

5.4.1 Disease Outbreak

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

The hazard profile is organized as follows:	The vulnerability assessment is organized as follows:
<ul style="list-style-type: none"> • Description • Extent • Previous Occurrences and Losses • Probability of Future Occurrences • Climate Change Impacts 	<ul style="list-style-type: none"> • Impact on Life and Safety • Impact on General Building Stock • Impact on Community Lifelines • Impact on Economy • Impact on Environment • Cascading Impacts on Other Hazards • Future Change that may Impact Vulnerability • Changes Since 2014 HMP • Identified Issues

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. The disease outbreak hazard includes **viral** (including those with pandemic potential) and **bacterial**, as well a **mosquito** and **tick-borne** diseases.

Description

For the purpose of this HMP update, the following diseases have been identified as the main disease of concern in Tompkins County and thus will be discussed in further detail as both **Viral/Bacterial Disease** or **Tick-Borne/Mosquito Based Disease**.

Viral/Bacterial Disease

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 more widespread, 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 will cause both widespread and sustained effects and is likely to stress the resources of both the State and federal government (NJOEM

A disease outbreak is the occurrence of disease cases in excess of normal expectancy. The number of cases varies according to the disease-causing agent, and the size and type of previous and existing exposure to the agent. Disease outbreaks are usually caused by an infection, transmitted through person-to-person contact, animal-to-person contact, or from the environment or other media (WHO 2020).



2019). The most recent occurrence of a pandemic is the novel Coronavirus, also known as COVID 19 which has severely impacted communities across the world.

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 may strain the healthcare system, require school or business to closure, cause high rates of illness and absenteeism that could undermine critical infrastructure across the county, and decrease 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).

Added detail on the main disease concerns are as follows:

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 that is still an active issue at time of plan development. It has now been detected across the world, including in the United States and New York State. 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 and a vaccine is still under development as of 2020. 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 trouble breathing, persistent pain or pressure in the chest, new confusion or inability to arouse, 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, New York State has urged the public to avoid touching of the face, properly wash hands often, wearing masks, and use various social distancing measures such as avoiding mass gatherings and maintaining a 6 feet distance between each other. Based on observations thus far, most cases are clustered in highly populated urban centers. At the time of this plan update, there are no specific vaccines for COVID-19 and treatments continue to be developed and improved upon. There are many ongoing clinical trials evaluating potential vaccines (WHO 2020). At the same time, in order contain the virus spread, active contact tracing and testing has been underway in Tompkins County and individuals who have been in contact with or have traveled out of state are required to self-quarantine.



Influenza

Based on the number of reported cases between 2017 and 2021, Tompkins County typically saw an average of 3,770 cases of flu per year. The risk of a global influenza pandemic has increased over the last several years. Influenza and pneumonia rank among the deadliest illnesses in the United States. Influenza also known as the flu, is caused by a virus, with symptoms including coughing, fatigue, and fever. 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. Based on national historic trend, the US has seen an overall decline in the number of deaths between 1999 and 2017 due to the increasing advancement in technology and medical systems (NYS Health Department, 2020).

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 (Barry Eaton District Health Department 2013).

At the national level, the CDC's Influenza Division has a long history of supporting the World Health Organization (WHO) and its global network of National Influenza Centers (NIC). With limited resources, most international assistance provided in the early years was through hands-on laboratory training of in-country staff, the annual provision of WHO reagent kits (produced and distributed by CDC), and technical consultations for vaccine strain selections. The Influenza Division also conducts epidemiologic research including vaccine studies and serologic assays and provided international outbreak investigation assistance (CDC 2010).

Ebola Virus

Although never reported in Tompkins County and only four times in the United States, Ebola is known for causing hemorrhagic fever and is a rare and deadly disease caused by infection with one of the Ebola virus strains. While this virus is known to have caused significant outbreaks throughout the world, the main countries that have seen the largest number of cases include Guinea, Liberia, and Sierra Leone, and other parts of West Africa. The virus is most known to be transmitted through blood or bodily fluids of an affected person or through objects (i.e. needles) that have been contaminated by the fluids. However, this EVD is not a food, water or airborne illness and cannot be transmitted through coughs or sneeze. Symptoms of EVD include fever, headaches, joint and muscle aches, abdominal pain, weakness, excessive secretion of body fluids, swelling, and difficulty of breathing and can last anywhere between 2 and 21 days (CDC 2014).

Measles

Measles is a growing concern with many NYS and national outbreaks in 2019. During the last outbreak, there were 426 confirmed cases in the State, with no cases reported in Tompkins County. It is a highly contagious respiratory disease that lives in the nose and throat mucus of an infected person. It can spread to others



through coughing and sneezing. Also, measles virus can live for up to two hours in an airspace where the infected person coughed or sneezed. If other people breathe the contaminated air or touch the infected surface, then touch their eyes, noses, or mouths, they can become infected. Measles is so contagious that if one person has it, 90% of the people close to that person who are not immune will also become infected (CDC 2017). On average, most people are infected for about 10 to 12 days. In some extreme cases, some individuals could react in a violent way by experiencing brain infection and or permanent brain damage and need to be hospitalized.

Tuberculosis

Tuberculosis (TB) is caused by a bacterium called *Mycobacterium tuberculosis*. The bacteria usually attack the lungs, but TB bacteria can attack any part of the body such as the kidney, spine, and brain. Not everyone infected with TB bacteria becomes sick. As a result, two TB-related conditions exist: latent TB infection (LTBI) and TB disease. If not treated properly, TB disease can be fatal (CDC 2016).

TB bacteria are spread through the air from one person to another. The TB bacteria are put into the air when a person with TB disease of the lungs or throat coughs, speaks, or sings. People nearby may breathe in these bacteria and become infected (CDC 2016).

Symptoms of TB disease depend on where in the body the TB bacteria are growing. TB bacteria usually grow in the lungs (pulmonary TB). TB disease in the lungs may cause symptoms such as a bad cough that lasts three weeks or longer, pain in the chest, and coughing up blood or sputum (phlegm from deep inside the lungs). Other symptoms of TB disease include weakness or fatigue, weight loss, no appetite, chills, fever, and sweating at night (CDC 2016).

Hepatitis A

Hepatitis A is a vaccine-preventable, communicable disease of the liver caused by the hepatitis A virus (HAV). It is usually transmitted person-to-person through the fecal-oral route or consumption of contaminated food or water. Hepatitis A is a self-limited disease that does not result in chronic infection. Most adults with hepatitis A have symptoms, including fatigue, low appetite, stomach pain, nausea, and jaundice, that usually resolve within 2 months of infection; most children less than 6 years of age do not have symptoms or have an unrecognized infection. Antibodies produced in response to hepatitis A infection last for life and protect against reinfection. The best way to prevent hepatitis A infection is to get vaccinated (CDC 2019).

Tick-Borne/Mosquito Based Diseases

Ticks and mosquitos can spread diseases through bites from infected insects. These arthropod-borne viruses, also known as arboviruses, are viruses that are maintained in nature through biological transmission between hosts (mammals such as deer and dogs) 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 2017). However, with climate change these diseases are becoming more year-round in nature.



Tick-Borne Diseases

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 2019). Pathogens that are transmitted from the Black Legged Tick is not just Lyme Disease, according to the CDC, but can include others including Anaplasmosis, Babesiosis, Ehrlichiosis, Southern tick-associated rash illness (STARI), and Tularemia. More information on these specific pathogens can be found through the CDC website: <https://www.cdc.gov/ticks/diseases/index.html>.

Lyme Disease

Lyme disease is a growing concern in Tompkins County, with 58 reported cases in 2018 (most current statistics). It is an infection caused by the bacteria *Borrelia burgdorferi* and is spread to humans through the bite of infected blacklegged ticks (or deer ticks). The infection can cause a variety of symptoms and, if left untreated, can be severe. While it is commonly known that deer ticks are the carriers of Lyme, that is not always the case given not all deer ticks carry the virus. 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 2017). In general, it takes approximately 36 to 48 hours for the tick to stay attached and transmit the virus, while it takes 3 to 30 days for symptoms to show, which can include a circular bulls eye rash around the bite, chills and fever, headache, fatigue, stiff neck, and muscle/ joint pain. If went untreated these symptoms can worsen and lead to heart and central nervous system problems (Tompkins Health Department, 2020).

Mosquito Based Diseases

Mosquito-borne diseases are spread through the bite of an infected female mosquito. In general, Eastern equine encephalitis (EEE, "triple E") is a very rare but serious virus that can infect people, horses, and other mammal, as well as birds, reptiles and amphibians. In the US, about 5-10 EEE cases are reported each year and in New York State a total of 5 cases have been reported since 1971, according to the New York State Health Department. All five of these cases occurred in 1971, 1983, 2009, 2010, and 2011 in nearby Oswego and Onondaga Counties. Each one of these cases reported death.

West Nile Virus

Based on existing data provided by the New York State Department of Health, 2019 records show that 571 WNV-positive mosquito pools have been identified while 13 human cases, 1 equine, and 1 presumptive viremic donor has been reported to the CDC (NYS DOH, 2020).



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 along with 37 deaths (NYS Department of Health 2019). Note that WNV is separate from Eastern equine encephalitis or EEE, which is a much more serious illness that is more likely to result in death, even though they are both transmitted through mosquitos. Also, EEE has common symptoms as WNV including a fever, headache, body aches, and skin rash/ swollen glands (Tompkins Health Department, 2020). 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. Unfortunately, as of 2020, there are no specific treatments for WNV and as already noted, depending on the individual body reaction can cause serious illness, and in some cases, death, if not permanent brain damage. Usually, symptoms occur from 3 to 14 days after being bitten by an infected mosquito (Tompkins Health Department, 2020).

Eastern Equine Encephalitis

Based on existing data provided by the New York State Department of Health, 2019 records show that 66 EEE Virus positive mosquito pools have been identified while 0 human and 8 equine cases, 1 caprine and 1 ratite case has been reported (NYS DOH, 2020)

Eastern equine encephalitis (EEE), sometimes confused with West Nile Virus due to its similar symptoms, is a virus disease of wild birds that is transmitted to horses and humans by mosquitoes. It is a rare but serious viral infection. EEE is a rare but serious and often fatal infection that causes encephalitis or inflammation of the brain (NYS Department of Health 2016). EEE is most common in the eastern half of the U.S. and is spread by the bite of an infected mosquito. EEE can affect humans, horses, and some birds. The risk of getting EEE is highest from late July through September. People at the greatest risk of developing severe disease are those over 50 years of age and younger than 15 years of age (NYS Department of Health 2019). Based on records of individuals who have been infected by the eastern equine encephalitis since 1971, a total of 5 cases have been reported for the years of 1971, 1983, 2009, 2010, and 2011 in Oswego and Onondaga Counties, all of which resulted in death. Like WNV, there are no specific treatments available for EEE, other than supportive therapy such as hospitalization, respiratory support, and IV fluids.

St. Louis Encephalitis

Although St. Louis Encephalitis (SLE) has never been reported in Tompkins County, it has been found in the United States. It is a rare but serious viral infection. It is transmitted to humans by the bite of an infected mosquito. Most cases of SLE disease have occurred in eastern and central states. Most persons infected with SLE have no apparent illness. Initial symptoms of those who become ill include fever, headache, nausea,



vomiting, and tiredness. Severe neuroinvasive disease (often involving encephalitis, an inflammation of the brain) occurs more commonly in older adults (CDC 2019).

Extent

Viral/Bacterial Disease

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.

It is important to note that, unlike many other counties in New York State, Tompkins County, especially the City of Ithaca, is unique in that a large portion of the population is highly mobile between regions due to the high student population, especially those with connection to larger urban centers from New York, to Los Angeles, to international cities like Hong Kong. As a result, Tompkins County is especially vulnerable to disease outbreak, and requires close monitoring between its local and student population in order to contain outbreaks.

Coronavirus, Influenza and Ebola

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

Interpandemic Phase New virus in animals, no human cases	Low risk of human cases	1
	Higher risk of human cases	2
Pandemic Alert New virus causes human cases	No or very limited human-to-human transmission	3
	Evidence of increased human-to-human transmission	4
	Evidence of significant human-to-human transmission	5
Pandemic	Efficient and sustained human-to-human transmission	6

of a given illness. The Ebola virus is spread to others through direct contact; it is not spread through the air like influenza. 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

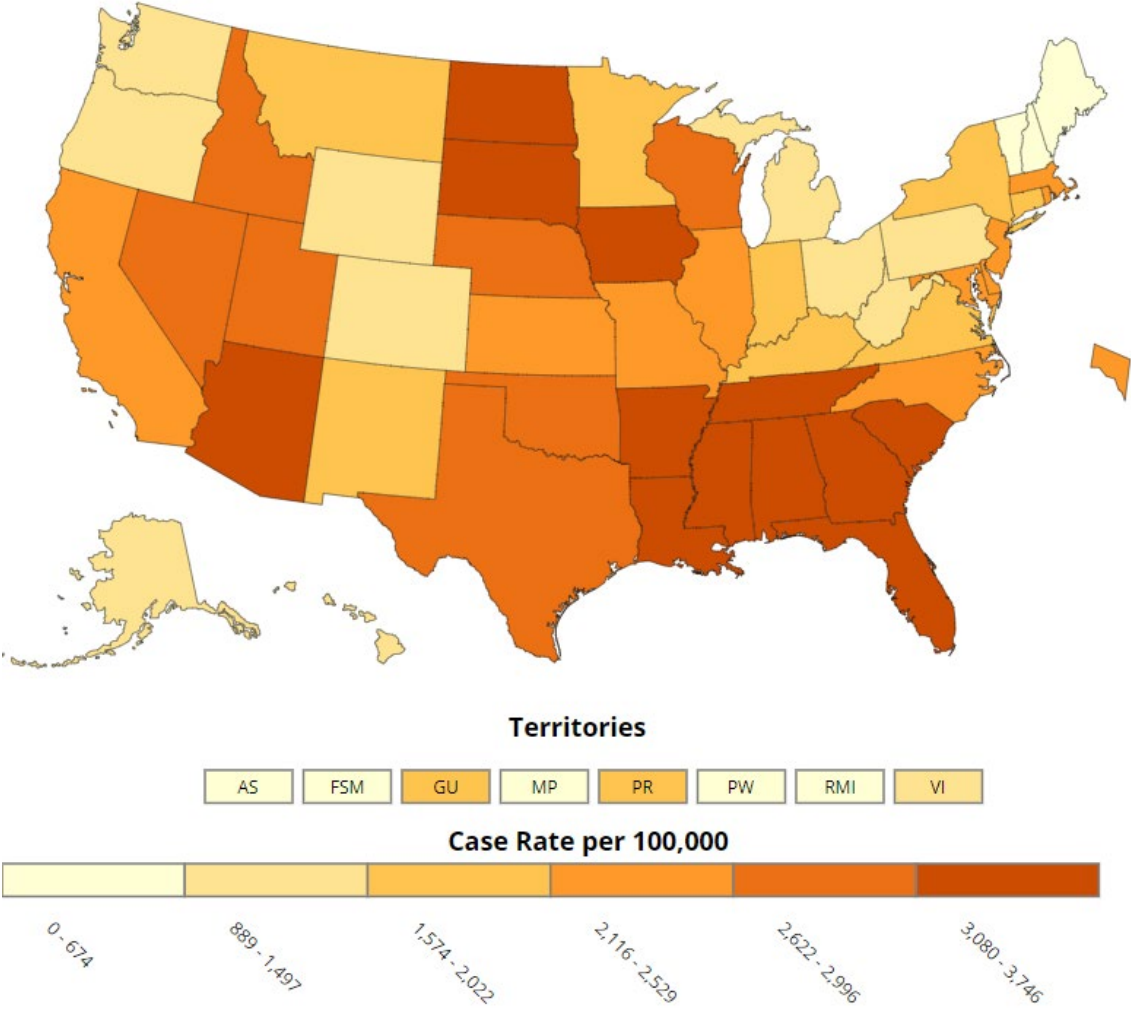


that classifications be determined by assessing risk based on a range of scientific and epidemiological data (WHO 2009).

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).

As the entire world is in the midst of the Coronavirus pandemic, New York State and Tompkins County have taken extensive measures to measure the number of cases contracted day by day. Because the number of cases continue to grow at this time, the extent cannot be shown. However, based on existing data, the average number of cases per 100,000 individuals has been recorded and depicted in the following CDC map.

Figure 5.4.1-1. Average Number of COVID-19 Cases Per 100,000 Individuals



Measles

From 2014 to 2018, there were no reported cases of Measles in Tompkins County (NYS Department of Health 2020).

Tuberculosis

From 2014 to 2018, there were 12 confirmed cases of Tuberculosis in Tompkins County (NYS Department of Health 2020).

Hepatitis A

From 2014 to 2018, there was one confirmed case of Hepatitis A in Tompkins County (NYS Department of Health 2020).

Tick-borne and Mosquito Based Disease

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 Tompkins County.

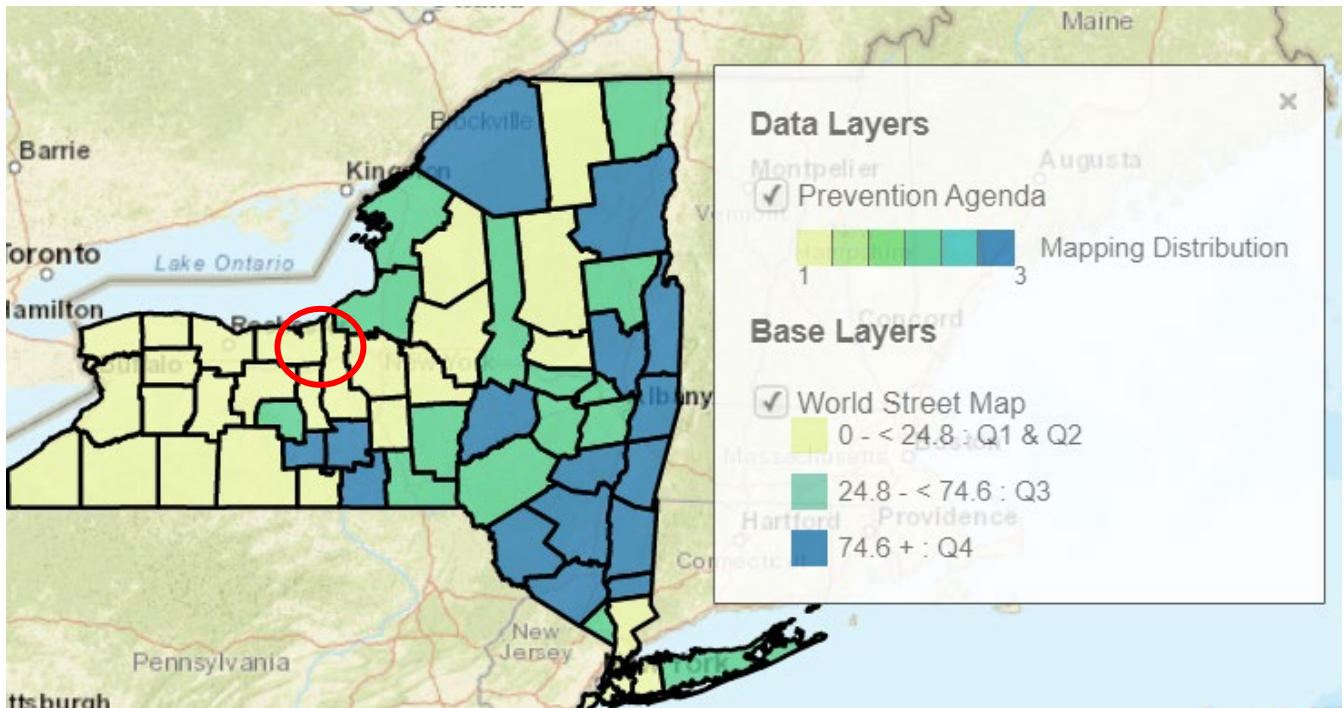
Lyme Disease

Lyme disease is the most commonly reported vector borne illness in the U.S. Between 2014 and 2018, there were 716 confirmed cases of Lyme disease in Tompkins County (NYS Department of Health 2020) including 319 cases in 2018 alone. Figure 5.4.1 2 shows the risk of Lyme disease in New York State. The figure indicates that Tompkins County has some of the highest incidence of the disease, with a rate of 116.7 persons per 100,000 people between 2014-2016. While this is not the highest frequency, it is relatively a County with a higher incident of Lyme, compared to the State-wide average.

The CDC Division of Vector Borne Diseases (DVBD) indicated in 2018 that New York was the state with the third-highest number of confirmed Lyme disease cases, totaling approximately 2,886 cases (CDC 2019).



Figure 5.4.1-2. Lyme Disease Incidence Rate per 100,000



Source: Health Data NY

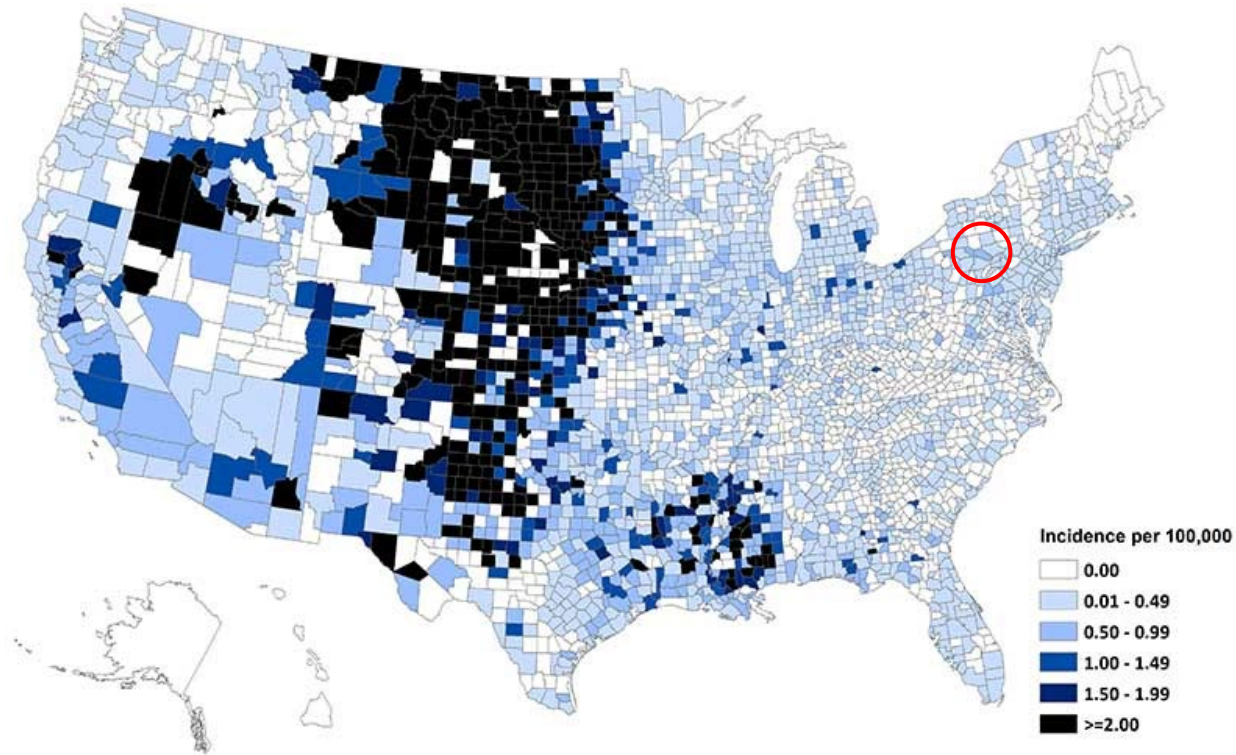
Note: The red circle indicates the approximate location of Tompkins County.

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 New York State in 1999 to almost all of the continental U.S., seven Canadian provinces and throughout Mexico and parts of the Caribbean by 2004. Since 2000, 490 human cases and 37 deaths of WNV have been reported statewide. Based on existing data provided by the New York State Department of Health, 2019 records show that 571 WNV-positive mosquito pools have been identified while 13 human cases, 1 equine, and 1 presumptive viremic donor has been reported to the CDC (NYS DOH, 2020). Figure 5.4.1-3 illustrates WNV activity in the U.S. from 1999-2018.



Figure 5.4.1-3. 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 Tompkins County.

Eastern Equine Encephalitis

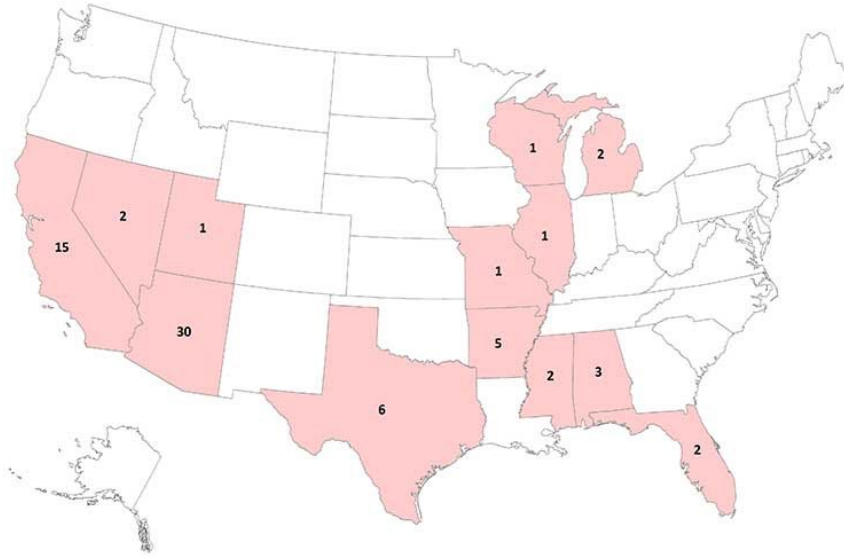
In New York State, there has been five cases of EEE, reported for the years 1971, 1983, 2009, 2010, and 2011, occurring in Oswego and Onondaga Counties. Based on existing data provided by the New York State Department of Health, 2019 records show that 66 EEE Virus positive mosquito pools have been identified while 0 human and 8 equine cases, 1 caprine and 1 ratite case has been reported (NYS DOH, 2020)

St. Louis Encephalitis

In New York State, there have been no cases of St. Louis Encephalitis from 2009-2018. However, nearby states have reported cases as shown in the map below (CDC 2019).



Figure 5.4.1-4. *St. Louis encephalitis Virus* Noninvasive disease cases reported by state of residence 2010-2019

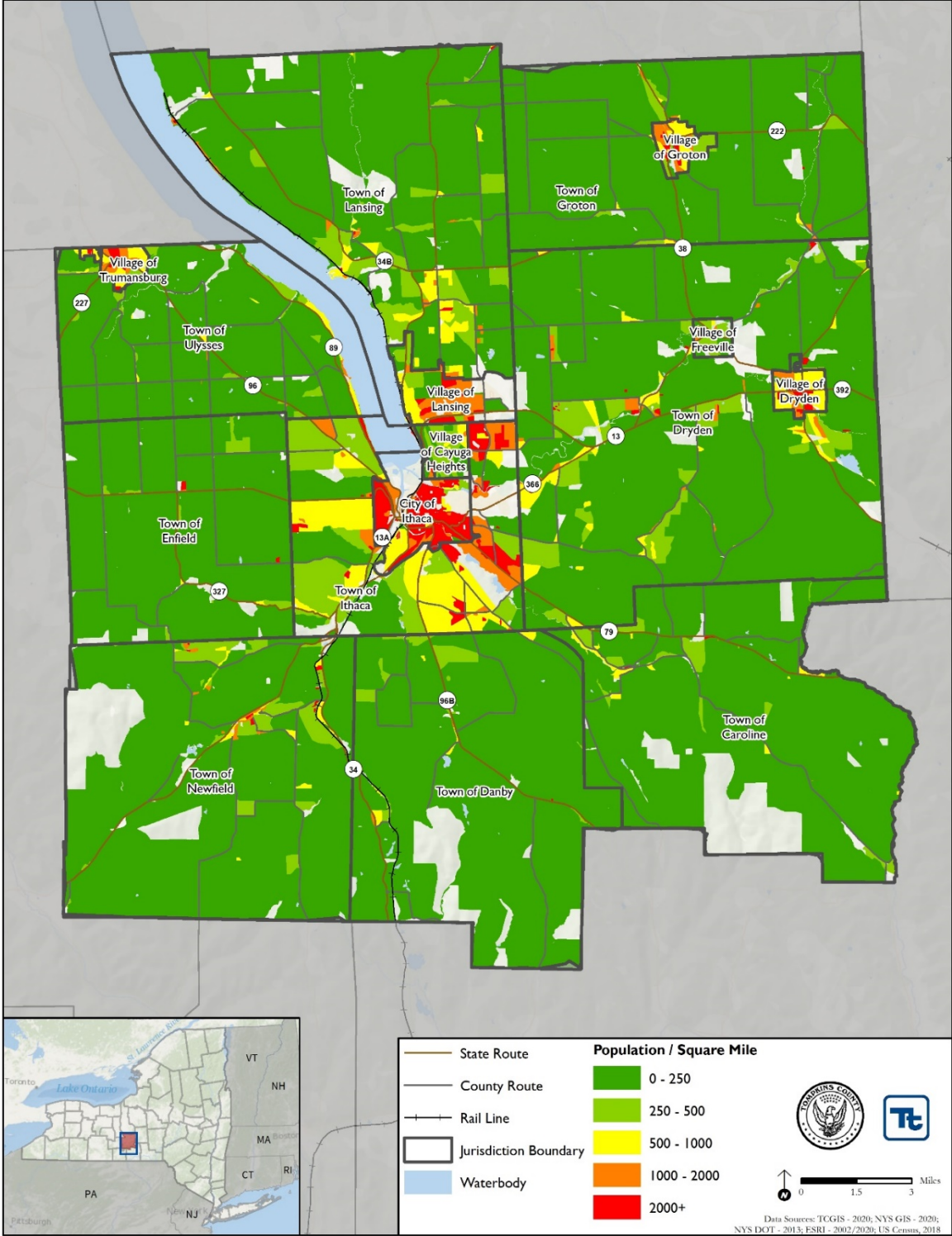


Location

Tompkins County is located in a relatively rural setting. The closest large urban centers in the region are Syracuse, Rochester, and Binghamton, all of which are 50 miles or more away. However, unlike most upstate communities, Ithaca and Tompkins County are particularly vulnerable to visitor exposure due to thriving tourism industry and large college student populations. College student populations include those attending Cornell University, Ithaca College, and Tompkins Cortland Community College, all of which total approximately 30,000 people. This means that during the school year, the population of Ithaca, which is also around 30,000, doubles in size. While not all of these individuals are from large cities, a vast majority of these students, as well as staff and faculty, travel between larger urban centers. As a result, while geographically isolated, Ithaca acts as a unique international node that has particularly high exposure to large urban centers, thus placing Tompkins County in high vulnerability to disease exposure.



Figure 5.4.1-5. Tompkins County Population Density



Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with disease outbreak events throughout New York and Tompkins 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. However, not all counties were included in the disaster declarations. Tompkins County was included in all three of these declarations (FEMA 2020).

Table 5.4.1-1. Disease Related FEMA Declarations for Tompkins County, 1954 to August 2020

Date(s) of Event	FEMA Declaration Number	Event Type
May 22-November 1, 2000	EM-3155	New York Virus Threat (West Nile Virus)
January 20, 2020 and continuing	EM-3434	New York Covid-19
January 20, 2020 and continuing	DR-4480	New York Covid-19 Pandemic

Source: FEMA Data Visualization. Accessed 10/12/2020

Previous Occurrences

For this 2020 HMP update, known disease outbreak events that have impacted Tompkins County between 2014 and 2020 are identified in Table 5.4.1-2.



Table 5.4.1-2. Disease Outbreak Events in Tompkins County, 2014 to 2020

Date(s) of Event	Disease Type	FEMA Declaration Number (if applicable)	Tompkins County Designated?	Description
2014	Hepatitis A	N/A	N/A	The New York State Health Department reported a single case of Hepatitis A in Tompkins County in 2014.
2014	Lab Confirmed Influenza	N/A	N/A	The New York State Health Department reported 267 cases of Lab Confirmed Influenza in Tompkins County in 2014.
2014	Lyme Disease*	N/A	N/A	The New York State Health Department reported 103 cases of Lyme Disease in Tompkins County in 2014.
2014	Tuberculosis	N/A	N/A	The New York State Health Department reported 4 cases of Tuberculosis in Tompkins County in 2014.
2014	West Nile Virus	N/A	N/A	The New York State Health Department reported a single case of Tuberculosis in Tompkins County in 2014.
2015	Lab Confirmed Influenza	N/A	N/A	The New York State Health Department reported 368 cases of Lab Confirmed Influenza in Tompkins County in 2015.
2015	Lyme Disease*	N/A	N/A	The New York State Health Department reported 135 cases of Lyme Disease in Tompkins County in 2015.
2015	Tuberculosis	N/A	N/A	The New York State Health Department reported 2 cases of Tuberculosis in Tompkins County in 2015.
2016	Encephalitis (NON-WNV)	N/A	N/A	The New York State Health Department reported 2 cases of Encephalitis (Non-WNV) in Tompkins County in 2016.
2016	Lab Confirmed Influenza	N/A	N/A	The New York State Health Department reported 430 cases of Lab Confirmed Influenza in Tompkins County in 2016.
2016	Lyme Disease*	N/A	N/A	The New York State Health Department reported 129 cases of Lyme Disease in Tompkins County in 2016.



Date(s) of Event	Disease Type	FEMA Declaration Number (if applicable)	Tompkins County Designated?	Description
2016	Tuberculosis	N/A	N/A	The New York State Health Department reported 2 cases of Tuberculosis in Tompkins County in 2016.
2017	Encephalitis (NON-WNV)	N/A	N/A	The New York State Health Department reported 4 cases of Encephalitis (Non-WNV) in Tompkins County in 2017.
2017	Lab Confirmed Influenza	N/A	N/A	The New York State Health Department reported 663 cases of Lab Confirmed Influenza in Tompkins County in 2017.
2017	Lyme Disease*	N/A	N/A	The New York State Health Department reported 185 cases of Lyme Disease in Tompkins County in 2017.
2017	Tuberculosis	N/A	N/A	The New York State Health Department reported 2 cases of Tuberculosis in Tompkins County in 2017.
2018	Encephalitis (NON-WNV)	N/A	N/A	The New York State Health Department reported 4 cases of Encephalitis (Non-WNV) in Tompkins County in 2018.
2018	Lab Confirmed Influenza	N/A	N/A	The New York State Health Department reported 1041 cases of Lab Confirmed Influenza in Tompkins County in 2018.
2018	Lyme Disease*	N/A	N/A	The New York State Health Department reported 164 cases of Lyme Disease in Tompkins County in 2018.
2018	Tuberculosis	N/A	N/A	The New York State Health Department reported 3 cases of Tuberculosis in Tompkins County in 2018.
Spring 2020 and ongoing	Coronavirus	EM 3434, DR-4480	Yes	Spread of novel coronavirus (COVID-19) led to an emergency declaration and disaster declaration, New York State social distancing requirements, shutdown of non-essential businesses, and the declaration of a global pandemic by the World Health Organization. As of October 12th, 2020, 254,532 tests yielded 475 cases of coronavirus. 433 individuals were noted as recovered from the virus. The majority of



Date(s) of Event	Disease Type	FEMA Declaration Number (if applicable)	Tompkins County Designated?	Description
				<p>cases were found in the City of Ithaca (202), and the Town of Ithaca (58), and the Town of Dryden (32)</p> <p>By summer 2020, new coronavirus cases and associated deaths were decreasing in New York State and Tompkins County and restrictions were eased. However, in fall 2020, cases across New York State and the nation were increasing with projections indicating a second wave of infections was likely in the late fall and winter months.</p>

Source: New York Department of Health 2019; FEMA 2020, WHO 2020, TCHD and Cayuga Health System 2020

N/A Not Available

WNV West Nile Virus

*The number has been extrapolated based on 30 laboratory results.

With disease outbreak documentation for New York and Tompkins County being so extensive, not all sources have been identified or researched. Therefore, Table 4.3.13-3 may not include all events that have occurred in the County. 2019 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 pandemic. 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 at the national, State, and local level (NYSDOH 2019).

In Tompkins 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 Tompkins 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. Therefore, based on all available information and available data regarding mosquito populations, it can be presumed that mosquito-borne diseases will continue to be a threat to Tompkins County.

Disease-carrying ticks will continue to inhabit the northeast, including Tompkins 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. Deer management is advocated by a wide range of conservation partners in Tompkins County, including the Finger Lakes Land Trust and Cornell Natural Areas. 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). However, it is important to note that, based on existing localized trends and projections documented by the Cornell Cooperative Extensions, the warmer winters are likely to contribute to the increasing population of ticks in general, as they would be less likely to die with warmer winters (Tompkins Health Department/ Cooperative Extensions Tompkins County, 2020)

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. Regional organizations such



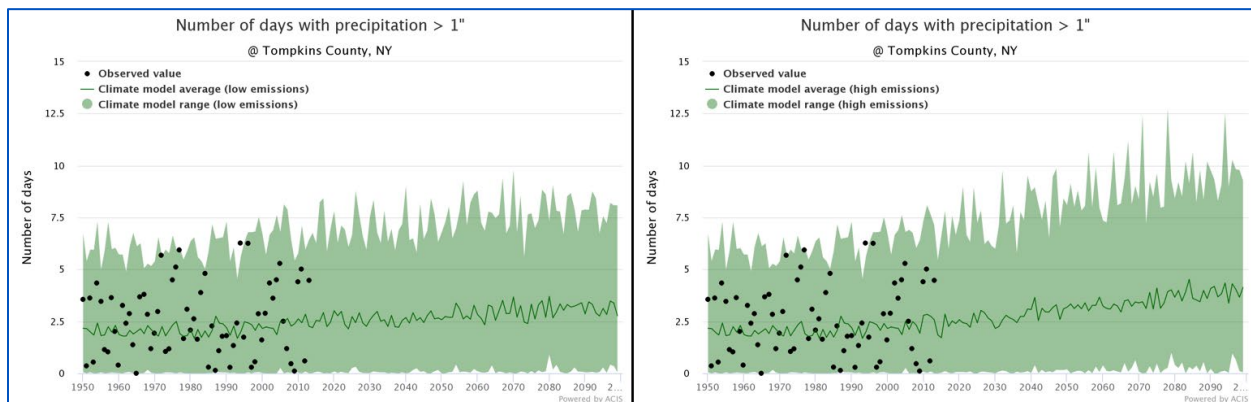
as Cornell Cooperative Extension will need to further develop and expand their efforts around tick borne illnesses in Tompkins County (Cornell Cooperative Extension, 2020). Based on available information and the ongoing trends of disease-carrying tick populations, it is anticipated that Lyme disease infections and other tick-borne diseases will continue to be a threat to Tompkins County.

In Section 5.3, the identified hazards of concern for Tompkins 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'.

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. Tompkins County is part of Region 3, Elmira. In Region 3, it is estimated that temperatures will increase by 3.5°F to 5.5°F by the 2050s and 4.5°F to 8.5°F by the 2080s (baseline of 46 °F, mid-range projection). Precipitation totals will increase between 0 and 10% by the 2050s and 5 to 10% by the 2080s (baseline of 38 inches, mid-range projection) (NYSERDA 2014). The heaviest 1% of daily rainfalls have increased by approximately 70% between 1958 and 2011 in the Northeast (Horton et al. 2015). Based on data provided by the New York Paleontological Research Institute located in Ithaca, model projections from the Climate Smart Farming Tool for both high and low emissions scenarios state that by the end of the 21st century in Tompkins County, the mean of model results for days per year with rainfalls above 1 inch in a 24 hour period is about *1 more day per year* for a low emissions scenario, and about *2 more days per year* for a high emissions scenario, compared with the period 1996-2005 (shown in graph below). Increased rainfall and heavy rainfalls increase the chances of standing water where mosquitos breed.

Figure 5.4.1-6 Low and High Emission Scenario Precipitation Projections



*(1) High Emissions: Under this scenario, greenhouse gas emissions and concentrations increase considerably over time, with no mitigation. This is also known as RCP8.5, as defined by the Intergovernmental Panel on Climate Change (IPCC).



(2) Low Emissions: Under this scenario, greenhouse gas emissions peak at year 2040 and then level off. This is also known as RCP4.5, as defined by the IPCC.

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 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). Other factors such as land use, development, agricultural practices, and industrial contamination are also at play in contributing to the increasing prevalence of disease outbreak and insect borne diseases.

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 Tompkins County's vulnerability, in a qualitative nature, to the disease outbreak hazard.

Impact on Life, Health and Safety

The entire population of Tompkins 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.

Individuals most vulnerable to disease outbreak include: healthcare providers, first responders, over 65, long-term care facility residents, and those with underlying medical conditions.

Most recently with COVID-19, the Centers for Disease Control and Prevention have indicated that persons over 65 years, 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 13,561 persons over 65 years old in Tompkins County 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 Tompkins County is within the top 30 counties for number of cases that tested positive for the COVID-19 virus in the state of New York (NYSDOH 2020).



Impact on General Building Stock

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

Impact on Community Lifelines

No critical facilities or infrastructure 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 COVID-19 pandemic has led to overwhelmed hospitals in numerous hotspots. The importance of other community lifelines particularly food providers have been particularly stressed and valued from the recent COVID-19 pandemic.

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.

In Tompkins County, pest management and control services are available for the communities to control ticks, mosquitos, and reduce the annoyance and threat of disease carried by these insects. The County recommends residents to contact the State Health Department for questions and concerns about pests in their community (Tompkins County 2020). Most recently, the Health Department has played an active role in maintaining and controlling COVID-19 protocols across the state. This activity requires additional costs from the State and County to manage COVID-19 in the communities. Further, there has been secondary economic impact of closing non-essential facilities to reduce the spread of the virus. The final costs of this virus are still to be determined.

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 Tompkins 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, 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 population projections from the Cornell Program on Applied Demographics, Tompkins County will experience a continual population increase from 2020 through 2040 (over 6,040 people in total by 2040). The U.S. Census Bureau also shows that the population in Tompkins County has increased 0.6-percent between 2010 and 2019 (U.S. Census Bureau 2020). An increase in the population throughout Tompkins County and 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), for additional discussion on population trends.

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 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 (NYS DEC 2020).

Change of Vulnerability Since the 2014 HMP

In the Tompkins County's 2014 Hazard Mitigation Plan, the County assessed human driven epidemic events as a hazard of concern. Disease outbreak is a counterpart to this original hazard of concern, which uses updated population information and more recent research of disease outbreaks to assess the County's change in risk to this hazard of concern. Overall, the entire County is still considered vulnerable to disease outbreaks.

Identified Issues

- Ithaca and Tompkins County are particularly vulnerable to visitor exposure due to a thriving tourism industry and large college student populations. During the school year, the population of Ithaca doubles in size. While not all of these individuals are from large cities, a vast majority of these students, as well as staff and faculty, travel between larger urban centers, with significant numbers traveling from international locations. As a result, while geographically isolated, Ithaca acts as a unique international node that has particularly high exposure to large urban centers, thus placing Tompkins County in high vulnerability to disease exposure.
- From 2004 to 2016, Lyme disease cases in the United States doubled from 22,000 to 48,000 and accounted for 82 percent of tick-borne diseases. Since 2000, the number of reported cases in Tompkins County has steadily increased. This increase can be related to an increase in state and local health department reporting, new tick species, and changing climate patterns, (CDC 2019).
- The elderly population is more susceptible to the effects of certain diseases because they are at higher risks of acquiring infection, more disease-related complications, and increased risk of disease-related deaths.
- The impact of climate change on disease outbreaks is unknown; however, could accelerate the spread of an infectious disease.
- During an outbreak, any localities, including the County, can experience a shortage of proper personal protective equipment (PPE) for essential personnel, increasing risk of spread and other diseases among residents and essential personnel.

