

5.4.8 Pandemic Disease

The following section provides the hazard profile (description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the pandemic disease hazard for the Allegany County Hazard Mitigation Plan (HMP).

5.4.8.1 Profile

Hazard Description

Pandemic diseases are large-scale disease outbreaks, defined by the ways in which the disease spreads, rather than the number of fatalities associated with it. A pandemic outbreak has several recognizable characteristics, including rapid, large-scale (potentially global) spread. Pandemics often cause overloaded healthcare systems, resulting in inadequate available medical supplies, medical supply shortages, and a disrupted economy and society (Flu.gov 2015). Pandemics typically result from infectious diseases. An infectious disease, as defined by the World Health Organization (WHO), is caused by pathogenic organisms (such as bacteria, viruses, fungus, or parasites) that spread from one person to another, whether through direct or indirect contact. Zoonotic disease, a type of infectious disease, occurs when animals transmit a disease to humans (WHO 2015). Although any infectious disease can reach pandemic levels, influenza (flu) has the greatest likelihood of causing the next pandemic.

Although other diseases may impact Allegany County, including foodborne illness, waterborne diseases, vaccine-preventable disease, and vector-borne diseases (tick-borne and mosquito-borne), this profile will focus on influenza, the Zika virus, and the Ebola virus.

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 flu should not be confused with seasonal flu. Seasonal flu is a less severe concern because of its regularity of occurrence and predictability. Table 5.4.8-1 lists key differences between pandemic and seasonal flus.

Table 5.4.8-1. Pandemic Flu vs. Seasonal Flu

Pandemic Flu	Seasonal Flu
Rare occurrence (three times in 20 th century).	Occurs annually and usually peaks in January or February.
People have little or no immunity because they have no previous exposure to the virus.	Usually some immunity built up from previous exposure.
Healthy people may be at increased risk for serious complications.	Usually only people at high risk, not healthy adults, are at risk of serious complications.
Healthcare providers and hospitals may be overwhelmed.	Healthcare providers and hospitals can usually meet public and patient needs.
Vaccine probably would not be available in the early stages of a pandemic.	Vaccine available for annual flu season.

Pandemic Flu	Seasonal Flu
Effective antivirals may be in limited supply	Adequate supplies of antivirals are usually available.
Number of deaths could be high (U.S. death toll during the 1918 pandemic was approximately 675,000).	Seasonal flu-associated deaths in the United States over 30 years ending in 2007 have ranged from about 3,000 per season to about 49,000 per season.
Symptoms may be more severe	Symptoms include fever, cough, runny nose, and muscle pain.
May cause major impact on the general public, such as widespread travel restrictions and school or business closings.	Usually causes minor impact on the general public; some schools may close and sick people are encouraged to stay home.
Potential for severe impact on domestic and world economy.	Manageable impact on domestic and world economy.

Source: Flu.gov 2015

Approximately 12,470 Americans died from swine influenza (H1N1) within a roughly 1-year period from April 2009 to April 2010 (Centers for Disease Control and Prevention [CDC] 2009). Between October 2015 and March 19, 2016, the number of deaths attributable to pneumonia and influenza only exceeded the epidemic threshold once. During Week 1 of the 2015/2016 flu season, 7.53 percent of deaths were attributable to pneumonia and flu, and the threshold was listed at 7.48 percent. An epidemic occurs when incidence rate exceeds expected rate but is not at the magnitude of a pandemic. CDC tracks this rate on a weekly basis during flu season, which typically runs from October to May of each year (CDC FluView 2016). A severe pandemic could change daily life for a time, including limitations on travel and public gatherings.

At the national level, the CDC’s Influenza Division has a long history of supporting 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).

Ebola Virus

Ebola, previously known as Ebola hemorrhagic fever, is a rare and deadly disease caused by infection with one of the Ebola virus strains. According to the CDC, the 2014 Ebola epidemic is the largest in history affecting multiple countries in West Africa. Two imported cases (including one death) and two locally-acquired cases in healthcare workers have been reported in the United States. CDC and partners are taking precautions to prevent the further spread of Ebola in the United States (CDC 2014).

Zika Virus

Zika is a flavivirus related to dengue, West Nile, yellow fever, and Japanese encephalitis. It was first isolated in 1947 from a Rhesus monkey in the Zika region of Uganda, and in 1968 from a human in Nigeria. Since that time, serologic evidence of human infections has been reported in several countries in tropical Africa and parts of Southeast Asia. In addition, Zika virus has been implicated as the cause of three mosquito-borne disease outbreaks outside of Africa and Asia, including Micronesia in 2007, French Polynesia in 2013, and the current outbreak in the Americas, which was first identified in May 2015 (New York State Department of Health [NYSDOH] 2016).

Infection associated with Zika virus is usually mild. About one in five people develop symptoms; hospitalization is rare. In cases where symptoms develop, they usually appear between two (2) and seven (7) days following the bite of an infected mosquito. Additionally, the virus has been reported as impacting women who are pregnant and their child. In Brazil and other countries, microcephaly has been reported in babies of mothers who were infected with Zika virus while pregnant. While more studies are needed to learn more about the risks of Zika virus infection during pregnancy, public health authorities are recommending that pregnant women, women actively trying to become pregnant, or women of child-bearing age take special precautions to reduce their risk of exposure to Zika virus (NYSDOH 2016).

Location

Pandemic events cover a wide geographic area and can affect large populations, which may include multiple countries or continents. The size and extent of an infected population depends on how easily the illness is spread, mode of transmission, and amount of contact between infected and uninfected individuals. Locations with higher-density populations are more susceptible to pandemic outbreaks, as the disease can be transmitted more easily. Additionally, vulnerable populations, especially the young and the elderly (who have weaker immune systems), are at greater risk for both contracting a disease and suffering fatal or severe consequences. Flu most frequently spreads through the air or by touch; when an infected person coughs, infected droplets go into the air or onto their hands, facilitating transmission of the disease to other people (WHO 2015).

Travel, tourism, and more mobile populations across the United States increase the vulnerability of people to importation and spread of infectious diseases. While Allegany County is not a major tourism destination within New York State or the Mid-Atlantic region, it still experiences some tourism to its borders. In 2016, Allegany County was one of the featured destinations for Fireball Run, a television show promoting America’s under-discovered places. This could lead to a greater increase in tourism. Additionally, Allegany County is within several hours of metropolitan areas including Pittsburgh, PA; Toronto, Canada; Rochester, NY; and New York City, NY. Allegany residents traveling on vacation to these cities may come into contact with diseases that they could bring back to Allegany County.

Disease outbreaks pose serious threats to the County and could strain the capacity of hospitals, clinics, and other healthcare facilities to respond to those seeking medical attention. Additionally, while Allegany County’s natural resources could lead to a greater risk of vector-borne diseases, it is not one of the counties in New York State that is home to mosquitos that can transmit Zika (NYSDOH 2016).

Extent

When a pandemic or disease outbreak occurs, WHO and other public health institutions begin tracking the disease outbreak, treatment, and other related information. Ebola was a significant pandemic concern for American public health officials in 2014 and 2015; however, the disease primarily remained in Africa. Should a pandemic take hold in the United States, the CDC and the National Institutes of Health (NIH) would be actively involved in managing the outbreak and treatment of the disease.

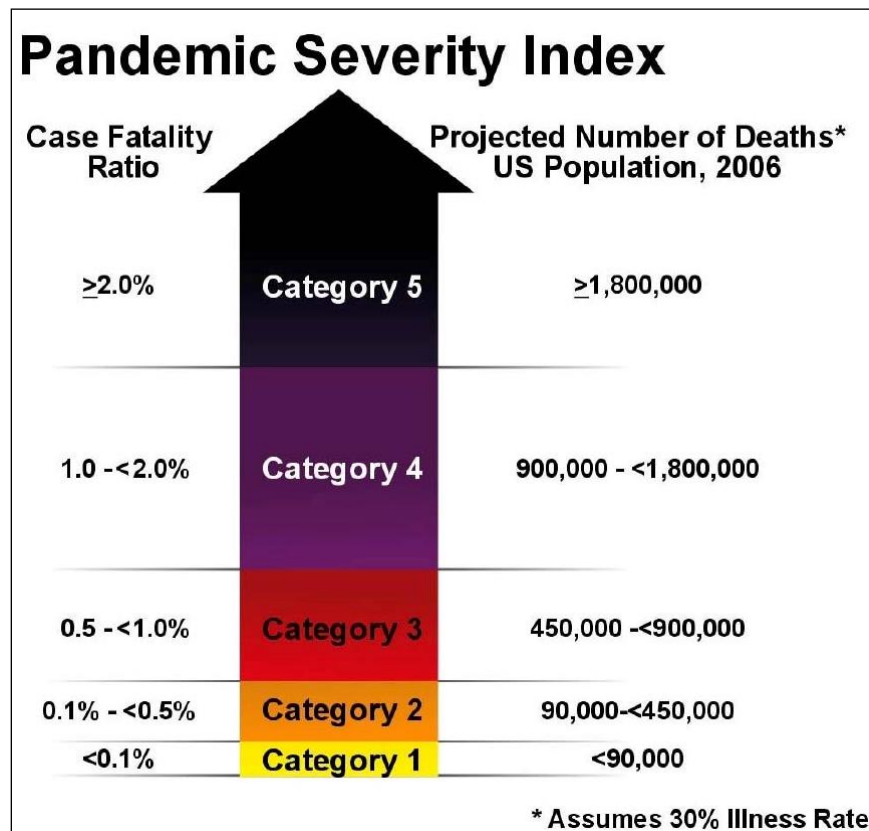
Influenza viruses with the potential to reach pandemic levels include the avian influenza A (H5N1) and avian influenza (H7N9) (CDC 2015). Several years ago, the swine influenza (H1N1) was of particular concern. H1N1 was first detected in people in the United States in April 2009. On June 11, 2009, WHO signaled that a pandemic of 2009 H1N1 flu was underway (CDC 2009).

Severity of a pandemic depends on a number of factors, including aggressiveness of the disease, ease of transmission, and factors associated with the impacted community (for example, access to medical care, demographic data, and population density). Advancements in medical technologies have greatly reduced the

number of deaths caused by influenza, the disease most likely to reach pandemic scale in Allegany County. Consequently, global effects of various influenza outbreaks have declined over the past century.

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 to one of five discrete categories of increasing severity (Category 1 to Category 5) (CDC 2015). Figure 5.4.8-1 illustrates the five categories of the PSI.

Figure 5.4.8-1. Pandemic Severity Index



Source: CDC 2015

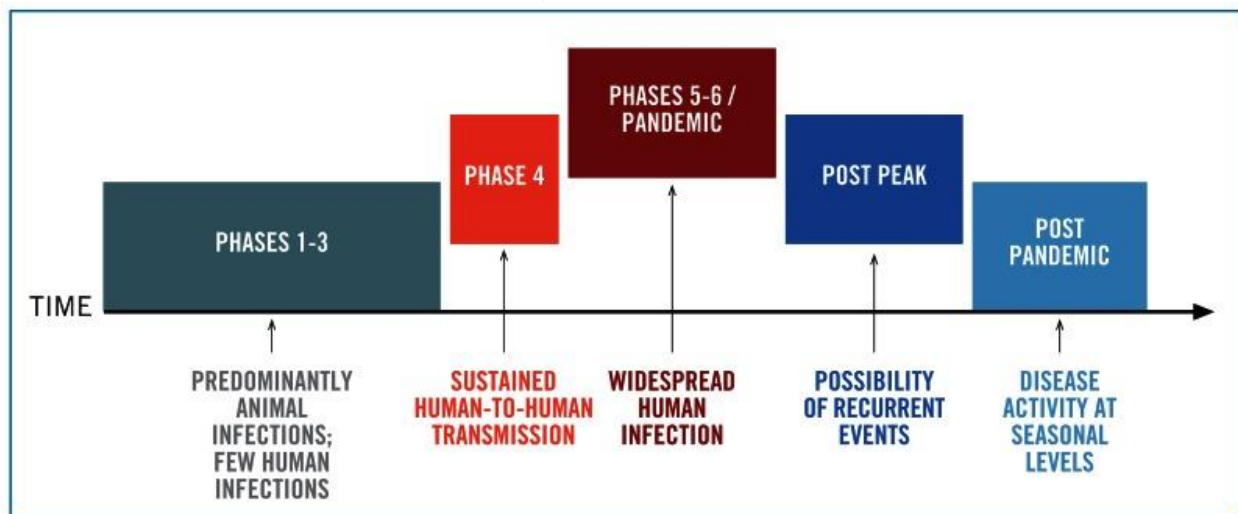
Additionally, WHO developed a series of pandemic phases in 1999 and revised these in 2005 and 2009 to provide a global framework and aid in pandemic preparedness and response planning. In addition to facilitating implementation of preparedness recommendations, the phases also help provide greater understanding of when an event is considered to have reached pandemic levels. The six phases are shown on Figure 5.4.8-2 below and are described as follows:

- Phase 1: No viruses circulating among animals have been reported among humans.
- Phase 2: An animal influenza virus circulating among domesticated or wild animals has caused known infection in humans and is now 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, such as close contact between an infected person and an unprotected caregiver.
- Phase 4: Verified human-to-human transmission of an animal or human-animal influenza reassortment virus is able to cause “community-level outbreaks.” The ability to cause sustained disease outbreaks in a community marks a significant upwards shift in the risk of a pandemic. Any country that suspects or has verified such an event should urgently consult with WHO so that the situation can be jointly assessed and a decision can be made by the affected country if implementation of a rapid pandemic containment operation is warranted. Phase 4 indicates a significant increase in risk of a pandemic but does not necessarily mean that a pandemic is a forgone conclusion.
- Phase 5: Human-to-human spread of the virus has been verified 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. Phase 6 indicates that a global pandemic is underway.

Conclusion of Phase 6 leads to the post-peak period, wherein pandemic levels decrease in most countries with surveillance capabilities. Despite a decrease in activity, countries still must be prepared for additional waves of the pandemic. Pandemic waves can be separated by a period of months, leading to a long recovery time to guarantee entry of the pandemic into the post-pandemic phase (WHO 2009).

Figure 5.4.8-2. Pandemic Influenza Phases



Source: WHO 2009

The NYSDOH and State Emergency Operation Center (EOC) also have their own activation levels in response to a pandemic event. Multiple waves of pandemic can be anticipated throughout the life cycle of an event.

Information regarding the various levels of pandemic stages categorized by New York State can be found at <https://www.health.ny.gov/diseases/communicable/influenza/pandemic/>.

Previous Occurrences and Losses

Several pandemic influenza outbreaks have occurred over the past 100 years. A list of worldwide pandemic events appears in Table 5.4.8-2. Deaths occurred in the United States as a result of Spanish flu, Asian flu, and Hong Kong flu outbreaks. Spanish flu (1918-1920) claimed 500,000 lives in the United States, with 350,000 cases reported in Pennsylvania. Most deaths resulting from Asian flu occurred between September 1957 and March 1958; within the United States, approximately 70,000 people died, and approximately 15 percent of the population of Pennsylvania was affected. The first cases of Hong Kong flu in the United States were detected in September 1968, with deaths peaking between December 1968 and January 1969 (Global Security 2009). As of August 2010, H1N1 was in a post-pandemic period.

Table 5.4.8-2. Previous Pandemic Outbreaks

Date	Pandemic/Subtype	Worldwide Deaths (Approx.)
1918-1920	Spanish Flu/H1N1	50 million
1957-1958	Asian Flu/H2N2	1.5-2 million
1968-1969	Hong Kong Flu/H3N2	1 million
2009-2010	Swine Flu/H1N1	> 18,000

Source: CDC 2010

Each year, cases of influenza have been reported in Allegany County. NYSDOH publishes weekly influenza surveillance reports online, which include a County breakdown for influenza activity. To date, Allegany County has had no reported cases of Ebola or Zika.

Between 1954 and 2016, New York State was included in one disease outbreak-related emergency (EM) declaration, classified as a virus threat, due to West Nile Virus impacting the State (EM-3155, May – November 2000). Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations. Allegany County was included in this declaration (Federal Emergency Management Agency [FEMA] 2016).

Additionally, Allegany County experienced a rabies outbreak in wild animals in 1902, a Hepatitis A outbreak in 1985, and a rubella outbreak in the late 1980s. The rabies outbreak led to infected livestock and economic impacts, while the Hepatitis A and rubella outbreaks primarily affected college students at the Alfred campuses.

Probability of Future Occurrences

Based on historical data, Allegany County is expected to undergo pandemic influenza outbreaks every 11 to 41 years. Exact timing of pandemic influenza outbreaks is unpredictable, and complete avoidance of these is impossible.

In Section 5.3, the identified hazards of concern for Allegany County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Partnership, the probability of occurrence for disease outbreaks in the County is considered “frequent” (likely to occur within 25 years, as presented in Table 5.3-3).

Climate Change Impacts

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

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Allegany County is part of Region 3, the Southern Tier. Some of the issues in this region that are affected by climate change include increasing number of extreme events and intense precipitation; loss of high-elevation plants, animals, and ecosystem types; decline in winter recreation; and decline in milk production (NYSERDA 2011).

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

Regional precipitation across New York State is projected to increase by approximately one (1) to eight (8) percent by the 2020s, three (3) to 12 percent by the 2050s, and four (4) to 15 percent by the 2080s. The results for future time periods are compared to the model results for the baseline period (1971 to 2000). By the end of the century, the greatest increases in precipitation are projected to be in the northern areas of the State (NYSERDA 2014).

Within Region 3, temperatures are estimated to increase between 3.6 °F to 7.1 °F by the 2050s, and 4.2 °F to 11.6 °F by the 2080s. Precipitation totals will increase between two (2) and 15 percent by the 2050s and by between three (3) and 16 percent by the 2080s. While annual precipitation and temperature projections are more certain than seasonal results, much of this additional precipitation is expected to occur during the winter months, which may result in greater annual snowfall in Allegany County.

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

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 diseases 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. Climate change may be likely to work synergistically with many of these factors, especially as rapid travel among humans and enhanced resistance among viruses and bacteria increase (Harmon 2010).

5.4.8.2 Vulnerability Assessment

To understand risk, a community must evaluate its assets that are exposed or vulnerable to the identified hazard. For disease outbreaks, all of Allegany County is considered exposed to the hazard. Therefore, all assets in the County, as described in the County Profile (Section 4), are exposed and potentially vulnerable. This section addresses the following factors to evaluate and estimate the potential impacts of pandemic disease outbreaks on the County:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact to (1) life, health, and safety of residents; (2) general building stock; (3) critical facilities; (4) economy; and (5) future growth and development
- Further data collections that will assist understanding this hazard over time

Overview of Vulnerability

Pandemic disease outbreaks are a significant concern to Allegany County, mainly due to its impact on public health and natural resources. Estimated losses are difficult to quantify; however, disease outbreaks can impact the County’s population and economy. Areas with a higher population density will have a higher exposure to disease outbreaks, especially those populations living in areas prone to mosquitoes and ticks. Additionally, vulnerable populations such as the young and elderly are considered at higher risk.

Data and Methodology

Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and the potential impacts associated with this hazard.

Impact on Life, Health, and Safety

The entire population of Allegany County is vulnerable to the pandemic disease outbreak hazard. Depending on characteristics of the disease/virus, certain population groups can be at higher risk of infection.

Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. Additionally, regarding seasonal influenza, about 60 percent of hospitalizations and 90 percent of flu-related deaths occur among people 65 and older. However, during the relatively recent H1N1 pandemic, 90 percent of hospitalizations and 87 percent of H1N1-related deaths occurred in people younger than 65. As with seasonal flu, people with underlying health conditions faced a much higher probability of contracting H1N1. Schools, convalescent centers, and other institutions are highly conducive to faster transmission of pandemic diseases (CDC 2010).

Impact on General Building Stock and Critical Facilities

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

Impact on Economy

The impact that pandemic disease outbreaks have on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with the activities and programs implemented to conduct surveillance and address disease outbreaks have not been quantified in available documentation. Instead, activities and programs implemented by the County to address this hazard are described below, all of which could impact the local economy.

Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across Allegany County. Any areas of growth could be potentially impacted by the pandemic disease outbreak hazard because the entire planning area is exposed and vulnerable.

Additional Data and Next Steps

For the HMP Update, any additional information regarding historic costs incurred to conduct surveillance or prevent, treat, and eradicate disease outbreaks may help with quantifying losses, given a margin of uncertainty. These data will be developed to support future revisions to the plan. Mitigation efforts could include building on existing New York State, Allegany County, and local efforts.