4.22 PANDEMIC

SECTION 4.22 PANDEMIC

4.22-1 HAZARD OVERVIEW

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 caused by an infectious agent which humans have no or little natural immunity towards and can spread from person-to-person though a variety of transmission modes. These modes may include direct contact, air, or by the consumption of contaminated products with the infectious agent. A pandemic will cause both widespread and sustained effects and is likely to stress the resources of both the State and federal government. 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. In this section disease outbreaks that occurred in New Jersey will be further discussed, including coronavirus, foodborne diseases, mumps, norovirus, influenza, West Nile Virus and Zika virus.

Coronavirus

According to the Centers for Disease Control and Prevention (CDC), coronavirus disease 2019, also known as COVID-19, is a very contagious disease caused by the virus SARS-CoV-2. When a person infected with COVID-19 breathes, droplets and very small particles that contain the virus can spread and infect other around them. COVID-19 can also spread through droplets and particles that land on people's eyes, nose, or mouth or when people touch contaminated surfaces (CDC, 2023a). Once infected, people may first notice symptoms 2-14 days being exposed to the virus (CDC, 2022). People infected with COVID-19 most commonly experience respiratory cold- and flu-like symptoms, although the disease may affect other parts of the body (CDC, 2023a).

Foodborne Disease Outbreaks

Foodborne illness is caused by consuming contaminated foods or beverages. Many different disease-causing microbes or pathogens can contaminate foods, so there are many different types of foodborne illnesses. Foodborne illness, caused by a variety of bacteria, viruses, and parasites, can be spread by consumption of improperly prepared food items, poor hygiene among food handlers, or contamination in food processing facilities or farms. Many foodborne pathogens also can be acquired through recreational or drinking water, from contact with animals or their environment, or through person-to-person spread (NJDOH, 2017).

After eating contaminated food, people can develop anything from a short, mild illness, often mistakenly referred to as "food poisoning," to life-threatening disease. The Centers for Disease Control and Prevention (CDC) indicate that foodborne illnesses, each year, result in 76 million becoming ill; more than 300,000 hospitalizations; and 5,000 deaths (NJDOH, 2013). Some of the foodborne diseases reported to NJDOH include, Campylobacteriosis, Foodborne Poisonings, Salmonellosis, Cyclosporiasis, Hepatitis A, Shigellosis, E. coli, Listeriosis and Vibriosis.

An outbreak of foodborne illness occurs when a group of people consume the same contaminated food and two or more of them come down with the same illness. It may be a group that ate a meal together somewhere, or it may be a group of people who do not know each other at all, but who all happened to buy and eat the same contaminated item from a grocery store or restaurant. For an outbreak to occur, something must have happened to contaminate a batch of food that was eaten by a group of people. Often, a combination of events contributes to the outbreak (NJDOH, 2013a).

Mumps

Mumps is a contagious disease that is caused by the mumps virus. Mumps typically starts with a few days of fever; headache, muscle aches, tiredness, and loss of appetite, and is followed by swelling of salivary glands. Anyone who is not immune from either previous mumps infection or from vaccination can get mumps (CDC, 2017).

Norovirus

Norovirus, formerly called norwalk-like virus, is a virus that causes acute gastroenteritis in humans. The most common symptoms of norovirus are diarrhea, vomiting, and abdominal pain. Fever, chills, headache, body aches and fatigue may also be present. Symptom onset is usually abrupt, which is very characteristic of norovirus. Norovirus is very contagious, and is spread through contaminated food or water, by contact with an infected person, or by contamination of environmental surfaces. The virus has an incubation period of 24 to 48 hours. Infected individuals are symptomatic for one to two days, but may not shed the virus for up to two weeks after recovering (NJDOH, 2013a).

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 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, 2011).

West Nile Virus

The CDC indicates that the West Nile virus (WNV) is most commonly transmitted to humans by infected mosquitoes. There are no medications to treat or vaccines to prevent WNV infection. Fortunately, most people infected with WNV will have no symptoms. About one in five people who are infected will develop a fever with no other symptoms. Less than 1% of infected people develop a serious, sometimes fatal, neurologic illness. WNV is established as a seasonal epidemic in North America that flares up in the summer mosquito season and continues into the fall. Mosquitos become infected when they feed on infected birds. The mosquitos can then spread WNV to humans and other animals when they bite. In 2017, there were 2,002 reported cases of WNV in the United States, along with 121 deaths from this disease (CDC, 2018).

ZIKA Virus

In 2015 the Zika virus disease became a nationally notifiable condition. The Zika virus is an infectious disease spread mostly by the bite of an infected mosquito. In most cases, the virus has no symptoms, but when present, they are usually mild. Symptoms may include fever, red eyes, joint pain, headache, and a rash.

Regulations In Place To Manage The Hazard

In New Jersey, a municipality in which a pandemic occurs bears the first and primary responsibility to control the epidemic. Pandemics that remain uncontrolled warrant local mutual aid from neighboring municipal and/or county and state resources. If the epidemic remains beyond the capabilities of local law enforcement agencies alone, limited State Police assistance may be requested. If the restoration of public health is beyond local, county, and state abilities, the Governor may declare a State of Emergency calling on federal and worldwide support.

4.22-2 LOCATION, EXTENT, AND 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 magnitude of a pandemic may be exacerbated by the fact that an influenza pandemic will cause outbreaks across the United States, limiting the ability to transfer assistance from one jurisdiction to another. Additionally, effective preventative and therapeutic measures, including vaccines and other medications, will likely be in short supply or will not be available. During a pandemic wave in a community, during a six to eight-week outbreak, between 25% and 30% of persons will become ill. Among working-aged adults, illness attack rates will be lower than in the community as a whole. A CDC model suggests that at the peak of pandemic disease, about 10% of the workforce will be absent because of illness or caring for an ill family member. Impacts will likely vary between communities and work sites and may be greater if significant absenteeism occurs because persons stay home for fear of becoming infected (Global Security, 2011).

In 1999, the WHO Secretariat published guidance for pandemic influenza and defined the six phases of a pandemic. Updated guidance was published in 2009 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. The grouping and description of pandemic phases have been revised to make them easier to understand, more precise, and based upon observable phenomena. Phases 1–3 correlate with preparedness, including capacity development and response planning activities, while Phases 4–6 clearly signal the need for response and mitigation efforts. Furthermore, periods after the first pandemic wave are elaborated to facilitate post pandemic recovery activities. The WHO pandemic phases are outlined in Table 4.22-1.

Table 4.22-1 WHO Global Pandemic Phases

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

Source: WHO, 2009

In New 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 4.22-2 compares the federal and New Jersey pandemic influenza phases and situations.

Table 4.22-2 Federal and New Jersey Pandemic Phases and Situations

Federal Pandemic Influenza Stage		New Jersey Situations	
0	New domestic outbreak in at-risk country	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	3	Human case of novel (new) influenza virus outside of the U.S.

Federal Pandemic Influenza Stage		New Jersey Situations	
2	Confirmed human outbreak overseas	4	Human-to-human spread of novel (new) influenza outside the U.S. (no widespread human transmission)
3	Widespread human outbreak in multiple locations overseas	5	Clusters of human cases outside the U.S.
4	First human case in North America	6	Human case of novel (new) influenza virus (no human spread) in the U.S./NJ
5	Spread in the U.S.	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 Widespread cases of human-to-human spread of novel (new) influenza outside the U.S./NJ
		9	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: Homeland Security Council, 2006; NJDOH, 2012

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.

Coronavirus

All counties experienced COVID-19 and may experience an outbreak of new variants in the future. Densely populated areas will spread diseases quicker than less densely populated areas. Section 3.0: State Profile shows population density throughout the State. Vaccination rates can also impact the spread of COVID-19. See "A Closer Look at the COVID-19 Pandemic" below for more information.

While some people infected with COVID-19 experience mild symptoms, others may become severely ill (CDC, 2023a). COVID-19 symptoms can include fever or chills, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, and diarrhea. Trouble breathing, persistent chest pain or pressure, new confusion, trouble waking up staying awake, and discolored skin, lips, or nail beds (depending on skin tone) are all warning signs that may require emergency medical attention (CDC, 2022).

Those infected may also develop Post-COVID conditions called "Long COVID." (CDC, 2023a). Long COVID is broadly defined by the CDC and Department of Health and Human Services (HHS) as "signs, symptoms, and conditions that continue or develop after acute COVID-19 infection" (CDC, 2023b). Long COVID can last weeks, months, or years; it encompasses a wide range of new, returning, or ongoing health problems. Long COVID could first be identified at least 4 weeks after infection, after when most people with COVID-19 get better. People who experience Long COVID commonly report fever, feeling tiredness or fatigue that interferes with their daily life, and symptoms that get worse after exerting themselves physically or mentally effort. People with Long COVID may also experience respiratory and heart symptoms, neurological symptoms, digestive symptoms, joint or muscle pain, rash, and changes in menstrual cycles. While anyone infected with SARS-CoV-2 can experience Long COVID, it more often occurs in people who had severe COVID-19 illness. Unvaccinated people infected with COVID-19 may have a higher risk of developing Long COVID than vaccinated people. A person unaware they had COVID-19 may also experience Long COVID (CDC, 2023b).

SARS-CoV-2 and other viruses change over time through mutation. This mutation can lead to new strains of the virus, also called variants. The CDC monitors all variants that can be found spreading throughout the United States. Variants may spread more easily than the original virus or are resistant to treatments and vaccines created for the original virus. (CDC, 2023d). The CDC classifies variants as a Variant Being Monitored (VBM), Variant of High Consequence (VOHC), Variant of Concern (VOC), and Variant of Interest (VOI). Classifications vary based on how resistant the variant is to antibodies, how resistant the variant is to vaccinations and treatments, the severity of the disease caused and how quickly the disease spreads (CDC, 2023d).

As of March 2023, the CDC was tracking 11 VBMs and one VOC related to COVID-19. The VOC, the Omicron variant, was first classified as a VOC on November 26, 2021, and may spread more easily and cause more severe disease than the original virus. Antibodies, treatments, or vaccines may not be as effective against the Omicron variant (CDC, 2023d).

Foodborne Disease Outbreaks

In general, food born illness outbreaks tend to be local in nature. They are recognized when a group of people discovers that they all became ill after sharing a common meal. For example, a local outbreak might follow a catered meal at a reception, a potluck supper, or a meal at an understaffed restaurant on a particularly busy day. However, outbreaks are increasingly being recognized that are more widespread, that affect persons in many different places, and that are spread out over several weeks. For example, an outbreak of salmonellosis was traced to persons eating a breakfast cereal produced at a factory in Minnesota, and marketed under several different brand names in many different states. No one county or state had very many cases, and the cases did not know each other (NJDOH, 2017).

Mumps

Similarly, mumps is spread by exposure, so is also typically local. The Immunization Action Coalition states that mumps spread from person to person by saliva or mucus from the mouth, nose, or throat of an infected person, usually when the person coughs, sneezes or talks. The virus may also be spread indirectly when someone with mumps touches items or surfaces without washing their hands. The incubation period of mumps is usually 16 to 19 days, but can range from 12 to 25 days.

Norovirus

Norovirus outbreaks are common in schools and daycare facilities. In New Jersey, norovirus is not reportable; however, outbreaks associated with the virus are reportable (NJDOH, 2013).

Influenza

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. Section 3.0: State Profile shows population density throughout the State.

West Nile Virus

Additionally, much of the State can experience other diseases such as WNV due to the abundance of water bodies throughout the State, which provide a breeding ground for infected mosquitos. Section 3.0: State Profile shows the locations of water sources throughout the State.

ZIKA Virus

All of New Jersey is prone to a Zika outbreak. New Jersey is particularly vulnerable to travel-related cases because there are a significant segment of residents who travel back and forth to Puerto Rico, where a national emergency had been declared in 2016 because of the virus.

4.22-3 PREVIOUS OCCURRENCES AND LOSSES

Three major influenza pandemics affected areas across the globe in the 20th century, causing millions of deaths. New Jersey saw the impacts of these pandemics. If a new influenza virus were to begin spreading throughout the world, New Jersey could experience more than 50,000 deaths, more than 275,000 people hospitalized, and more than 2.5 million people ill (NJDOH, 2012). Table 4.22-3 provides details on pandemic events that have impacted New Jersey.

Table 4.22-3 Previous Pandemic Occurrences

Date(s) of Event	Event Type	Counties Affected	Description
1918-1919	1918 “Spanish” Influenza Pandemic	Statewide	The influenza pandemic of 1918-1919 caused between 20 and 40 million deaths, more than World War I. This pandemic has been cited as the most devastating epidemic in recorded history. More people died of influenza in a single year than in the four years of the Black Death Bubonic Plague from 1347 to 1351. By September 27, 1918, the State health officer announced that the disease “was unusually prevalent” throughout New Jersey. The State was reporting that 2,000 cases had been reported in the preceding three days. On October 10, State officials formally banned all public gatherings. By October 15, officials had reported 88,256 cases of influenza. By the October 22, State authorities estimated that there were at least 149,540 cases, with 4,398 deaths being officially reported. On October 22, the pandemic peaked in New Jersey. On that day, there were 7,449 new cases and 366 deaths. The situation slowly improved after the third week of October.
1976	1976 Fort Dix Swine Influenza A Outbreak	Burlington	In early 1976, the Hsw1N1 influenza virus caused severe respiratory illness in 13 soldiers with one death at Fort Dix. Because New Jersey was similar to the 1918–1919 influenza pandemic, rapid outbreak assessment and enhanced surveillance were initiated. New Jersey virus was detected only from January 19 to February 9 and did not spread beyond Fort Dix. H3N2 spread simultaneously, also caused illness, and persisted until March. Up to 230 soldiers were infected with the New Jersey virus. Rapid recognition of New Jersey, swift outbreak assessment, and enhanced surveillance resulted from excellent collaboration between Fort Dix, New Jersey Department of Health, Walter Reed Army Institute of Research, and CDC personnel.
1999-2002	West Nile Virus Outbreak	Statewide	WNV was identified in New York City in 1999, and spread rapidly across the United States, with human disease documented in 39 states and the District of Columbia. In 2002, WNV spread westward and activity was reported in all but six states (Arizona, Utah, Nevada, Oregon, Alaska, and Hawaii) and triggered the largest human arboviral encephalitis epidemic in U.S. history. From June 10 to December 31, 2002, there were 4,156 cases of WNV (including 284 deaths) reported in 39 states and the District of Columbia.
October 2009	Mumps	Ocean County	On September 26, the NJDHSS was informed of eight suspected mumps cases in two Ocean County private schools. By October 30, a total of 40 cases were reported; the median age of patients was 19.5 years old.
2009	Global H1N1 Pandemic	Statewide	The first novel H1N1 patient in the United States was confirmed April 15, 2009. The second patient was confirmed on April 17, 2009. On April 22, the CDC activated its Emergency Operations Center to better coordinate the public health response. On April 26, 2009, the U.S. government declared a public health emergency and began actively and aggressively implementing the country’s pandemic response plan. By June 19, 2009, all 50 states in the United States reported novel H1N1 infection. On June 11, 2009, the WHO signaled that a global pandemic of H1N1 was underway by raising the worldwide pandemic alert level to Phase 6. At the time, more than 70 countries had reported cases of novel influenza A (H1N1) infection. In total there were 18,306 lab-confirmed deaths as a result of H1N1 worldwide. In the United States between April 2009 and August 2009 there were 9,079 cases that required hospitalization and 593 deaths. In New Jersey, cases were widespread in July 2009, with 1,414 confirmed cases and 15 deaths.
January – 2/1/2011	Escherichia coli O157:H7	N/A	Between January 10 and February 15, 2011, a total of 14 persons were infected with the outbreak strain of Escherichia coli O157:H7 were reported in five states, including two reports in New Jersey. Three of the 14 were hospitalized; no deaths occurred. The outbreak was associated with Lebanon bologna.
February – September 2011	Salmonella Heidelberg	N/A	Between February 27 and September 13, 2011, a total of 136 persons infected with the outbreak strain of Salmonella Heidelberg were reported from 34 states, including one report in New Jersey. Ill persons ranged in age from less than one year old to 90years old. Thirty-seven people were hospitalized; one death was reported.
April – November 2011	Salmonella Heidelberg	N/A	Between April 1 and November 17, 2011, a total of 190 illnesses occurred due to Salmonella Heidelberg that was linked to kosher broiled chicken livers. Sixty-two of those illnesses were reported in New Jersey. Ill person’s ages ranged from less than 1 year old to 97 years old. Thirty of the infected people were hospitalized.

Date(s) of Event	Event Type	Counties Affected	Description
8/1/2011	Salmonella Enteritidis	N/A	A total of 43 individuals infected with the outbreak strain of Salmonella Enteritidis were reported from five states, including two cases in New Jersey. Ill persons ranged in age from less than one year old to 94 years old. Two patients were hospitalized; no deaths occurred. The outbreak was linked to Turkish pine nuts purchased from bulk bins at Wegmans grocery stores.
1/1/2012	Norovirus Outbreak	Cumberland, Mercer	A norovirus outbreak impacted New Jersey during the early part of 2012. In January, medical staff at Cumberland Manor (Cumberland County) declared the third floor of the nursing home quarantined, as 34 of the 55 residents contracted the norovirus. Four of the residents were sent to the hospital. In February, an outbreak was reported at Rider and Princeton Universities. At Rider University (Mercer County), approximately 123 cases were reported and 40 students were sent to the hospital for treatment. At Princeton University (Mercer County), an unusually severe norovirus outbreak struck the University. At least 190 students came down with norovirus. This was the largest outbreak at the University in 10 years. The last outbreaks were in 2002 (73 students sick), 2004 (110 students sick), and 2008 (60 students sick).
January – June 2012	Salmonella Infantis	N/A	Between January 4 and June 26, 2012, a total of 49 individuals (human) were infected with the outbreak strain of Salmonella Infantis linked to multiple brands of dry dog food produced by Diamond Pet Foods produced at a facility in Gaston, South Carolina. Ten people were hospitalized; there were no deaths. Twenty states reported an outbreak, including two cases in New Jersey. Ill persons ranged in age from less than 1 year old to 82 years old.
January – July 2012	Salmonella Bareilly and Salmonella Nchanga	N/A	Between January 1 and July 7, 2012, a total of 425 individuals were infected with the outbreak strain of Salmonella Bareillyand Salmonella Nchanga. Twenty-eight states reported outbreaks, included 46 cases in New Jersey. The outbreaks were associated with an imported frozen raw yellowfin tuna product, known as Nakaochi Scrape, from Moon Marine USA Corporation. Ill persons ages ranged from less than 1 year old to 86 years old.
March-September 2012	Salmonella Infantis, Salmonella Newport, and Salmonella Lille	N/A	Between March 1, 2012 and September 24, 2012, a total of 195 individuals were infected with the outbreak strain of Salmonella Infantis, Salmonella Newport, and Salmonella Lille. Twenty-seven states reported an outbreak, including five cases in New Jersey. The outbreak was linked to chicks, ducklings, and other live poultry from Mt. Healthy Hatchery in Ohio. Ill persons ranged in age from less than 1 year old to 100 years old.
March-October 2012	Listeria monocytogenes Outbreak	N/A	Between March 28, and October 6, 2012, a total of 22 individuals were infected with the outbreak strain of Listeria monocytogenes. Ricotta salata cheese was the likely source of this outbreak. Thirteen states reported an outbreak, including three cases in New Jersey. Twenty of the persons infected were hospitalized, nine were related to pregnancy, and three were diagnosed in newborns. The others ranged from 30 years old to 87 years old.
June-September 2012	Salmonella Bredeney	N/A	Between June 14 and September 21, 2012, a total of 42 individuals were infected with the outbreak strain of Salmonella Bredeney. The outbreak was linked to Trader Joe's Valencia Peanut Butter. Twenty states reported an outbreak, including two cases in New Jersey. Ill persons ranged in age from less than 1 year old to 79 years old, with a median age of 7 years old.
July-September 2012	Salmonella Braenderup, Salmonella		
2012	West Nile Virus Outbreak	Statewide	During the summer-fall months of 2012, the worst WNV outbreak in the United States occurred. As of December 11, 2012, 48 states reported WNV infections in people, birds, or mosquitoes. A total of 5,387 cases of WNV in people, including 243 deaths, have been reported to CDC. Of these, 2,734 (51%) were classified as neuroinvasive disease (such as meningitis or encephalitis) and 2,653 (49%) were classified as non-neuroinvasive disease. In New Jersey, there were 46 positive test results.
July-October 2016	Zika Outbreak	Statewide	In August 2016 the number of Zika cases reported in New Jersey reached over 100. Two counties - Bergen and Passaic - accounted for more than a third of the cases statewide.
January 20, 2020 - May 11, 2023*	COVID-19	Statewide	The first confirmed case of COVID-19 in the U.S. was in Washington State on January 21, 2020; the first confirmed case in New Jersey was reported on March 4, 2020. From March 2020 to August 24, 2023, there have been 2,588,728 confirmed cases of COVID-19 in New Jersey. During that period, 172,973 people have been hospitalized with confirmed cases and 36,242 have died in deaths associated with COVID-19.

Sources: Billings 1997; DHHS 2013; CDC 2008; CDC 2009; WHO 2010; CDC 2011; Laday, 2012; Jaslow, 2012; Rochabrun, 2012; Rochabrun, Nj.com, 2016; 2012; CDC, 2018; Fallon, 2020; FEMA, 2023; NJDOH, 2023

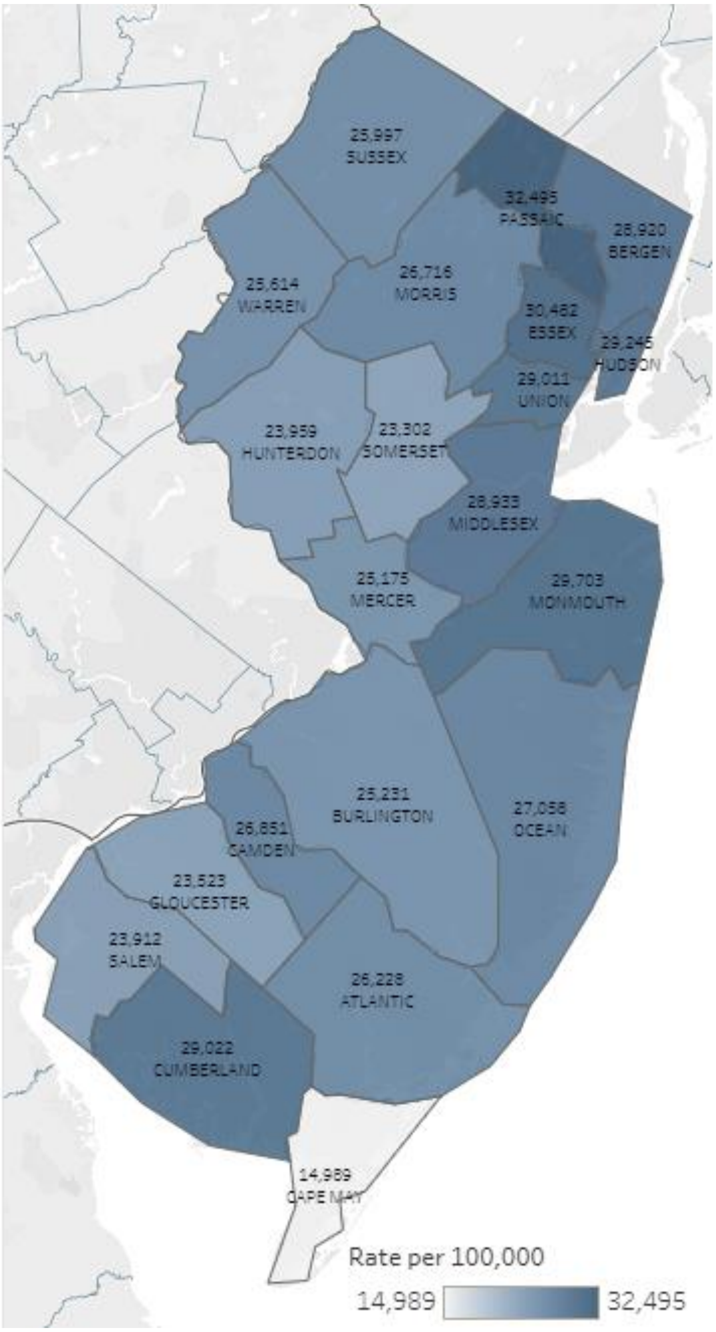
**Note: This date shows the incident period of the New Jersey COVID-19 Pandemic as defined by the FEMA Disaster Declaration. As of August 24, 2023, people are still becoming infected with COVID-19.*

A Closer Look at the COVID-19 Pandemic

On March 9, 2020, Governor Murphy declared a state of emergency and public health emergency in New Jersey. Then, on March 12, Governor Murphy recommended the cancellation of all public gatherings of more than 250 people in New Jersey, effective immediately. On March 21, the Governor ordered all non-essential retail businesses in the state to close until further notice. Over the coming weeks, the Governor continued to announce restrictions on activities throughout the state to combat the spread of the virus. Schools were moved to virtual platforms and aid organizations were set up. Mandatory use of face coverings or masks were also imposed to stop the transmission of the disease (Fallon, 2020).

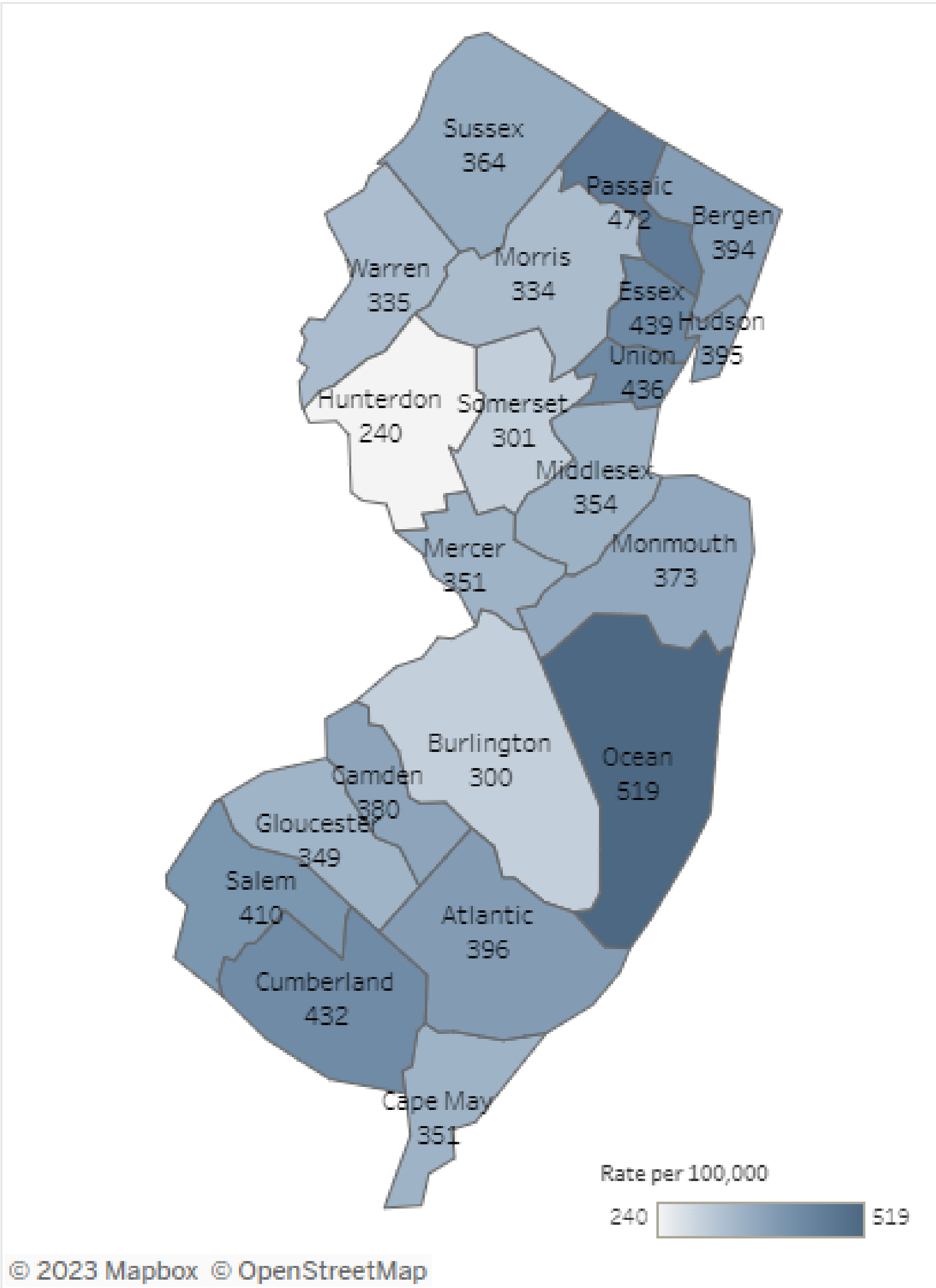
From March 2020 through August 24, 2023, the largest number of confirmed cases of COVID-19 were found in Bergen County (276,396 cases), Essex County (263,280 cases), and Middlesex County (249,738 cases). Figure 4.22-1 shows the rates of COVID-19 per 100,000 residents by county. The highest rates of COVID-19 infection include Passaic County (32,495 cases per 100,000 residents), Essex County (30,482 cases per 100,000 residents), and Monmouth County (29,703 cases per 100,000 residents). Figure 4.22-2 shows the mortality rates per 100,000 residents by county. The highest mortality rates include Ocean County (519 deaths per 100,00 residents), Passaic County (472 deaths per 100,000 residents) and Essex County (439 deaths per 100,000 residents).

Figure 4.22-1 Rates of COVID-19 cases per 100,000 residents by county



Source: NJDOH, 2023

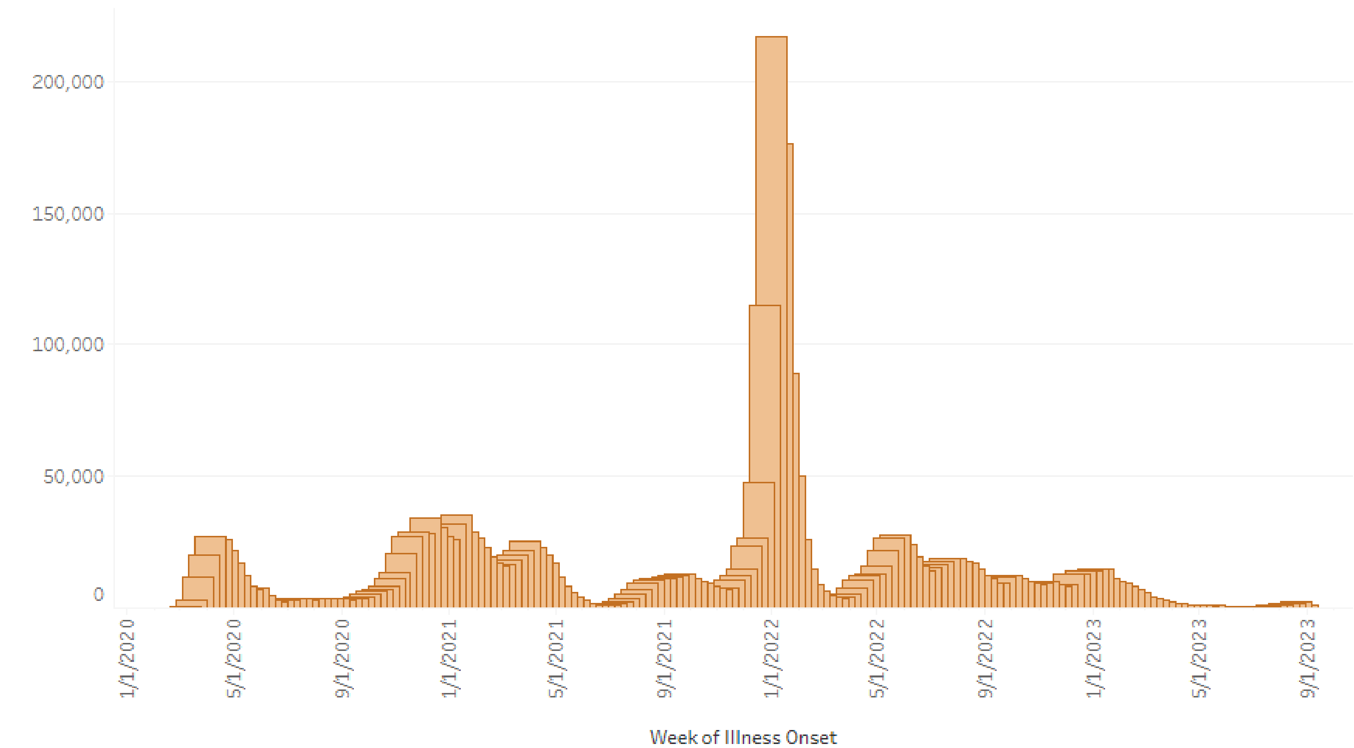
Figure 4.22-2 Rates of COVID-19 deaths per 100,000 residents by county



Source: NJDOH, 2023

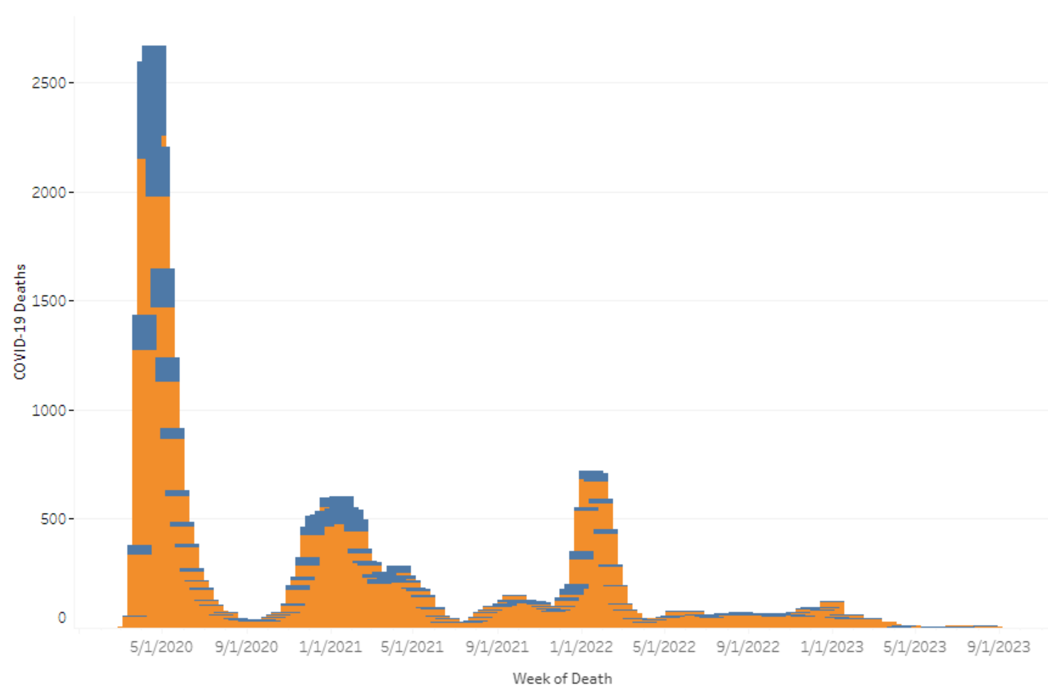
The pandemic has come in waves. Figure 4.22-3 shows confirmed cases of COVID-19 in New Jersey from March 2020 to August 24, 2023. Figure 4.22-4 shows COVID-19 deaths in new jersey by date of death. The greatest number of deaths occurred at the beginning of the virus, when there were no treatments or vaccines. Deaths have waxed and waned over time but for the most part have drastically declined since the beginning of 2022. Note that the height of COVID-19 cases in 2022 does not correspond to a similarly high peak in COVID-19 deaths at that time; this may be attributed to the availability and proliferation of treatments and vaccines.

Figure 4.22-3 COVID-19 Cases from March 2020 to August 24, 2023



Source: NJDOH, 2023

Figure 4.22-4 COVID-19 Deaths from March 2020 to August 24, 2023



Source: NJDOH, 2023

Note: Blue indicates probable deaths from COVID-19. Orange indicates confirmed deaths of COVID-19.

In April 2021, all people 16-years-old or older became eligible for the COVID-19 vaccine. At the time, these vaccines were under emergency use authorization but were all later approved by the U.S. Food and Drug Administration (FDA). Later, in September and October 2021, the FDA issue directives to allow for booster doses of COVID-19 vaccines to be administered at least 6 months after the initial series of vaccinations (U.S. Department of Health and Human Services, 2022). Boosters are recommended by the CDC because vaccinated people have lower risk of severe illness, hospitalization, and death from COVID-19 than those who haven't completed recommend doses or are unvaccinated. Protection from COVID-19 can also decrease since previous vaccination; additional updated COVID-19 vaccine dose can help restore this protection (CDC, 2023).

As of August 24, 2023, 20,401,967 doses of primary, additional, and bivalent series vaccinations have been delivered to NJ residents and non-NJ residents in New Jersey (NJDOH, 2023). Vaccination rates by county vary. The highest vaccination rates of primary series vaccinations are in Hudson (83%), Bergen (82%) and Morris County (81%). The lowest vaccination rates of primary series vaccinations are in Cumberland (56%), Ocean (57%), and Salem (58%) (The New York Times, 2023). Cumberland County has the fifth highest rate of COVID-19 cases per 100,000 residents (29,022) from March 2020 to August 24, 2023 (NJDOH, 2023). Table 4.22-4 shows the total COVID-19 vaccination rates by county.

Table 4.22-4 Total COVID-19 Vaccination Rates by County as of August 24, 2023

County	Completed Primary Series	Bivalent Booster Rate
Atlantic	71%	14%
Bergen	82%	18%
Burlington	79%	20%
Camden	73%	19%
Cape May	79%	18%
Cumberland	56%	11%
Essex	77%	16%
Gloucester	65%	16%
Hudson	83%	15%
Hunterdon	75%	21%
Mercer	76%	22%
Middlesex	77%	17%
Monmouth	71%	17%
Morris	81%	21%
Ocean	57%	12%
Passaic	73%	11%
Salem	58%	13%
Somerset	80%	22%
Sussex	65%	15%
Union	75%	15%
Warren	71%	14%

Source: The New York Times, 2023

A Closer Look at the Zika Outbreak

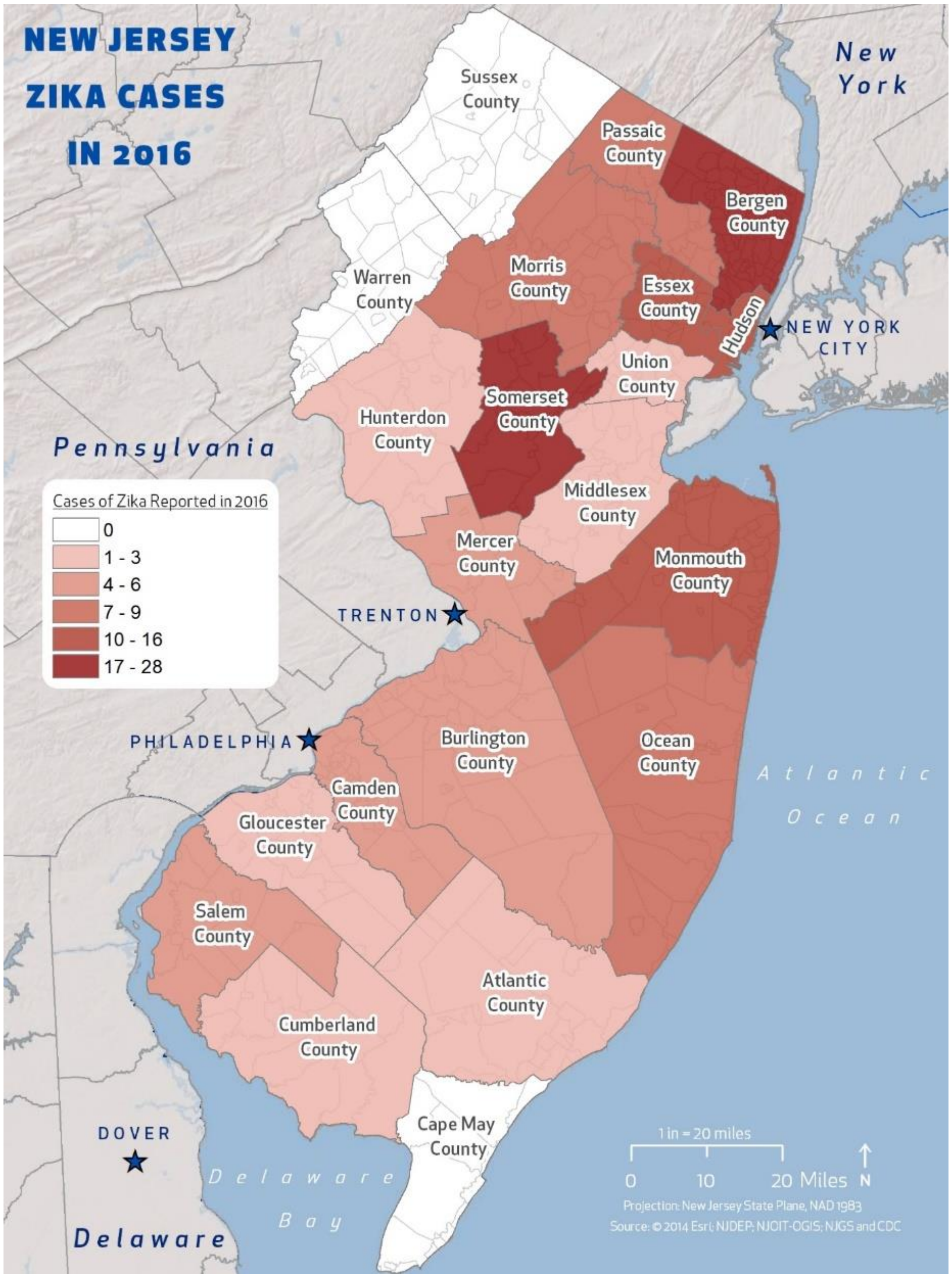
Due to the recent outbreak of Zika, data on the location of the outbreak of the virus is available and has been assessed more in depth. In the United States 5,658 symptomatic Zika virus disease cases have been reported, of which 228 cases have been acquired through presumed local mosquito borne transmission, and 54 cases have been acquired through other routes (CDC, 2018). Table 4.22-5 provides information on the cases that have been reported in New Jersey and Figure 4.22-5 shows the location of reported cases.

Table 4.22-5 Zika Virus Cases in New Jersey

Year	Symptomatic Disease Cases	Other Cases
2015	1	0
2016	180	0
2017	12	0
2018	1 (As of 3/7/2018)	0

Source: CDC Zika Virus Case Counts, 2015 to 2018

Figure 4.22-5 2016 Zika Outbreak Cases by County



Source: NJDOH, 2016

FEMA Declared Disasters

Between 1954 and 2023, FEMA declared three pandemic-related disaster in the State of New Jersey. These declarations are identified in Table 4.22-6.

Table 4.22-6 FEMA Pandemic-Related Disaster Declarations, 1954 to 2023

Disaster Number	Disaster Type	Declaration Date	Incident Period	Impacted Number of Counties
EM-3156	New Jersey Virus Threat	12/1/2000	5/30/2000 to 11/1/2000	21
EM-3451	New Jersey COVID-19	3/13/2020	1/20/2020 to 5/11/2023	21
DR-4488	New Jersey COVID-19 Pandemic	3/25/2020	1/20/2020 to 5/11/2023	21

Source: FEMA, 2023

4.22-4 PROBABILITY OF FUTURE OCCURRENCES

It is difficult to predict when the next pandemic 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 (Barry-Eaton District Health Department, 2013).

In New Jersey, the probability for a future pandemic 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 State, the probability of a pandemic event occurring also increases.

Coronavirus

While the Incident Period for the FEMA Declared Disaster of COVID-19 ended in May 2023, COVID-19 is still spreading in New Jersey. As the virus mutates, new variants may continue to develop.

Foodborne Disease Outbreaks

Federal regulators claim that the probability of a foodborne disease outbreak has increased in recent years, even with more enhanced food safety regulations. This is primarily because new pathogens are emerging as demand for year-round produce increases. Also, as agricultural operations increase, there are more chances for contamination to occur (nj.com, 2015).

Mumps

The mumps vaccine helps prevent major outbreaks of mumps. However, outbreaks can still occur in highly vaccinated communities. Possible outbreaks could occur in close contact settings such as schools, colleges, and camps. Vaccination helps limit the size and duration of an outbreak, but future outbreaks are still possible (NJDOH, 2017).

Norovirus

The probability of a future norovirus outbreak is high since the illness is highly contagious. Outbreaks are common due to the ease of transmission and the ability for anyone to get infected with the virus multiple times over a lifetime (NJDOH, 2017).

Influenza

Due to the anticipated increase in influenza occurrences, in 2015 the New Jersey Department of Health (NJDOH) created a Pandemic Influenza Plan to prepare for future occurrences. The purpose of this plan is to minimize the impact of a potential influenza pandemic, provide guidance to local health departments and stakeholders on response methods and to establish the role of NJDOH in response to an influenza pandemic (NJDOH, 2015).

West Nile Virus

Future occurrences of WNV are difficult to predict. Instances of the virus have been generally decreasing 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 (Epstein, 2001).

ZIKA Virus

While instances of Zika have decreased since the outbreak in 2016, there is still the possibility of an outbreak occurring in the future. New Jersey's vulnerability to the Zika virus in unclear currently. However, since the virus is primarily mosquito born, it is easy for the virus to spread. As climate change occurs, and the climate of New Jersey becomes warmer and more humid, there is the potential for mosquitos with the virus to appear in the state. The species of mosquito that carries Zika can survive in small wet environments such as tires, pots, gutters, and the species has been reported in Washington D.C. (Rutgers Center for Vector Biology, 2016).

Potential Effects of Climate Change

Climate change has the potential to increase the probability of pandemic occurring. While the relationship between climate change and increase in virus susceptibility is difficult to predict with certainty, there are scientific linkages between the two. As warm habitats that host insects such as mosquitoes increase, more of the population becomes exposed to potential virus threats (The Washington Post, 2017). The notion that rising temperatures will increase the number of mosquitoes that can transmit diseases such as WNV and Zika among humans (rather than just shift their range) has been the subject of debate over the past decade. Some believe that climate change may affect the spread of disease, while others are not convinced. However, many researchers point out that climate is not the only force at work in increasing the spread of infectious diseases into the future.

4.22-5 VULNERABILITY ASSESSMENT

To understand risk, the assets exposed to the hazard are identified. This section discusses New Jersey's vulnerability, in a qualitative nature, to a pandemic. A consequence analysis for this hazard was also conducted and presented in Section 10.0 EMAP. Impacts on the public, responders, continuity of operations, delivery of services, property, facilities and infrastructure, the environment, economic condition of the State, and the public confidence in the State's governance is discussed in Section 10.0: EMAP in accordance with Emergency Management Accreditation Program (EMAP) standards.

Built Environment

While the actual structures of State buildings, critical facilities, and infrastructure will not be impacted by a pandemic or disease outbreak, the effect of absenteeism on State workers will impact State services. Table 4.22-7 breaks down economic loss by industry as estimated by a study conducted by the American Trust for Health in 2007.

Table 4.22-7 Potential Losses by Industry in New Jersey During a Severe Flu Pandemic

Private Industry/Government	2005 Annual GDP Demand Loss in GDP	Private Industry/Government
Agriculture, forestry, fishing, and hunting	$ 623,000,000	$ 16,000,000
Mining	$ 262,000,000	$ 7,000,000
Utilities	$ 7,917,000,000	-
Manufacturing	$ 41,034,000,000	$ 1,026,000,000
Wholesale trade	$ 34,985,000,000	$ 875,000,000
Retail trade	$ 27,766,000,000	$ 694,000,000
Transportation and warehousing	$ 12,836,000,000	$ 150,000,000
Information	$ 20,268,000,000	$ 0
Finance and insurance	$ 36,808,000,000	$ 920,000,000
Real estate, rental, and leasing	$ 69,515,000,000	$ 0
Professional and technical services	$ 35,770,000,000	$ 0
Management of companies and enterprises	$ 9,242,000,000	$ 0
Administrative and waste services	$ 13,804,000,000	$ 0
Educational services	$ 3,694,000,000	$ 92,000,000

Private Industry/Government	2005 Annual GDP Demand Loss in GDP	Private Industry/Government
Health care and social assistance (increase)	$ 30,661,000,000	$ 1,150,000,000
Arts, entertainment, and recreation	$ 3,805,000,000	$ 761,000,000
Accommodation and food services	$ 10,888,000,000	$ 2,178,000,000
Other services, except government	$ 9,125,000,000	$ 114,000,000
Government	$ 44,228,000,000	$ 0

Source: Trust for American Health, 2007

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. CDC's model estimates an increase of more than 25% in the demand for hospitalization and intensive care unit services, even in a 'moderate pandemic' (United States Department of Health and Human Services, 2005).

In addition to higher demand of critical facility use, it could be anticipated that there would be less employees available to run facilities. Employees who are unable to come to work would result in a loss of service, impacting the function of critical facilities. According to Census data, in 2010 there were 150,300 State workers in New Jersey. A 10% absentee rate would mean that a shortage of 15,300 State employees would impact State facilities and thus the services they provide. Procedures for continuity of government operations will also need to be implemented during a pandemic. Using the CDC absentee rate of 10% of the population, and the 2010 census data, the following table illustrates critical infrastructure industries and the impact of a pandemic. Table 4.22-8 presents the number of ill workers based on the 10% estimate discussed.

Table 4.22-8 Approximate Critical Facility Absent Workers During a Pandemic

Industry	Workforce Statewide	Number of Ill Workers
Admin Support/Waste Mgt/ Remediation Services	238,600	23,860
Health Care and Social Assistance	511,300	51,130
Utilities	14,200	1,420
	Total	76,410

Source: United States Census, 2010

Population and Economy

The entire State's population is vulnerable to the effects of a pandemic. Areas with higher population density are more prone to being exposed to a virus. As established in Section 3.0: State Profile, the most populous counties are located in the northeast portion of the state. Additionally, vulnerable populations such as the young and elderly are considered at higher risk. As noted in Section 5.1: Risk Assessment Overview, no counties included pandemic as a hazard of concern in their hazard mitigation plans.

While seasonal influenza and pandemic influenza differ, it is helpful to look at how seasonal influenza influences the population, to gain a better understanding of the impacts that pandemic influenza could have. In 2012 a study was conducted on the economic impacts of seasonal influenza by county, titled "Annual economic impacts of seasonal influenza on US counties: Spatial heterogeneity and patterns" (Mao et al). This study assesses the economic risk of influenza to US counties and will be used for analysis in the risk assessment.

In addition to life and safety, a pandemic would have a significant impact on the economy in New Jersey. The 2012 study on annual economic impacts of seasonal influenza by county produced estimated costs of influenza on each New Jersey County. These estimated costs by county are shown in Table 4.22-9.

Table 4.22-9 Losses Related to Seasonal Flu in New Jersey by County

County	Total Cases	Direct Cost	Indirect Cost	Total Cost
Atlantic	23,839	$ 10,213,523.02	$ 19,173,942.24	$ 29,387,465.26
Bergen	63,818	$ 27,969,676.85	$ 57,777,452.04	$ 85,747,128.89
Burlington	37,420	$ 15,920,266.75	$ 30,661,013.13	$ 46,581,279.88
Camden	46,192	$ 18,836,961.30	$ 34,817,062.04	$ 53,654,023.34
Cape May	8,715	$ 4,598,252.23	$ 8,567,848.19	$ 13,166,100.41

County	Total Cases	Direct Cost	Indirect Cost	Total Cost
Cumberland	14,599	$ 5,822,396.74	$ 10,209,975.21	$ 16,032,371.95
Essex	57,268	$ 22,210,612.69	$ 43,351,707.79	$ 65,562,320.47
Gloucester	26,506	$ 10,764,489.03	$ 19,146,651.57	$ 29,911,140.59
Hudson	44,057	$ 16,613,149.81	$ 34,030,830.74	$ 50,643,980.55
Hunterdon	10,554	$ 4,569,279.38	$ 8,967,964.39	$ 13,537,243.77
Mercer	29,673	$ 12,050,244.61	$ 24,405,298.54	$ 36,455,543.16
Middlesex	61,758	$ 24,714,679.51	$ 49,100,824.53	$ 73,815,504.05
Monmouth	46,937	$ 19,975,494.62	$ 38,820,671.20	$ 58,796,165.82
Morris	37,309	$ 15,909,726.95	$ 34,701,956.95	$ 50,611,683.90
Ocean	46,899	$ 22,511,262.79	$ 44,089,772.41	$ 66,601,035.20
Passaic	37,376	$ 14,675,557.97	$ 27,682,502.10	$ 42,358,060.07
Salem	6,281	$ 2,774,115.27	$ 5,341,493.68	$ 8,115,608.95
Somerset	25,672	$ 10,367,158.50	$ 22,978,450.85	$ 33,345,609.35
Sussex	11,507	$ 4,818,806.19	$ 8,365,884.03	$ 13,184,690.22
Union	40,442	$ 16,231,862.79	$ 32,632,015.48	$ 48,863,878.27
Warren	8,895	$ 3,842,239.43	$ 7,170,376.60	$ 11,012,616.03
Total	**685,717**	**$ 285,389,756.43**	**$ 561,993,693.71**	**$ 847,383,450.13**

Source: Mao et. al., 2012

Economic Impacts of COVID-19

Economic recession has been a secondary impact of the coronavirus pandemic. To control the spread of the disease, businesses were forced to close and, eventually, to reopen on a phased plan that emphasized curbside pickup. In April 2020, New Jersey lost over 750,000 jobs, with nearly a million jobs lost in March and April 2020 combined. By August 29, 2020, over 1.5 million unemployment insurance claims were filed in New Jersey, which is almost 40% of New Jersey's workforce. Over the summer of 2020, there was a rebound in employment as coronavirus-related restrictions lifted, and more than 40% of the jobs lost were recovered. These statistics are current as of September 2020, as reported by the *New Jersey Department of Labor and Workforce Development's Economic Brief: New Jersey's Changing Economy and the Recent Impact of the COVID-19 Pandemic* (NJDLWD, 2021).

Ecosystems and Natural Assets

The type of virus outbreak will determine the severity of any effect on the environment. Diseases which are transmitted from man to animals or animals to man (zoonotic) may have agricultural impacts. Sixty percent of emerging infection diseases that affect humans are zoonotic, originating in animals. Livestock and poultry populations could also be at risk. If there is a high death toll due to pandemic, the necessity for mass burials of animals or humans may impact the environment as well (CDC, 2013).

Impact Analysis

Severity and Warning Time

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.

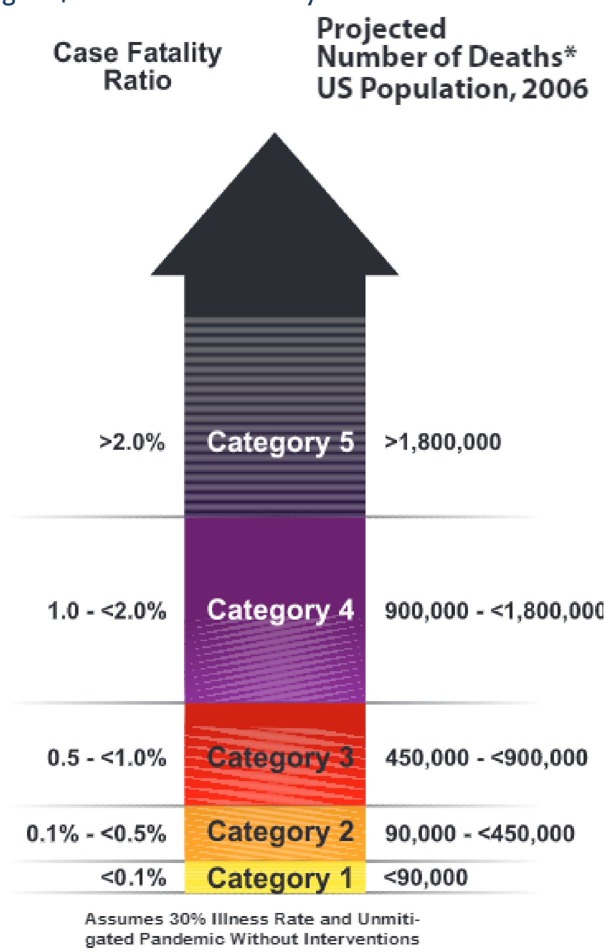
The severity and length of the next pandemic cannot be predicted; however, experts expect that its effect on the United States could be severe. Based on previous pandemics and without medications or vaccines available, it is estimated that a severe pandemic could cause almost 2 million deaths in the United States, more than nine million hospitalizations, and more than 90 million people ill (NJDOH, 2012). Pandemics are assigned to one of five discrete categories of increasing severity (Category 1 to Category 5) (NJDOH, 2017). Figure 4.22-6 illustrates the five categories of the PSI.

The H1N1 outbreak of 2009 is one case where the severity of a virus outbreak can easily be measured. The severity of illness from the 2009 H1N1 influenza flu virus has varied, with the gravest cases occurring mainly among those populations considered be at highest risk including children, the elderly, pregnant women, and patients with chronic diseases and reduced immune system capacity. While most people infected with H1N1 in 2009 have recovered without needing medical treatment, the virus resulted in some deaths. According to the CDC, about 70% of those who have been hospitalized with the 2009 H1N1 flu virus in the United States belonged to a high-risk population group (CDC, 2009).

Severity of the threat of pandemic is likely to increase. Factors, such as expanded rapid travel and evolution of resistance to medical treatments, are already changing the ways pathogens infect people, plants, and animals. Climate change accelerates may likely to work synergistically with many of these factors, especially in populations increasingly subject to massive migration and malnutrition (Harmon, 2010).

Pandemics are inevitable and arrive with very little warning. Air travel could hasten the spread of a new virus and decrease the time available for implementing interventions. Outbreaks are expected to occur simultaneously throughout much of the United States, preventing shifts in human and material resources. Warning time for any pandemic will depend on the origin of the virus and the amount of time needed to identify the virus.

Figure 4.22-6 Pandemic Severity Index



Source: NJDOH, 2012

Secondary Hazards

Secondary hazards related to pandemics are related to an outbreak's direct impact on the population of New Jersey. Directly affected will be the State's critical infrastructure and healthcare systems. Approximately 10% of the workforce will be absent at a given time during a pandemic. Without workers to fulfill key roles during a pandemic, secondary effects may include utility failures and other critical infrastructure disruptions.

Maintaining certain key functions is important to preserve life and decrease societal disruption during pandemic. Heat, 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. Critical infrastructure groups have a responsibility to maintain public health, provide public safety, transport medical supplies and food, implement a pandemic response, and maintaining societal functions. If these workers were absent due to pandemic outbreak, these systems will fail (Global Security, 2011).

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 (Global Security, 2011).

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. CDC models estimate increases in hospitalization and intensive care unit demand of more than 25%. Ventilators will be the most critical shortage if a pandemic were to occur (Global Security, 2011).