

SECTION 4. RISK ASSESSMENT

This section provides a profile and vulnerability assessment of the disease outbreak hazard in Camden County.

4.3 Hazards of Concern

2022 HMP Changes

- Disease Outbreak is a new hazard for Camden County due to the ongoing nature of the Coronavirus disease (COVID-19) during this planning process.
- Previous events between 2015 and 2020 were researched.
- The 2019 5-year American Community Survey population estimates were used to assess the County's vulnerability to disease outbreak.

4.3.3 Disease Outbreak

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).

Of particular concern in Camden 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). More than 100 arboviruses can cause disease in humans; over 30 have been identified as human pathogens in the western hemisphere (New Jersey Department of Health and Senior Services 2008). New Jersey, including Camden County have been impacted by various past and present infestations including high population of mosquitoes (mosquito-borne diseases) and deer ticks (tick-borne diseases).

Mosquito-borne diseases are diseases that are spread through the bite of an infected female mosquito. The three most common mosquito-borne diseases in New Jersey are: West Nile Virus (WNV), Eastern equine encephalitis (EEE) virus, and St. Louis encephalitis (SLE) virus. 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 (New Jersey Department of Health 2013).

Tick-borne diseases are bacterial illnesses that spread to humans through infected ticks. The most common tick-borne diseases in New Jersey are Lyme disease, Ehrlichiosis, Anaplasmosis, Rocky Mountain Spotted Fever, and Babesiosis. 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 Jersey that may carry disease-causing micro-organisms are the deer tick, lone star tick, and the American dog tick (New Jersey Department of Health 2013b).

In addition to arboviruses, Camden County has been impacted by influenza outbreaks in the past five years. Most recently, the County has been monitoring the Coronavirus (COVID-19). Coronavirus disease (COVID-19) is an infectious disease first identified in 2019. The virus rapidly spread into a global pandemic by spring of 2020 (WHO 2020).

For the purpose of this HMP Update, the following disease outbreaks will be discussed in further detail: diseases related to mosquitos (including Chikungunya, Dengue, Malaria, and West Nile Virus); diseases related to ticks (including Human Ehrlichiosis, Lyme Disease, and Rocky Mountain Spotted Fever); Influenza Groupings (including 2009 H1N1, A, H1, H3, and B); and the COVID-19 pandemic.

Mosquito-Borne Diseases

Chikungunya

Chikungunya is a virus that is spread through mosquito bites. The virus has been found in parts of Africa, southern Europe, Southeast Asia, and islands in the Indian and Pacific Oceans. In 2013, Chikungunya was found for the first time in North America and has since spread to the Caribbean, and South and Central America. Symptoms usually begin three to seven days after being bitten by an infected mosquito. The most common symptoms are fever and severe joint pain. Other symptoms may include headache, muscle pain, joint swelling, or rash (CDC 2014).

Dengue

Dengue viruses are spread to humans through the bite of an infected *Aedes* species mosquito (CDC 2020). These same mosquitoes also spread Chikungunya, Zika, and other viruses. Dengue is common in more than 100 countries and about 40 percent of the world's population live in areas with a risk of Dengue. Each year, approximately 400 million people get infected with Dengue. Approximately 100 million people get sick from infection, and about 22,000 die from severe Dengue each year. Dengue is common in the United States territories of Puerto Rico, the US Virgin Islands, and American Samoa. Nearly all Dengue cases in the 48 contiguous US were reported by travelers infected elsewhere. Symptoms can be mild to severe, and can include nausea, vomiting, rash, and aches and pains, with most people recovering in about a week (CDC 2020).

Malaria

Malaria is a mosquito-borne disease caused by a parasite that infects mosquitos, which in turn feed on humans. People that get Malaria are typically very sick with high fevers, shaking child, and flu-like illness (CDC 2020). About 2,000 cases of malaria are diagnosed in the United States annually. The vast majority of cases are travelers returning from countries where Malaria transmission occurs, many from sub-Saharan Africa and South Asia.

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. For the first time in North America, WNV was confirmed in the New York metropolitan area during the summer and fall of 1999. WNV successfully over-wintered in the northeastern U.S. and has been present in humans, horses, birds, and mosquitoes since that time. WNV is spread to humans by the bite of an infected mosquito. A mosquito becomes infected by biting a bird that carries the virus (New Jersey Department of Health 2014).

Tick-Borne Diseases

Human Ehrlichiosis

Human ehrlichiosis is a disease caused by at least three different Ehrlichia species in the United States: *Ehrlichia chaffeensis*, *Ehrlichia ewingii*, and a third Ehrlichia species provisionally called *Ehrlichia muris*-like (EML). Ehrlichiae are transmitted to humans by the bite of an infected tick. The lone star tick (*Amblyomma americanum*) is the primary vector of both Ehrlichia chaffeensis and Ehrlichia ewingii in the United States (CDC 2013).

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 Jersey, 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 (New Jersey Department of Health 2012b).

Rocky Mountain Spotted Fever

Rocky Mountain spotted fever (RMSF) is a tick-borne disease by the bacterium *Rickettsia rickettsii*. This organism is a cause of potentially fatal human illness in North and South America. It is transmitted to humans by the bite of an infected tick. In the United States, these include the American dog tick, Rocky Mountain wood tick, and the brown dog tick. RMSF can be a severe or even fatal illness if not treated in the first few days of symptoms (CDC 2013).

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).

At the national level, the Centers for Disease Control and Prevention (CDC) 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 2011).

Coronavirus

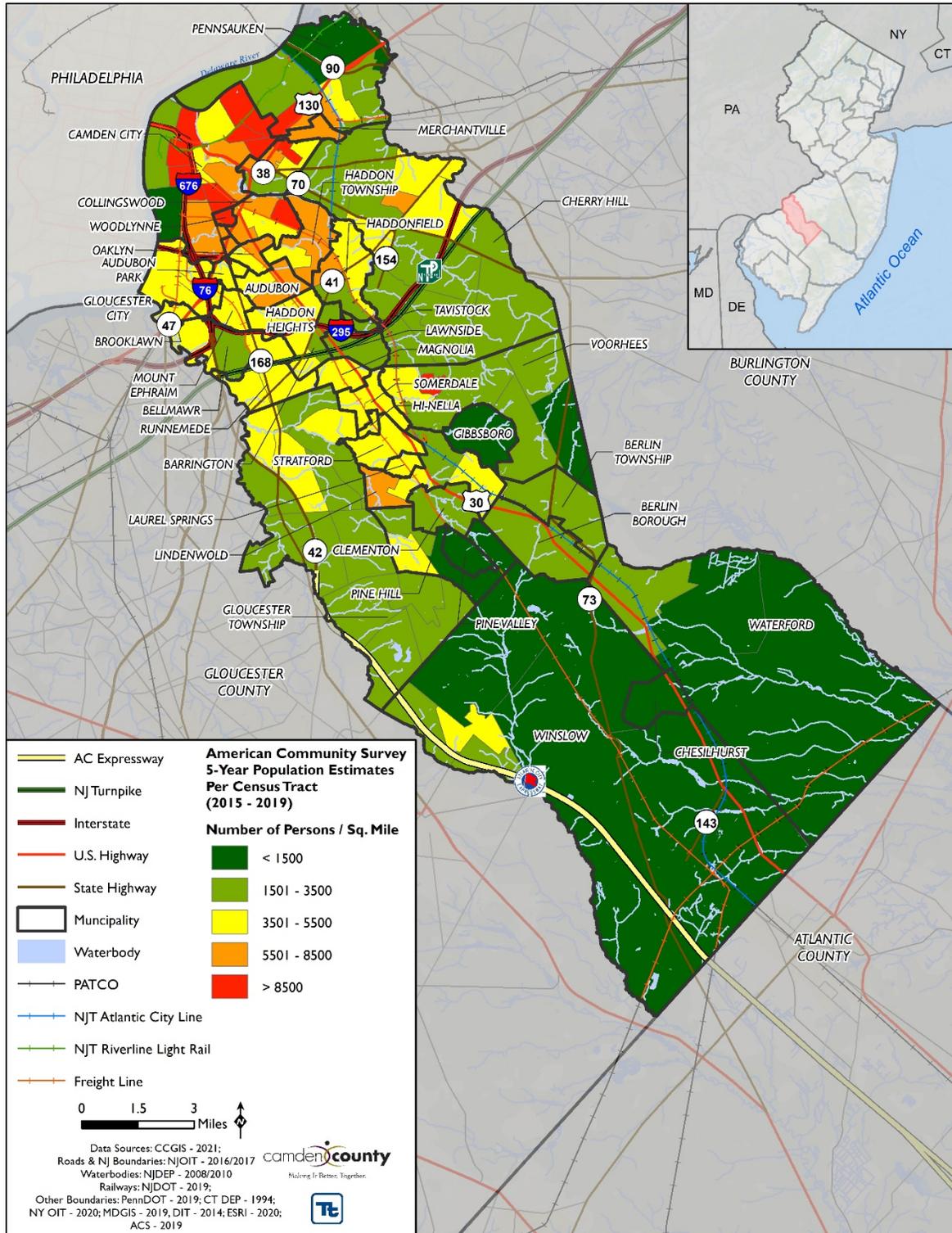
Coronavirus disease (COVID-19) is an infectious disease first identified in 2019. The virus rapidly spread into a global pandemic by spring of 2020. The elderly and those with underlying medical conditions such as cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness (WHO 2020). With the virus being relatively new, information regarding transmission and symptoms of the virus is emerging from the research. 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, the federal government and States have urged the public to avoid touching of the face, properly wash hands often, wear face masks, and use various social distancing measures. At the time of this plan update, New Jersey has begun vaccinating residents for COVID-19.

4.3.3.1 Location and Extent

New Jersey's geographic and demographic characteristics make it particularly vulnerable to importation and spread of infectious diseases. All 21 counties in New Jersey have experienced the effects of a pandemic or disease outbreak. 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 4.3.3-1 shows population density throughout Camden County. Additionally, much of Camden County can experience other mosquito-borne diseases such as WNV and Chikungunya due to the abundance of water bodies throughout the County, which provide a breeding ground for infected mosquitos.

Figure 4.3.3-1. Camden County Population Density



4.3.3.2 Range of Magnitude

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 also 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 Jersey and Camden County.

Mosquito-Borne Diseases

Chikungunya

Since 2015, there have been four reported cases of Chikungunya in Camden County (NJ DOH 2021).

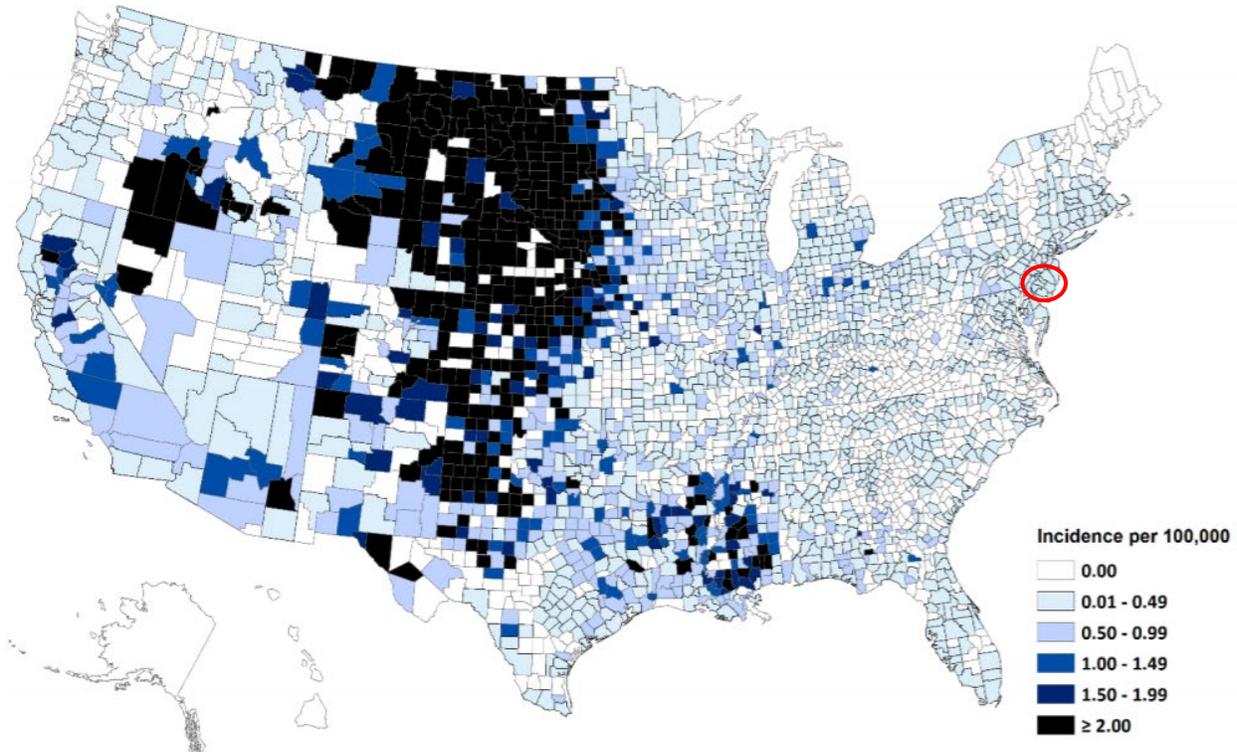
West Nile Virus

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 (USGS, 2012).

The CDC has a surveillance program for WNV. Data is collected on a weekly basis and reported for five categories: wild birds, sentinel chicken flocks, human cases, veterinary cases and mosquito surveillance (CDC, 2011). Between 1999 and 2019, there were 215 reported cases of West Nile Virus neuroinvasive disease in New Jersey.

Figure 4.3.3-2 shows the average annual incidence of West Nile Virus neuroinvasive disease reported to the CDC by county from 1999 to 2019.

Figure 4.3.3-2. Average Annual Incidence of West Nile Virus Neuroinvasive Disease Reported to CDC by County, 1999-2019



Source: CDC 2020

Note: The red circle indicates the approximate location of Camden County. The figure shows Camden County, on average, experiences between 0.01 and 0.49 per 100,000 reported WNV incidents.

Tick-Borne Diseases

Human Ehrlichiosis

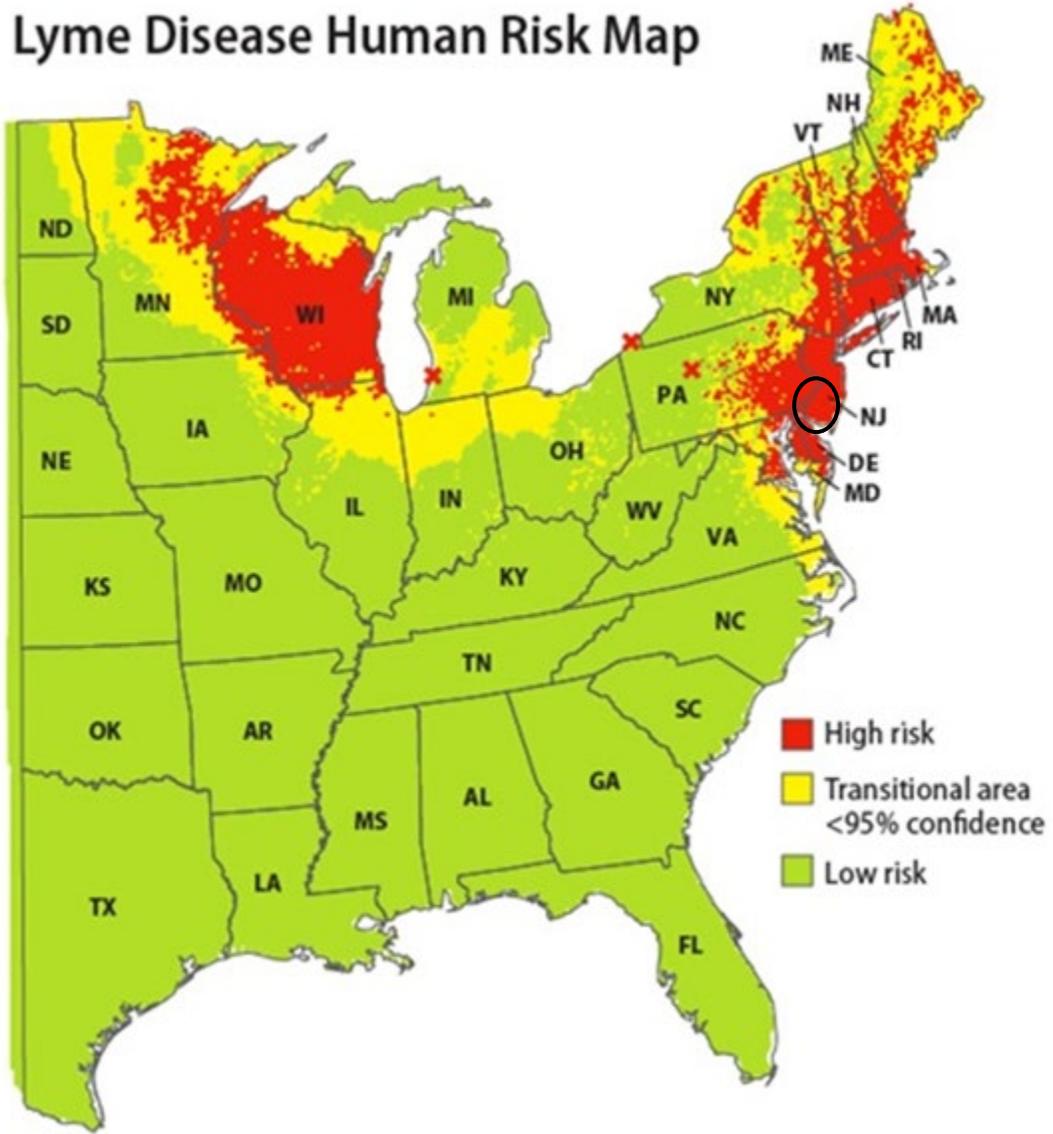
Since 2015, there have been 23 reported cases of Ehrlichiosis in Camden County, including *Ehrlichia Chaffeensis* (previously known as Human Monocytic Ehrlichiosis [HME]), *Anaplasmosis* (previously known as Human Granulocytic Ehrlichiosis [HGE]), and Ehrlichiosis from an undetermined bacterial species (NJ DOH 2021).

Lyme Disease

Lyme disease is the most commonly reported vector borne illness in the U.S. Between 2015 and 2019, there were 658 confirmed cases of Lyme disease in Camden County (NJ DOH 2021). Figure 4.3.3-3 shows the risk of Lyme disease in the northeastern U.S. The figure indicates that all of Camden County is located in a high-risk area.

Figure 4.3.3-3. Lyme Disease Human Risk Map in the Northeast United States

Lyme Disease Human Risk Map



Source: Yale School of Public Health, 2013

Note: The approximate location of Camden County is located within the black circle. All of Camden County is located within a high-risk area.

The CDC Division of Vector Borne Diseases (DVBD) indicated in 2018 that New Jersey was the state with the second-highest number of confirmed Lyme disease cases, totaling approximately 2,876 confirmed cases, and 1,124 probable cases (CDC 2019). For total number of cases between 2007 and 2018, New Jersey ranked third highest for the number of confirmed Lyme disease cases, totaling approximately 32,731 (12.4% of the total reported cases in the U.S.) (CDC 2018).

Rocky Mountain Spotted Fever

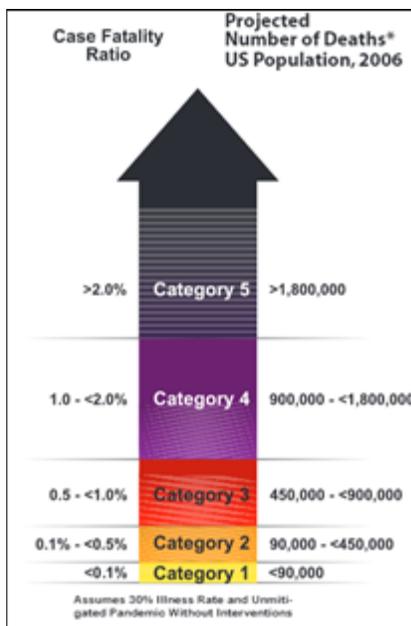
Since 2015, there have been 5 reported cases of Rocky Mountain Spotted Fever in Camden County, as well as 17 reported cases of Spotted Fever Group Rickettsiosis (NJ DOH 2019).

Influenza and Pandemics

The severity of a pandemic or infectious disease threat in New Jersey will range significantly depending on the aggressiveness of the virus in question and the ease of transmission. Pandemics around the nation have the potential to affect New Jersey’s populated areas.

The CDC and Prevention Community Strategy for Pandemic Influenza Mitigation guidance introduced a Pandemic Severity Index (PSI), which uses the case fatality ratio as the critical driver for categorizing the severity of a pandemic. The index is designed to estimate the severity of a pandemic on a population to allow better forecasting of the impact of a pandemic, and to enable recommendations on the use of mitigation interventions that are matched to the severity of influenza pandemic. Pandemics are assigned

Figure 4.3.3-4. Pandemic PSI



Source: NJ DOH 2017

to one of five discrete categories of increasing severity (Category 1 to Category 5) (NJDOH, 2017). Figure 4.3.2-6 illustrates the five categories of the Pandemic Severity Index (PSI).

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 4.3.3-1.

Table 4.3.3-1. 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 reassortment 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.

Phase	Description
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	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 Jersey, health and supporting agency responses to a pandemic are defined by the WHO phases and federal pandemic influenza stages, and further defined by New Jersey pandemic situations. The State’s situations are similar, but not identical to the United States Department of Homeland Security federal government response stages. Transition from one situation to another indicates a change in activities of one or more New Jersey agencies. Table 4.3.3-2 compares the federal and New Jersey pandemic influenza phases and situations.

Table 4.3.3-2. Federal and New Jersey Pandemic Phases and Situations

Federal Pandemic Influenza Stage		New Jersey Situations	
0	New domestic outbreak in at-risk country (WHO Phase 1, 2, or 3)	1	Novel (new) influenza virus in birds or other animals outside the U.S.
		2	Novel (new) influenza virus in birds or other animals in the U.S./NJ
1	Suspected human outbreak overseas (WHO Phase 3)	3	Human case of novel (new) influenza virus outside of the U.S.
2	Confirmed human outbreak overseas (WHO Phase 4 or 5)	4	Human-to-human spread of novel (new) influenza outside the U.S. (no widespread human transmission)
		5	Clusters of human cases outside the U.S.
3	Widespread human outbreak in multiple locations overseas (WHO Phase 6)		
4	First human case in North America (WHO Phase 6)	6	Human case of novel (new) influenza virus (no human spread) in the U.S./NJ
5	Spread in the U.S. (WHO Phase 6)	7	First case of human-to-human spread of novel (new) influenza in the U.S./NJ
		8	Clusters of cases of human spread in the U.S./NJ
		9	Widespread cases of human-to-human spread of novel (new) influenza outside the U.S./NJ
6	Recovery and preparation for subsequent waves (WHO Phase 5 or 6)	10	Reduced spread of influenza or end of pandemic

Source: NJOEM 2019

NJ New Jersey
 U.S. United States
 WHO World Health Organization

Coronavirus

The COVID-19 pandemic was currently impacting Camden County at the time the 2022 draft HMP was written. Between March 6, 2020 and March 23, 2021, there were 41,818 total confirmed positive cases in the County, and 1,113 deaths from COVID-19. In late December 2020, New Jersey began administering two-step vaccinations for the COVID-19 virus. As of March 23, 2021, over 218,000 doses had been administered in Camden County (NJ DOH 2021).

4.3.3.3 Past Occurrences

Many sources provided historical information regarding previous occurrences and losses associated with disease outbreak events throughout New Jersey and Camden County. Between 1954 and 2019, FEMA issued a disaster (DR) or emergency (EM) declaration for the State of New Jersey for two disease outbreak-related events (FEMA 2019).

Table 4.3.3-3. Disease Outbreak-Related FEMA Declarations for Camden County, 1954 to 2020

FEMA Declaration Number	Date(s) of Incident	Incident Type	Incident Title
EM-3156	May 30 – November 1, 2000	Other	West Nile Virus
DR-4488 / EM-3451	January 20, 2000 to present	Pandemic	New Jersey COVID-19 Pandemic

Source: FEMA 2020

While the above diseases are of high concern and priority in Camden County, the New Jersey State Department of Health (NJ DOH) reports on all communicable diseases within the County. The table below contains reported disease counts of all reported communicable diseases in Camden County from 2015-2019. Only diseases reported within these years are reflected in the table, and therefore does not include COVID-19 statistics.

Table 4.3.3-4. Disease Outbreak Events in Camden County, 2015 to 2019

	Amoebiasis	Babesiosis	Botulism - infant	Campylobacteriosis	Chikungunya	Cryptosporidiosis	Cyclosporiasis	Dengue fever - dengue	Ehrlichiosis - anaplasma phagocytophilum (previously HGE)	Ehrlichiosis - ehrlichia chaffeensis (previously HME)	Ehrlichiosis - undetermined	Giardiasis	Haemophilus influenzae	Hepatitis A	Hepatitis B - acute	Hepatitis B - chronic	Hepatitis C - acute	Hepatitis C - chronic	Influenza, human isolates - Type 2009 H1N1	Influenza, human isolates - Type A	Influenza, human isolates - Type A H1	Influenza, human isolates - Type A H3	Influenza, human isolates - Type B	Legionellosis	Listeriosis
2015	0	14	0	104	3	2	1	0	2	2	0	19	6	1	13	20	17	912	0	179	0	27	35	17	0
2016	1	6	0	106	0	12	0	1	0	2	1	3	12	4	8	11	14	827	103	289	25	7	205	3	1
2017	2	15	0	51	1	5	2	1	1	3	2	7	5	2	9	9	16	740	1	812	3	34	210	10	1
2018	0	13	1	58	0	7	1	1	3	2	0	10	8	9	7	18	7	686	2	1097	22	31	703	28	0
2019	3	10	0	72	0	12	5	0	0	4	0	11	10	163	11	17	3	577	16	1051	3	11	122	17	1

	Lyme Disease	Malaria	Measles	Meningococcal Disease	Mumps	Pertussis	Rocky Mountain Spotted Fever	Salmonellosis - non typhoid	Shiga toxin-producing E.coli (stec) - non o157:h7	Shiga toxin-producing E.coli (stec) - o157:h7	Shigellosis	Spotted Fever Group Rickettsiosis	Streptococcus agalactiae (GBS)	Streptococcus pneumoniae	Streptococcus pyogenes - with Toxic Shock Syndrome	Streptococcus pyogenes - without Toxic Shock Syndrome	Tularemia	Typhoid Fever	Varicella	Vibrio infections (other than v.cholerae spp.)	West Nile virus (WNV)	Yersiniosis	Zika virus - disease, non-congenital	Zika virus - infection, non-congenital
2015	138	5	0	0	0	35	4	67	1	1	16	0	5	49	0	24	0	0	16	3	1	1	0	0
2016	123	4	0	0	3	57	1	55	4	3	20	0	7	45	0	38	0	0	10	1	2	3	0	0
2017	159	4	0	0	0	18	0	55	0	0	5	6	4	49	1	52	1	1	13	2	0	1	2	2
2018	157	5	1	0	1	9	0	69	4	1	17	4	1	36	0	42	0	2	11	3	3	3	0	0
2019	81	9	0	1	10	14	0	85	1	1	10	7	2	56	1	42	0	0	7	8	0	2	0	0

Source: NJ DOH 2021

4.3.3.4 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 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 (NJOEM 2019). As Camden County, New Jersey, and countries around the globe continue to administer vaccinations against the COVID-19 disease, we can expect those a decrease in confirmed cases, as well as severity of disease and symptoms, and ultimately, a decrease in deaths.

In Camden 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.

Disease-carrying ticks will continue to inhabit the northeast, including Camden 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 will continue to be a threat to Camden County.

In Section 4.4, the identified hazards of concern for Camden 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 'frequent'.

4.3.3.5 Climate Change Impacts

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. Waterborne human infections occur by contact with contaminated drinking water, recreational water, or by food. This

may be due to human actions, such as improper disposal of sewage, or due to weather events such as rainfall and high temperatures. Rainfall can influence the transport and dissemination of infectious agents, while temperature affects their growth and survival (World Health Organization, 2020).

The notion that rising temperatures will increase the number of mosquitoes that can transmit diseases such as WNV, Zika and 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 (NJOEM 2019).

4.3.3.6 Vulnerability Assessment

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

Impact on Life, Health and Safety

The entire population of Camden County is vulnerable to the disease outbreak hazard. Maintaining certain key functions is important to preserve life and decrease societal disruption during pandemics. Temperature control, clean water, waste disposal, and corpse management all contribute to public health. Ensuring functional transportation systems also protects health by making it possible for people to access medical care and by transporting food and other essential goods (Global Security 2011). Critical infrastructure employees provide public safety, transport medical supplies and food, implement a pandemic response, and maintain societal functions. If these workers were absent due to a pandemic outbreak, these systems and services will be interrupted having cascading impacts in the community and region (CISA 2020).

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 due to their proximity to potentially infected people. Further, the elderly and immunocompromised individuals may have increased vulnerability to becoming infected or experience exacerbated impacts depending upon the disease. Refer to Section 3 (County Profile) for summary of the vulnerable populations in Camden County.

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 there are 77,791 persons over 65 years old in Camden County; ; these individuals are considered high risk to the COVID-19 virus, or experience exacerbated impacts. While the statistics of this virus are subject to change during the publication of this HMP, the New Jersey Covid-19 dashboard shows that Camden County is within the upper half of the impacted NJ Counties. Overall, persons over 65 make up approximately 16.3-percent of positive COVID-19 cases in the entire State (NJ DOH 2020).

Impact on General Building Stock

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

Impact on Critical Facilities and Lifelines

While the actual structures of County and municipal buildings, critical facilities, and infrastructure will not be impacted by a pandemic or disease outbreak, the effect of absenteeism on workers will impact local government services. The most significant impact on critical facilities would be the increase in hospitalization and emergency room visits that would take place as a result of the outbreak. This would create a greater demand on these critical facilities, their staff, and resources.

Mortuary services could be substantially impacted due to the anticipated increased numbers of deaths. The timely, safe, and respectful disposition of the deceased is an essential component of an effective response. Pandemic influenza may quickly rise to the level of a catastrophic incident that results in mass fatalities, which will place extraordinary demands (including religious, cultural, and emotional burdens) on local jurisdictions and the families of the victims (Homeland Security Council 2006).

The healthcare system will be severely taxed, if not overwhelmed, from the large number of illnesses and complications from influenza requiring hospitalization and critical care. Ventilators will be the most critical shortage if a pandemic were to occur (Homeland Security Council 2006). The 2020 coronavirus pandemic has led to overwhelmed hospitals in numerous hotspots.

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 have been implemented by the County and State to address this hazard. Such resources include the COVID-19 Child Care Program to provide childcare for essential workers and the Camden County Nutrition Program, which delivers meals to at-risk populations, such as seniors. (Camden County 2021).

Most recently, the Health Department has played an active role in maintaining and controlling COVID-19 protocols across the County. This activity requires additional costs from the State and County to manage COVID-19 in 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. One study has shown that invasive mosquitos such as the Asian tiger mosquito, a common invasive mosquito found in New Jersey, have "desiccation-resistant eggs," which means that they have enhanced survival in inhospitable environments (Juliano and Lounibos 2005). This species is considered a competitive predator and will prey on other species of mosquitos and a range of insects disrupting the natural food chain. Invasive species of mosquitos 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 department of health. If these sprays are applied in large concentrations, they could potentially leach into waterways and harm nearby terrestrial species. However, there is a law in New Jersey's Pesticide Regulations that states "no person shall distribute, sell, offer for sale, purchase, or use any pesticide which has been suspended or canceled by the EPA, except as provided for in the suspension of cancellation order" (New Jersey nd).

Further 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

Any areas of growth could be potentially impacted by the disease outbreak hazard because the entire planning area is exposed. As population counts change in the County, there may be at increased risk to certain diseases. Higher concentrations of persons traveling via public transportation may become more vulnerable to the exchange of disease through airborne transmission.

According to the Camden County Planning Partners, there are 89 recent and anticipated new development projects in the County. Of these projects, 32 are for residential new development sites and will add several hundred apartment/condominium units and structures within the County.

Projected Changes in Population

Camden County has experienced population decline since 2010. According to the U.S. Census Bureau, the County's population has decreased 1.3-percent between 2010 and 2019 (U.S. Census Bureau 2020). Even though the population has decreased, any changes in the density of population can 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. Further, as the population ages there may be increased risk to this demographic. Older adults and people who have severe underlying medical conditions like heart or lung disease or diabetes seem to be at higher risk for developing more serious complications from certain diseases, such as COVID-19.

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).

Vulnerability Change Since the 2017 HMP

Disease outbreak is a new hazard of concern for the County.

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