

4.3.11 Pandemic and Infectious Disease

Pandemics are large-scale disease outbreaks, defined by the way in which a 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 causing (1) overloaded healthcare systems; (2) inadequate medical supplies; (3) medical supply shortages; and (4) a disrupted economy and society (CDC 2015). Pandemics typically result from infectious diseases. An infectious disease, as defined by the World Health Organization (WHO), is caused by pathogenic organisms (e.g., bacteria, viruses, fungus, or parasites) that spread from one person to another, whether through direct or indirect contact. Zoonotic disease is a type of infectious disease that occurs when animals transmit a disease to humans (WHO 2015). Although any infectious disease can reach pandemic levels, the 2019 Coronavirus (COVID-19), is the current pandemic affecting most countries.

This section describes the location and extent, range of magnitude, past occurrence, future occurrence, and vulnerability assessment for the pandemic and infectious disease hazard for the Dauphin County Hazard Mitigation Plan (HMP).

4.3.11.1 Location and Extent

Pandemic events cover a wide geographic area and can affect large populations, which can include multiple countries or continents. 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 are expelled into the air or onto their hands, facilitating transmission of the disease to other people (WHO 2015).

When a pandemic or disease outbreak occurs, WHO and other public health institutions begin tracking the disease outbreak, treatment, and more. COVID-19 is a global health threat and, as of the date of publication of this HMP update, continues to be a significant pandemic concern for American public health officials in the United States as well as the rest of the world. The Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH) is actively involved in managing the outbreak and treatment of the disease.

The first human cases of COVID-19 were first reported by officials in Wuhan City, China, in December 2019. In the United States, community transmission of COVID-19 was first detected in February 2020. By mid-March, all 50 states and four U.S. territories had reported cases of COVID-19. As of December 4, 2020, a total of 13,822,249 cases and 272,525 deaths related to COVID-19 have been reported in the United States (CDC 2020). Dauphin County has had a total of 8,618 cases of COVID-19 and 224 deaths as of December 4, 2020 (CDC 2020).

In addition to COVID-19, the possibility of a pandemic flu outbreak is also of concern. 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. Human cases of H1N1 were first detected in the United States in April 2009. On June 11, 2009, WHO signaled that a pandemic of 2009 H1N1 flu was underway. On August 10, 2010, the H1N1 influenza virus moved into the post-pandemic period (CDC 2009).

4.3.11.2 Range of Magnitude

Severity of a pandemic disease depends on a number of factors, including the aggressiveness of the disease, ease of transmission, and factors associated with the impacted community (e.g., access to medical care, demographic data, and population density). Advancements in medical technologies have greatly reduced the number of deaths caused by influenza, which was considered a disease most likely to reach pandemic scale in Pennsylvania. Consequently, global effects of various influenza outbreaks have declined over the past century. High-risk populations considered more vulnerable to various pandemic diseases are described in the vulnerability assessment presented in Section 4.3.11.5.

COVID-19 is currently the biggest pandemic threat to the county because (1) it is easily spreadable, (2) infected people can be asymptomatic, and (3) the virus is new and is not yet fully understood.

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 4.3.11-1 lists key differences between pandemic and seasonal flu.

Table 4.3.11-1. Seasonal Flu vs. Pandemic Flu

Pandemic Flu	Seasonal Flu
Rarely happens (three times in 20 th century).	Happens annually and usually peaks in January or February.
People have little or no immunity because they have no previous exposure to the virus.	Sufferers usually have some immunity built up from previous exposure.
Healthy people may be at increased risk for serious complications.	Usually only people in vulnerable populations, 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 is available for annual flu season.
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: CDC 2015

Approximately 12,470 Americans died from H1N1 within a roughly 1-year period from April 2009 to April 2010 (CDC 2010). Between October 2014 and late May 2015, 6.4 percent of deaths were attributable to pneumonia and influenza—below the epidemic threshold of 6.6 percent (an epidemic occurs when the incidence rate exceeds the expected rate but is not at the magnitude of a pandemic) (CDC 2016).

In 2014, the CDC updated the Pandemic Intervals Framework (PIF), which describes the progression of an influenza pandemic using six intervals. The framework is used to guide planning for an influenza pandemic and provides recommendations for risk assessment, decision-making, and action in the United States. Descriptions of CDC pandemic intervals are presented in Table 4.3.11-2.

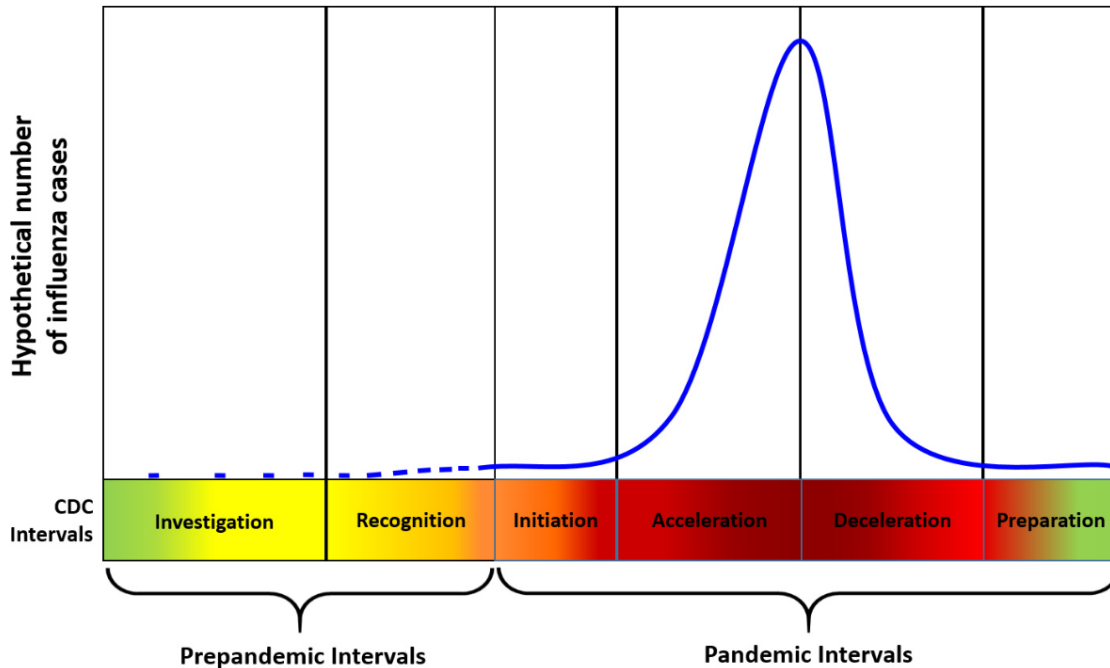
Table 4.3.11-2. CDC Pandemic Intervals Framework

Interval	Description
Interval 1: Investigation of cases of novel Influenza A virus infection in humans	When novel Influenza A viruses are identified in people, public health actions focus on targeted monitoring and investigation. This can trigger a risk assessment of that virus with the Influenza Risk Assessment Tool (IRAT), which is used to evaluate if the virus has the potential to cause a pandemic.
Interval 2: Recognition of increased potential for ongoing transmission of a novel Influenza A virus	When increasing numbers of human cases of novel Influenza A illness are identified and the virus has the potential to spread from person to person, public health actions focus on control of the outbreak, including treatment of sick persons.
Interval 3: Initiation of a pandemic wave	A pandemic occurs when people are easily infected with a novel Influenza A virus that has the ability to spread in a sustained manner from person to person.
Interval 4: Acceleration of a pandemic wave	The acceleration (or “speeding up”) is the upward epidemiological curve as the new virus infects susceptible people. Public health actions at this time may focus on the use of appropriate non-pharmaceutical interventions in the community (e.g. school and child-care facility closures, social distancing), as well the use of medications (e.g. antivirals) and vaccines, if available. These actions combined can reduce the spread of the disease and prevent illness or death.
Interval 5: Deceleration of a pandemic wave	The deceleration (or “slowing down”) happens when pandemic influenza cases consistently decrease in the United States. Public health actions include continued vaccination, monitoring of pandemic Influenza A virus circulation and illness, and reducing the use of non-pharmaceutical interventions in the community (e.g. school closures).
Interval 6: Preparation for future pandemic waves	When pandemic influenza has subsided, public health actions include continued monitoring of pandemic Influenza A virus activity and preparing for potential additional waves of infection. It is possible that a second pandemic wave could have higher severity than the initial wave. An influenza pandemic is declared ended when enough data shows that the influenza virus, worldwide, is similar to a seasonal influenza virus in how it spreads and the severity of the illness it can cause.

Source: CDC 2014

Conclusion of Interval 6 leads to the post-peak period, where the pandemic is declared ended when enough data shows that the influenza virus, worldwide, is similar to a seasonal influenza virus. 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 interval (CDC 2014). Figure 4.3.11-1 shows the six intervals of pandemic influenza described by the CDC.

Figure 4.3.11-1. Preparedness and Response Framework for Novel Influenza A Virus Pandemics



Source: CDC 2014

COVID-19 Symptoms and Prevention Measures

Symptoms may appear 2 to 14 days after exposure to the virus. Symptoms of COVID-19 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. Anyone can have mild to severe symptoms but older adults and people who have severe underlying medical conditions seem to be at higher risk for developing more serious complications. Ways to prevent the spread of COVID-19 include social distancing, staying home whenever possible and avoiding crowds, taking care of personal health (by resting and staying hydrated), staying in touch with family doctor or healthcare professional, and avoiding public transportation. COVID-19 has caused a major impact on the general public, such as widespread travel restrictions and school and business closings. COVID-19 has the potential for severe impact on domestic and world economy (CDC 2020). On December 11, 2020, the U.S. Food and Drug Administration issued the first emergency use authorization for a vaccine for the prevention of COVID-19 in individuals 16 years of age and older. The emergency authorization allows the Pfizer-BioNech COVID-19 vaccine to be distributed in the United States (U.S. Food and Drug Administration 2020).

4.3.11.3 Past Occurrence

Several pandemic influenza outbreaks have occurred worldwide over the past 100 years, as listed in Table 4.3.11-3. Deaths occurred in the United States as a result of Spanish Flu, Asian Flu, and Hong Kong Flu outbreaks. In the United States, about 675,000 people died while 22 million caught the Spanish Flu (1918-1920). Pennsylvania, one of the states that was hit the hardest, faced over 60,000 deaths (Shetty 2018). 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. The COVID-19 virus has no conclusion data, as it was first reported in 2019.

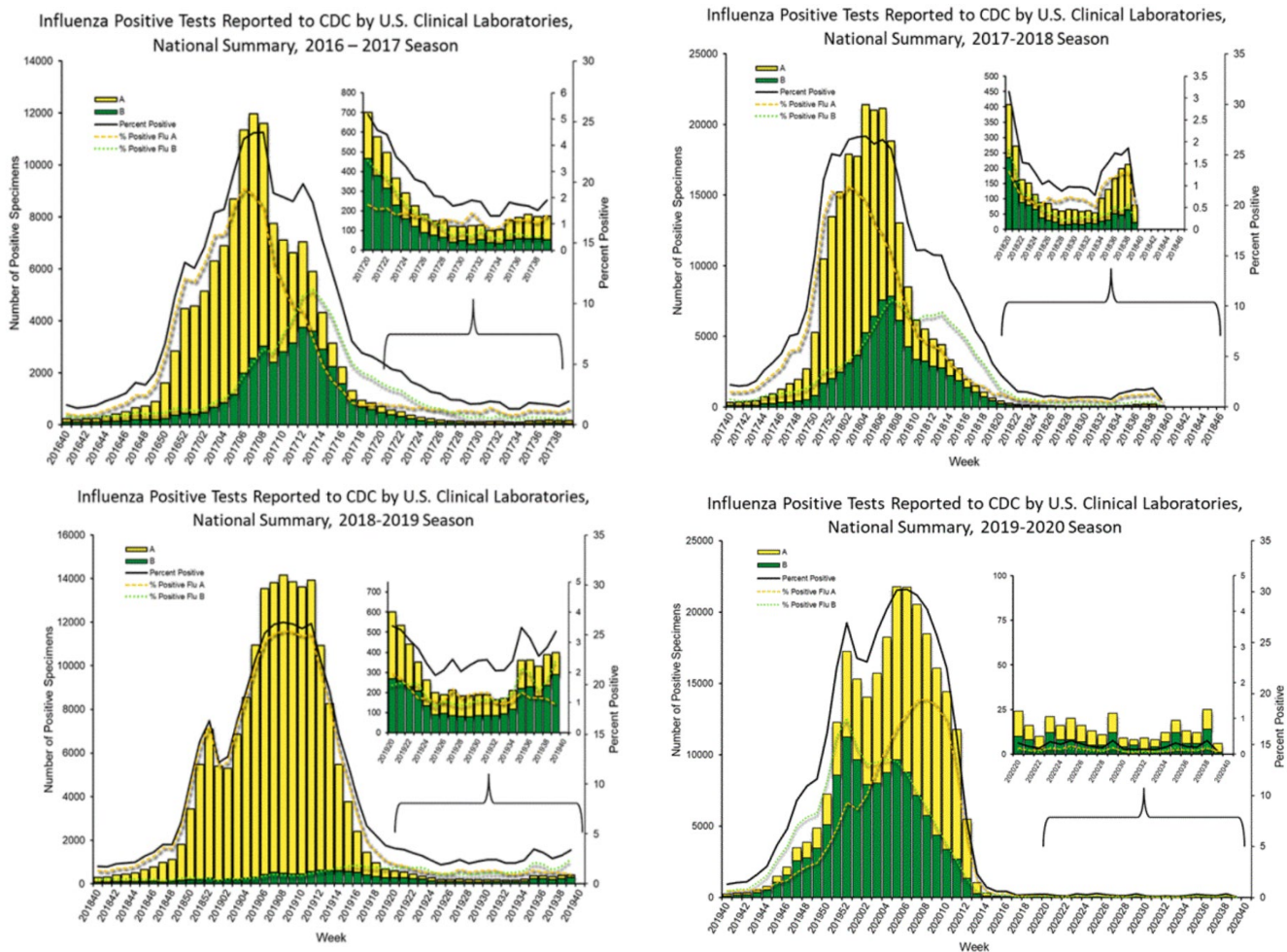
Table 4.3.11-3. Previous Pandemic Outbreaks

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
2019- ongoing	COVID-19	1.5 Million of 12/10/2020

Source: CDC 2010, WHO 2020

Epidemiologists and public health officials consistently track the rate of influenza or influenza-like illnesses (ILI) to monitor potential pandemic threats. This also allows them to provide annual data on ILI seasonal outbreaks. Figure 4.3.11-2Figure 4.3.11-1 below shows the national number of cases of ILI during 2016-2017, 2017-2018, 2018-2019, and 2019-2020 season, distinguishing each type of ILI (Influenza A and Influenza B) with a unique color. As shown below, Influenza A is more prevalent each season, with the most positive cases in the 2019-2020 season.

Figure 4.3.11-2. ILI Cases in the United States, 2016-2020 Seasons



Source: CDC Weekly Flu 2017, 2018, 2019, and 2020

4.3.11.4 Future Occurrence

Based on historical data, Dauphin County is expected to undergo pandemic influenza outbreaks every 11 to 41 years. Because COVID-19 is so new, the likelihood of future occurrence is unknown. Exact timing of pandemic influenza outbreaks is unpredictable and complete avoidance is impossible. Future occurrence is considered *possible*, as defined by the Risk Factor Methodology probability criteria (shown in Table 4.4-1 in Section 4.4 of this HMP).

4.3.11.5 Vulnerability Assessment

Depending on the characteristics of the disease or virus, certain population groups can be at higher risk of infection than others. About 60 percent of hospitalizations related to seasonal flu and 90 percent of flu-related deaths occur among people 65 and older. However, during the 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 face a much higher probability of contracting H1N1. Schools, convalescent centers, and other institutions are highly conducive to faster transmission of pandemic diseases (CDC 2010).

Table 4.3.11-4 shows the demographic change in children and the elderly from 2000 through 2018 in Dauphin County. Dauphin County has seen population increases in both individuals under 18 years of age as well as individuals over 65 years of age. Therefore, Dauphin County is more vulnerable to both seasonal influenza and pandemic influenza, such as the H1N1 pandemic.

Table 4.3.11-4. Demographic Trends for Vulnerable Populations

Vulnerable Population	2000 Census	2010 Census	2018 Census Estimate	2000 to 2018 Change
Under 18 years	61,113	62,228	62,354	1,241
Under 65 years	215,954	231,206	230,253	14,299
65 years and over	35,844	35,844	46,818	10,974

Source: U.S. Census Bureau 2020