SECTION 4. RISK ASSESSMENT

4.9 Health Risks

2018 HMP Update Changes

- The hazard profile has been enhanced to include a detailed hazard description, location, extent, previous occurrences, and probability of future occurrence (including climate change).
- Information has been added on dengue fever, chikungunya, rat lungworm, water-borne illnesses and Legionnaires' disease. The mumps have been removed from the risk assessment due to the low severity of this disease it is not likely to result in a state of disaster.
- Information of health risk events that occurred in the State of Hawai'i from January 1, 2012 through December 31, 2017, were researched for this 2018 HMP Update.
- Information has been added on the World Health Organization (WHO) pandemic phases.
- A qualitative vulnerability assessment was developed to summarize impacts to state assets, critical facilities, the population, general building stock, environmental resources and cultural assets from health risks.
- Discussion of future changes that may impact State vulnerability has been added.

4.9.1 Hazard Profile

The State is vulnerable to natural hazards. Health-related impacts have occurred with natural hazards, especially where water quality is compromised. Climate-related extreme events have resulted in gastrointestinal illness, respiratory problems (especially from wildfires), and vector-borne outbreaks, such as dengue fever. It is important to consider potential health-related disasters, and to factor these considerations in disaster risk reduction efforts and hazard mitigation planning. These and other risks to human health that occur as a result of natural hazard events are discussed throughout Section 4 (Risk Assessment). This section focuses on the infectious disease, pandemic flu, and bioterrorism hazards that may impact the State of Hawaii's resident and visitor populations. A discussion on volcanic emissions and volcanic ash, which are hazardous to human health, are discussed in Section 4.14 (Volcanic Hazards); human health impacts related to contaminated flood water is discussed in Section 4.7 (Event-Based Flood).

Hazard Description

The following provides a brief description of the health risks of concern in the State of Hawai'i. It should be noted that this is not a comprehensive assessment of all health risks that may impact Hawaii's residents and visitors, but it simply intended as a brief overview of risks and vulnerability in the State.

Vector-Borne Disease

Vector-borne diseases account for more than 17% of all infectious diseases worldwide. Vectors are living organisms that can transmit infectious diseases between humans or from animals to humans (WHO 2017). The most common known disease vector is mosquitoes and other biting insects.

Dengue Fever

Dengue fever is a viral disease that is transmitted by *Ades* mosquitos (Hawai'i DOH 2015). In the Western Hemisphere, the *Ades aegypti* mosquito is the most common transmitter of the virus, while the 2001 dengue outbreak in Hawaii was caused by the *Ades albopictus* mosquito (CDC 2009). Symptoms appear 5 to 7 days after being bitten by a mosquito that is infected with the virus, and include high fever, rash on the arms and legs, body aches, and headache. Dengue fever is not transmitted directly from one person to another, however mosquitos can transmit the disease by biting an infected individual and becoming a carrier of the virus, capable of infecting other people.

Chikungunya

Chikungunya is a viral disease spread by being bitten by the same types of mosquitos as those that carry Dengue fever and Zika (Hawai'i DOH 2016). Symptoms include fever, severe joint pain, headache, muscle pain, joint swelling, nausea, vomiting, redness around the eyes, and rash. Individuals who have been infected generally recover in 1 to 2 weeks. It cannot be passed from one person to another. Though there are no vaccines or specific treatment procedures, death from chikungunya is not common.

Zika

Zika is a viral illness that can be spread to people through mosquito bites. It was first discovered in a monkey in the Zika forest of Uganda in 1947. Before 2015, outbreaks were reported in areas of Africa, Southeast Asia, and the Pacific Islands. In 2015, outbreaks of Zika were reported in Brazil and other South American countries. As of April 2018, there have been no cases of locally-acquired Zika infections in Hawai'i (Hawai'i DOH 2018).

People are infected with Zika virus primarily through the bite of an infected *Aedes aegypti* or *Aedes albopictus* mosquito, which are the same mosquitoes that spread dengue fever and chikungunya. The mosquito becomes infected when it bites a person who is already infected with the Zika virus. It takes a week or more for the Zika virus to replicate in the mosquito; then the mosquito can transmit the virus to a new person (Hawai'i DOH 2018).

Rat Lungworm

Rat lungworm is a disease caused by a parasitic nematode (roundworm parasite) called *Angiostrongylus cantonensis* and is a disease that can affect the brain and spinal cord (Hawai'i DOH 2017). The adult form of *A. cantonensis* is only found in rodents. However, infected rodents can pass larvae of the worm in their feces. Snails, slugs, and certain other animals (including freshwater shrimp, land crabs, and frogs) can become infected by ingesting these larvae; these are considered intermediate hosts. Humans can become infected with rat lungworm if they eat (intentionally or otherwise) a raw or undercooked infected intermediate host, thereby ingesting the parasite. Sometimes people can become infected by eating raw produce that contain small infected snails or slugs. Rat lungworm is not spread person-to-person.

Rat lungworm can cause a rare type of meningitis (eosinophilic meningitis). While some infected people may not have any symptoms or only have mild symptoms, others infected may develop symptoms that are much more

severe. Symptoms usually start 1 to 3 weeks after exposure to the parasite, but have been known to range anywhere from 1 day to as long as 6 weeks after exposure. There is no specific treatment for the disease and symptoms usually last between 2 to 8 weeks (Hawai'i DOH 2017).

Water-Borne Disease

Water-borne diseases are conditions caused by pathogenic micro-organisms that are transmitted in water. Disease can be spread from swimming, washing, drinking water, or eating food exposed to infected water.

Leptospirosis

Leptospirosis is a bacterial disease that affects humans and animals. It is caused by bacteria of the genus *Leptospira*. Humans can get leptospirosis through direct contact with urine from infected animals or through water, soil, or food contaminated with their urine. In humans it causes a wide range of symptoms, and some infected persons may have no symptoms at all. Symptoms of leptospirosis include high fever, severe headache, chills, muscle aches, and vomiting, and may include jaundice (yellow skin and eyes), red eyes, abdominal pain, diarrhea, or a rash. If the disease is not treated, the patient could develop kidney damage, meningitis (inflammation of the membrane around the brain and spinal cord), liver failure, and respiratory distress. In rare cases death occurs. Many of these symptoms can be mistaken for other diseases. Leptospirosis is confirmed by laboratory testing of a blood or urine sample.

Leptospirosis occurs worldwide but is most common in temperate or tropical climates. It is an occupational hazard for many people who work outdoors or with animals, for example, farmers, sewer workers, veterinarians, fish workers, dairy farmers, or military personnel. It is a recreational hazard for campers or those who participate in outdoor sports in contaminated areas and has been associated with swimming, wading, and playing in contaminated steams and waterfalls. The incidence is also increasing among children who live in urban areas.

Legionnaires' Disease

Legionnaires' disease is caused by *Legionella*, a type of bacterium found naturally in freshwater environments. *Legionella* becomes a health concern when it grows and spreads in human-made building water systems not properly maintained (CDC 2016). Legionnaires' disease is a very serious type of pneumonia caused by inhalation of small droplets of water containing the bacteria. Early symptoms of Legionnaire's disease include muscle aches, headaches, loss of appetite, tiredness, and cough; and are often followed by chills, diarrhea, and high fever. Symptoms of Legionnaire's disease can be difficult to distinguish form other cases of pneumonia and typically begin to occur 5 to 6 days after exposure to *Legionella* bacteria, however can occur anywhere between 2 and 10 days (Hawai'i DOH 2016).

Outbreaks of Legionnaires' disease are often associated with large or complex water systems, like those found in hospitals, hotels, and cruise ships. The disease is typically treated with antibiotics that kill the bacteria in the body. Most people who get sick with Legionnaires' disease require hospital treatment and make a full recovery. However, about 1 out of 10 people who get Legionnaires' disease die from the infection (CDC 2016).

Pandemic Flu

There are numerous types of pandemic flu and the strains of the virus continue to mutate and change. Novel influenza represents the emergence of new subtypes of the influenza virus that have not previously been identified and represent a class of viruses against which there is little to no pre-existing immunity or vaccine. Each

county has been required to develop procedures for dealing with this type of "disaster" threat. While many of the recommendations include social distancing, it is important to plan for the eventuality of a pandemic to determine how to maintain businesses and services to prevent economic collapse in addition to the health threats.

H5N1 or Avian Flu

Avian influenza is an infection caused by avian influenza (bird flu) viruses. These influenza viruses occur naturally among birds. Wild birds worldwide carry the viruses in their intestines, but usually do not get sick from them. However, avian influenza is very contagious among birds and can make some domesticated birds, including chickens, ducks, and turkeys, very sick and kill them.

Infected birds shed influenza virus in their saliva, nasal secretions, and feces. Susceptible birds become infected when they have contact with contaminated secretions/excretions or with surfaces that are contaminated with secretions/excretions from infected birds. Domesticated birds may become infected with avian influenza virus through direct contact with infected waterfowl or other infected poultry, or through contact with surfaces (such as dirt or cages) or materials (such as water or feed) that have been contaminated with the virus.

Scientists are concerned that H5N1 virus one day could be able to spread easily from one person to another. Because these viruses do not commonly infect humans, there is little or no immune protection against them in the human population. If H5N1 virus were to gain the capacity to spread easily from person-to-person, an influenza pandemic (worldwide outbreak of disease) could begin. For more information about influenza pandemics, see the U.S. Government webpage dedicated to the flu virus at www.flu.gov.

H1N1 or Swine Flu

During the period from 2007 to 2010, there were incidents of swine flu (H1N1) outbreaks in the State of Hawai'i. Of particular concern is the 2009 outbreak of H1N1 Pandemic that resulted in several deaths from the flu. Similar to other outbreaks, the virus spread with international travelers. This is particularly concerning for the State since it is among the most remote places on the planet, and it will be difficult to sustain livelihoods should the State lose connection with the United States mainland or international travel.

Bioterrorism

The Center for Disease Control (CDC) defines a bioterrorism attack as the deliberate release of viruses, bacteria, or other germs (agents) used to cause illness or death in people, animals, or plants. These agents are typically found in nature, but it is possible that they could be changed to increase their ability to cause disease, make them resistant to current medicines, or to increase their ability to be spread into the environment. Biological agents can be spread through air, water, or food. Terrorists may use biological agents because they can be extremely difficult to detect and may not cause illness for several hours to several days. Some bioterrorism agents, such as the smallpox virus, can be spread from person-to-person and some, such as anthrax, cannot.

LOCATION

The State's central location between the continental United States and Asia, with hundreds of thousands of visitors each month, leads to considerable exposure to and potential for the introduction of new or re-emerging health risks. Health events can cover a wide geographic area and can affect large populations, including any of the Hawaiian Islands. 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 outbreaks, as disease can be transmitted easier between people due to their proximity to infected individuals. Additionally, facilities that group vulnerable populations, such as day cares, schools, senior centers and medical facilities may also contribute to disease transmission.

EXTENT

Severity of a disease depends on a number of factors. These include the size of the vector populations (the population size and distribution of insects or animals capable of transmitting a disease, e.g. mosquito-borne illnesses), 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). High-risk populations considered more vulnerable to various health hazards are described in the vulnerability assessment.

The magnitude of an infectious disease outbreak is also related to the ability of the public health and medical communities to stop the spread of the disease. Most disease outbreaks that cause catastrophic numbers of deaths are infectious in nature, meaning that they are spread from person to person. The public health and health care providers in Hawai'i routinely utilize known and established methods to reduce morbidity and mortality from infectious disease. However, the capacity of the health care system is limited and varies from county to county.

The severity of the impact of influenza depends on the nature of the outbreak- that is, if it is pandemic flu or seasonal flu. 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 4.9-1 lists key differences between pandemic and seasonal flus.

Table 4.9-1. Seasonal Flu Versus Pandemic Flu

Seasonal Flu	Pandemic Flu
Happens annually and usually peaks in January or February.	Rarely happens (three times in 20th century).
Usually some immunity built up from previous exposure.	People have little or no immunity because they have no previous exposure to the virus.
Usually only people at high risk, not healthy adults, are at risk of serious complications.	Healthy people may be at increased risk for serious complications.
Healthcare providers and hospitals can usually meet public and patient needs.	Healthcare providers and hospitals may be overwhelmed.
Vaccine available for annual flu season.	Vaccine probably would not be available in the early stages of a pandemic.
Adequate supplies of antivirals are usually available.	Effective antivirals may be in limited supply.
Seasonal flu-associated deaths in the U.S. over 30 years ending in 2007 have ranged from about 3,000 per season to about 49,000 per season.	Number of deaths could be high (U.S. death toll during the 1918 pandemic was approximately 675,000).
Symptoms include fever, cough, runny nose, and muscle pain.	Symptoms may be more severe.
Usually causes minor impact on the general public; some schools may close and sick people are encouraged to stay home.	May cause major impact on the general public, such as widespread travel restrictions and school or business closings.
Manageable impact on domestic and world economy.	Potential for severe impact on domestic and world economy.

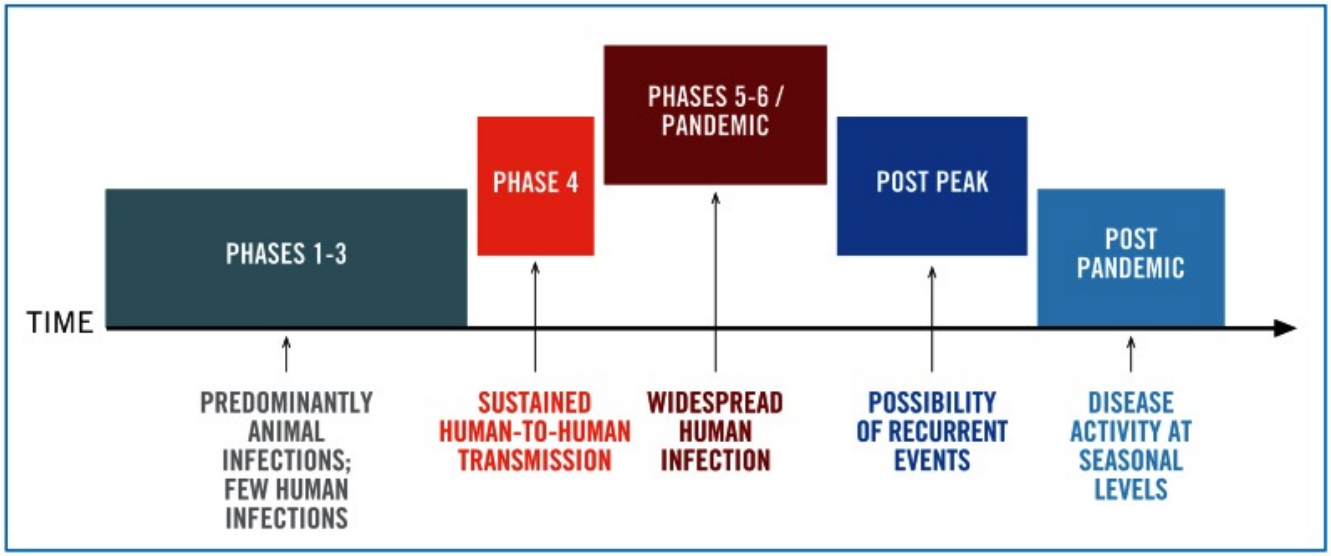
Source: www.flu.gov 2015

WHO described a series of pandemic phases in 1999 (revised 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 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 novel influenza 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 novel influenza 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 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:** There has been 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. Phase 6 indicates 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 4.9-1 shows the six phases of pandemic influenza described by WHO.

Figure 4.9-1. Pandemic Influenza Phases



Source: WHO 2009

Health-related events, such as pandemics, are inevitable and arrive with very little warning. Identification, containment and treatment of pandemic outbreaks and even cases of bioterrorism are further complicated by the highly transient nature of the tens of thousands of daily visitors, the State's isolation, and the associated delay in importing the necessary medical supplies, medicines and resources (Kaua'i County 2015).

Air travel could increase the speed of spread of a new virus and decrease the time available for implementing interventions. Passengers travelling through the State's airports are monitored for disease by airline crews, the federal Transportation Security Administration (TSA) staff, and State health officials. The Centers for Disease Control and Prevention (CDC) staff responds to reports of illnesses on airplanes, cruise, and cargo vessels at international ports of entry. The CDC operates a quarantine station at the Daniel K. Inouye International Airport in Honolulu. The station's jurisdiction includes all ports in Hawaii, Guam, American Samoa, the Freely Associated States and the Commonwealth of the Northern Mariana Islands (CDC 2017). The CDC .

Outbreaks are expected to occur simultaneously throughout much of the United States, potentially limiting the availability of Federal and or inter-state assistance in the form of human and material resources that usually occur in response to other disasters. Warning time for a pandemic influenza outbreak will depend on the origin of the virus, virus incubation time (the duration required before an individual begins to develop symptoms of an illness), and the amount of time needed to identify the virus.

Previous Occurrences and Losses

The Hawai'i State Department of Health Disease Outbreak Control Division (DOCD) maintains case records on a wide variety of health risks. In 2015, the most recent comparison data available (Hawai'i DOH 2016a), State data shows 7,477 cases of influenza, representing the highest number of cases of any health agent tracked by the DOCD. The State also saw 215 cases of dengue fever in 2015, and 54 in 2016 (238 of these cases were in the outbreak on Hawai'i County). Table 4.9-2 shows significant health events that have occurred in the State between

2012 and 2017. Records of health risks prior to 2012 as documented in the 2013 HMP are provided in Appendix X.

Table 4.9-2. Health Risk Events in the State of Hawai'i, 2012 to 2017

Date(s) of Event	Event Type	Counties Affected	Description
September 11, 2015 to March 17, 2016	Dengue Fever Outbreak	Hawai'i	264 confirmed cases of dengue fever. 238 were residents, and 26 were visitors.
2017	Mumps Infection	Honolulu, Hawai'i, Kaua'i, Maui	There were 760 confirmed cases of mumps in 2017. 602 were in Honolulu County, 106 were in Hawai'i County, 49 were in Kaua'i County, and 3 were in Maui County.

Sources: Hawai'i DOH 2016b, 2017a, 2017d

Table 4.9-3 shows the number of reported cases of notifiable diseases (diseases for which statistics are provided to the CDC to monitor national public health) in Hawai'i. For this 2018 HMP Update, this includes dengue fever, chikungunya, leptospirosis, Zika, mumps, and influenza.

Table 4.9-3. Reported Cases of Notifiable Diseases in the State of Hawai'i

Disease	2012	2013	2014	2015	2016	2017
Dengue Fever	7	10	14	209	54	15
Chikungunya	Not reported	Not reported	22	6	4	1
Zika	Not reported	Not reported	Not reported	6	22	9
Leptospirosis	11	17	24	22	34	26
Mumps	1	0	1	4	10	760
Influenza (lab-confirmed)	2,811	5,086	5,382	7,477	5,129	9,053

Source: Hawai'i DOH 2018

FEMA Disaster Declarations

Health risks and vulnerabilities are factored into the consideration for issuance of a FEMA Disaster Declarations in the event of any emergency for any hazard. There have been no FEMA Disaster Declarations for health risks and vulnerabilities in the State of Hawai'i.

DHHS Public Health Emergency Declarations

Public Health Emergency Declarations are made at the discretion of the Secretary of the U.S. Department of Health and Human Services (DHHS) under Section 319 of the Public Health Services (PHS) Act. There have been no DHHS Public Health Emergency Declarations issued for the State of Hawai'i.

Probability of Future Hazard Events

The best predictor of the probability of future health risks is the State's history of such events. The State can expect several cases of mosquito-borne illnesses each year, with periodic outbreaks (15 years passed between the last two outbreaks of dengue fever). The popularity of the State of Hawai'i as a tourist destination will also drive future health events. The Honolulu International Airport's number of annual passengers has risen in each

of the last five years (Hawai'i Department of Transportation 2017); currently serving 2.5 million international passengers annually (CDC 2017). The Kahului Airport serves 156,000 each year, and Keahole International Airport serves 30,000 each year. Additionally, 67,000 cruise and cargo ship passengers and crew visit the State each year (CDC 2017). As the number of people travelling into and out of the State increases, so too does the possibility of disease transmission.

Additionally, infrastructure and environmental quality have significant contributions to public health. Deterioration of either man-made or environmental systems can result in adverse impacts to public health, increasing the State's vulnerability to public health emergencies.

Impacts of Climate Change on Future Probability

The full extent of the link between climate change and health risks is still being investigated. However, it appears that there is a link between warmer temperatures and increased vector-borne diseases (CDC 2016). Warmer temperatures mean longer warm seasons, and shorter and milder winters, resulting in higher insect production rates. In addition, infectious agents in water will spread on a wider scale as more flooding results from climate change. Floodwaters that remain in small, still pools after flooding has subsided can provide additional habitat for mosquito reproduction. This leads to more mosquitos that can carry diseases such as dengue fever, chickungunya, and Zika. However, research into modeling vector-borne diseases and climate change has yielded varying results (Bernstein 2015).

Studies at the University of Hawai'i at Mānoa and at the East-West Center have demonstrated links between climate variability and El Niño Southern Oscillation (ENSO) cycles with outbreaks of dengue fever. Seventy percent of emerging infectious diseases that affect humans are zoonotic; meaning they originate in animals. Many factors lead to the emergence of zoonotic diseases such as habitat destruction, human encroachment and climate change. Climate and habitat change can expand the movement of vectors into new geographic areas. West Nile Virus, chikungunya and the dengue virus have already expanded their geographical footprint due to these changes (Wang and Crameri 2014).

4.9.2 Vulnerability Assessment

No spatial data was available to assess health risk vulnerability. Therefore, a qualitative assessment was conducted.

Assessment of State Vulnerability and Potential Losses

This section discusses statewide vulnerability of exposed state assets (state buildings and state roads) and critical facilities to health risks.

State Assets

State buildings and roads are not exposed or vulnerable to this hazard. While the actual structures will not be impacted, the effect of absenteeism on state workers will impact the delivery of state services. The impacts and potential losses from this hazard are largely economic and are dependent on the type, extent, and duration of the illness.

Procedures for continuity of government operations will need to be implemented during a public health emergency, such as a pandemic. A CDC model suggests that approximately 10% of the workforce will be ill or caring for an ill family member at the peak of a pandemic disease (United States Department of Health and Human Services 2005). According to Census data, in 2010 there were 51,214 government employees in the state (DBEDT 2010). A 10% absentee rate would mean that a shortage of 5,121 government employees would impact state facilities and thus the services they provide.

Critical Facilities

A pandemic outbreak could result in a temporary closure to ports of entry to the State impacting the State's 'just in time' supply management system and the import and export of goods and vital resources.

Similar to state assets, the actual critical facilities will not be impacted, however the effect of absenteeism on workers will impact the delivery of critical services. Healthcare workers in public health and in direct patient contact are essential during a health risk event. The impacts and potential losses from this hazard are largely economic and are dependent on the type, extent, and duration of the illness. According to Census data, in 2010 there were 50,096 healthcare employees in the state (DBEDT 2010). A 10% absentee rate would mean that a shortage of 5,001 healthcare employees would impact critical health-related facilities and thus the services they provide.

In addition, an increase in hospitalization and emergency room visits may take place as a result of a health risk, creating a greater demand on these critical facilities, their staff and resources. The CDC's model estimates increases 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).

Assessment of Local Vulnerability and Potential Losses

This section provides a summary of statewide exposure and potential losses to population, general building stock, environmental resources and cultural assets. The County of Kauai was the only county to include health risks in their local HMP.

Population

The entire population, residents and visitors, of the State of Hawai'i is exposed and potentially vulnerable to any of the health risks discussed above. Health risks can cover a wide geographic area and can affect large populations. 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 outbreaks, as the disease can be transmitted more easily.

Vulnerable populations, especially the young, pregnant women, the elderly and those who are already ill or who have weaker immune system, are at greater risk for both contracting a disease and suffering fatal or severe consequences. Refer to Section 3.0 (State Profile) which summarizes demographics by county which are exposed to health risks. According to Hawai'i Health Survey, the percentage of uninsured Hawaiians for 2012 was 4.6 percent compared to 15.4 percent nationally. In Hawai'i, the percentage of males and females that are uninsured is 5.4 and 3.8 respectively and the below poverty level uninsured is 14.5 percent.

Using the recent statewide outbreak of mumps as a point of reference in terms of impacts, it has been confirmed in both children and adults, both vaccinated and unvaccinated. According to Hawai‘i State Law, a person who contracts this highly contagious disease should not be allowed to attend school, work or travel for nine days after the start of swollen salivary glands (DOH 2016). As noted in the previous occurrences subsection above, the City and County of Honolulu has the highest number of confirmed cases to date followed by the County of Hawai‘i.

In addition to the physical impacts of a health risk event, mental health impacts should also be considered. Whether from a natural disaster, pandemic or bioterrorism event, research indicates there is a causal connection between disaster events and mental health consequences (Galea et al 2004). Mental stress and anxiety may be experienced by both the population directly impacted or first responders. Associated economic impacts include health care costs and lost productivity at work or in the home.

General Building Stock and Economy

The general building stock is not exposed or vulnerable to the identified health risks of a disease outbreak as a disease affects only persons susceptible to the illness. However, the general building stock may contribute to the transmission of disease during an outbreak as a result of various design conditions (i.e. homes without window screens are more vulnerable to the spread mosquito-borne diseases), while aging infrastructure of the State’s building stock could play a significant role in the spread of water-borne illness, such as Legionnaire’s disease.

According to the Hawai‘i Tourism Authority, tourism is the largest single source of private capital into the State’s economy. A health risk such as a pandemic would have a significant impact on the economy. As a point of reference, the State’s tourism peaked in 2007 with an average of $35 million in visitor spending per day. However, in 2008, tourism declined due to various economic and social factors, one of which was the H1N1 pandemic. In 2008 the total daily expenditure for the State’s tourism decreased to $31 million (Hawai‘i Tourism Authority 2014).

Environmental Resources and Cultural Assets

The type of health risk will determine the severity of any effect on the environment. A bioterrorism attack may not only impact the general population, but animals and plants as well because agents can spread through the air, water or in food. Livestock and poultry populations may become infected due to a health risk impacting the local economy and available food sources. Bacteria, pathogens, and other pollutants introduced into the local hydrology of the State’s water-cycle can also have long-term impacts on water resources, further contributing to adverse public health impacts.

Future Changes that May Impact State Vulnerability

Understanding future changes that impact vulnerability in the State can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The State considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

As the population characteristics of the State change, there will be more people in age categories that are more susceptible to infectious diseases (elderly and young populations). The ability to withstand impacts will depend on preparedness of the State as well as local communities.

In addition, the continued robust international tourism industry in Hawai‘i makes it more vulnerable to health risks. Air travel could increase the speed of spread of a new virus and decrease the time available for implementing interventions. Economically, a pandemic or another disease outbreak would likely have a significant impact on tourism as people decrease their travel. Scares of infectious disease and pandemic flu could collapse the tourism economy. Following the September 11, 2001, terrorism event in New York City, the State of Hawai‘i experienced significant declines in tourism to the State of Hawai‘i. A similar scenario is likely following a pandemic or disease outbreak (Hawai‘i State HMP 2013).