with New York City commonly identified as the epicenter to the national outbreak. The highly contagious virus particularly impacts human's respiratory

Date(s) of Event	Disease Type	FEMA Declaration Number (if applicable)	Chenango County Designated?	Description
				system. In Chenango County, as of December 31, 2020 there have been 1,179 confirmed cases and 18 deaths.

Source: Chenango County Department of Health; FEMA; New York State Department of Health; CDC

While the above diseases are of high concern and priority in Chenango County, the New York State Department of Health (NYS DOH) reports on all communicable diseases within the County. Some of the following diseases have also been included in the Chenango County Public Health Needs Assessment as diseases that affect the county, however, not all have been profiled in detail based on Steering Committee input. The table below contains reported disease counts of all reported communicable diseases in Chenango County from 2014-2018. Only diseases reported within these years are reflected in the table.

Table 5.4.1-4. Disease Outbreak Events in Chenango County, 2014 to 2018

	AIDS	Anaplasmosis	Brucellosis	Campylo-bacteriosis	Chlamydia	Crypto-sporidiosis	E. Coli Shiga-toxin	EHCEC	Ehrlichiosis	Giardiasis	Gonorrhea	Hemophilus Influenzae	Hemolytic Uremic Syndrome	Hepatitis A	Hepatitis B Chronic	Hepatitis C Acute	Hepatitis C Chronic	Hepatitis C Past/Present	HIV	Influenza	Legionellosis	Listeriosis	Lyme Disease	Meningitis Aseptic	Pertussis
2014	0	1	0	11	135	1	0	1	0	10	2	0	0	0	1	3	0	46	2	178	3	1	37	2	0
2015	1	1	1	12	126	2	0	1	0	4	12	0	0	0	1	3	0	42	3	318	2	0	63	3	0
2016	0	0	0	6	103	1	0	0	0	6	6	1	0	1	3	0	32	0	6	208	0	0	44	1	3
2017	0	1	0	8	116	10	1	0	2	8	8	3	1	0	2	1	41	0	0	508	1	1	127	2	2
2018	0	1	0	8	99	1	5	0	0	8	12	1	0	0	3	0	44	0	0	553	4	0	83	0	3

	RMSF	Salmonellosis	Strep Group A Invasive	Strep Group B Invasive	Strep Pneumo Invasive	Syphilis Early	Syphilis Late	Vibriosis	Yersiniosis
2014	0	10	3	8	6	1	0	0	0
2015	0	2	2	5	5	1	0	0	0
2016	0	10	1	10	10	1	1	0	0
2017	0	4	3	6	6	1	2	0	0
2018	1	7	2	8	9	0	0	1	1

Source: New York Department of Health 2020; FEMA 2020, WHO 2020
N/ANot Available
Note: With disease outbreak documentation for New York and Chenango County being extensive, not all sources have been identified or researched. Therefore, Table 5.4.1-4 may not include all events that have occurred in the County. 2019 and 2020 statistics were not available at the time of the plan update. Statistics from the 2020 Coronavirus pandemic were subject to change day to day.

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 Chenango 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.

All of the critical components necessary to sustain the threat of mosquito-borne disease in Chenango County have been clearly documented. Instances of the WNV have been generally decreasing throughout the Northeast because of aggressive planning and eradication efforts, but some scientists suggest that as global temperatures rise and extreme weather conditions emerge from climate change, the range of the virus in the United States will grow. While instances of Zika have decreased since the outbreak in 2016, there is still the possibility of an outbreak occurring in the future. Therefore, based on all available information and available data regarding mosquito populations, it is anticipated that mosquito-borne diseases will continue to be a threat to Chenango County.

Disease-carrying ticks will continue to inhabit the northeast, including Chenango County, creating an increase in Lyme disease and other types of infections amongst the county population if not controlled or prevented. Ecological conditions favorable to Lyme disease, the steady increase in the number of cases, and the challenge of prevention predict that Lyme disease will be a continuing public health concern. Personal protection measures, including protective clothing, repellents or acaricides, tick checks, and landscape modifications in or near residential areas, may be helpful. However, these measures are difficult to perform regularly throughout the summer. Attempts to control the infection on a larger scale by the eradication of deer or widespread use of acaricides, which may be effective, have had limited public acceptance. New methods of tick control, including host-targeted acaricides against rodents and deer, are being developed and may provide help in the future (Steere, Coburn, and Glickstein 2004).

Currently and in the future, control of Lyme disease will depend primarily on public and physician education about personal protection measures, signs and symptoms of the disease, and appropriate antibiotic therapy. Based on available information and the ongoing trends of disease-carrying tick populations, it is anticipated that Lyme disease infections and other tick-borne diseases will continue to be a threat to Chenango County.

In Section 5.3, the identified hazards of concern for Chenango 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 Steering and Planning Committees, the probability of occurrence for disease outbreaks in the County is considered 'occasional' (between 10 and 100% annual probability of a hazard event occurring).

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. Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Chenango County is located in Region 3, which includes the Southern Tier. In

Region 3, it is estimated that temperatures will increase by 3.6ºF to 7.1ºF by the 2050s and 4.2ºF to 11.6ºF by the 2080s (baseline of 47.5ºF). Precipitation totals will increase between 2 and 15% by the 2050s and 3 to 16% by the 2080s (baseline of 35.0 inches). Increased rainfall and heavy rainfalls increase the chances of standing water where mosquitos breed.

The relationship between climate change and increase in infectious diseases is difficult to predict with certainty, there are scientific linkages between the two. As warm habitats that host insects such as mosquitoes increase, more of the population becomes exposed to potential virus threats (The Washington Post 2017). The notion that rising temperatures will increase the number of mosquitoes that can transmit diseases such as WNV and Zika 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 (NJOEM 2019).

5.4.1.2 Vulnerability Assessment

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

Impact on Life, Health and Safety

The entire population of Chenango 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 2018 5-year American Community Survey indicates that there are 16,053 persons over 65 years old in Chenango 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 Chenango County is among the harder hit counties in the State in terms of total COVID-19 cases (New York State Department of Health 2020).

Impact on General Building Stock

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

Impact on Critical Facilities

No critical facilities are anticipated to be affected by disease outbreaks. Hospitals and medical facilities will likely see an increase in patients, but it is unlikely that there will be damages or interruption of services. However, 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 coronavirus pandemic has led to overwhelmed hospitals in numerous locations across New York State.

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.

The COVID-19 outbreak in 2020 resulted in significant negative impacts to economic activity in the County, State, and country owing to the identified need to enforce social distancing and quarantine conditions until the disease spread was lessened. Decreased economic activity caused large-scale unemployment throughout the State as well as more than 100,000 businesses to close as of May 2020 (Patch.com 2020). During the height of the COVID outbreak, all non-essential businesses were forced to close. The virus outbreak has also had a deleterious impact on government finances owing to tax delinquency and loss of user fees. Decreased revenues can lead to service cuts and prevent the County and community from procuring necessary supplies to weather the outbreak. Though the full scale of the economic fallout is yet to be quantified, the economic impact from disease outbreak was clearly felt in Chenango 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 Chenango County's local economies associated with lakes and its parks.

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 Chenango 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 close proximity to waterbodies or 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 Cornell University Program on Applied Demographics, the population of the County is expected to continue to decline through 2040. However, vulnerable populations (i.e., persons over 65) are increasing throughout the County, it can be assumed that more persons are at greater risk of impacts from disease outbreaks. Furthermore, 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.

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

Disease outbreak is a new hazard profile for the 2021 HMP update.