**4-7: Infectious Disease**

The Vermont Department of Health defines an infectious disease as one that is caused by micro-organisms, such as bacteria, viruses or parasites. A vector-borne disease is an infectious disease that is transmitted to humans by blood-feeding arthropods, including ticks, mosquitoes and fleas, or in some cases by mammals (e.g. rabies).

According to the Vermont Department of Health, infectious disease dynamics depend on a range of factors, including: land use, human behavior, climate, efficacy of healthcare services, population dynamics of vectors, population dynamics of intermediate hosts and the evolution of the pathogens themselves.

Many of these diseases require continuous monitoring, as they present seasonal threats to the general population. An epidemic emerges when an infectious disease occurs suddenly in numbers that are in excess of normal expectancy. Infectious disease outbreaks put a strain on the healthcare system, can cause continuity of operations challenges for local businesses, impact the economy, and interrupt daily life for everyone within a community. These outbreak incidents are a danger to emergency responders, healthcare providers, schools, and the public. Examples include Coronavirus 19 (COVID-19), influenza (e.g. H1N1), pertussis, West Nile virus, and many other diseases.

Upon consideration of five climate and health reviews, The Vermont Department of Health has separated vector-borne and other infectious diseases into five threat categories (Table 38). More details on this classification system and the diseases can be found in the 2016 Vermont Climate Health Report[[1]](#footnote-2).

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| **Table 38: Threat Categories of Vector-Borne and Other Infectious Disease** | |
| **Threat Classification** | **Disease** |
| Diseases already present in Vermont that may be exacerbated by climate change | West Nile Virus |
| Eastern Equine Encephalitis |
| Lyme Disease |
| Anaplasmosis |
| Babesiosis |
| Hard Tick Relapsing Fever |
| Jamestown Canyon Virus |
| Tularemia |
| Powassan Virus |
| Diseases that may spread to Vermont even without contribution of climate change, whose spread to and transmission of Vermont could be exacerbated by climate change | St. Louis Encephalitis |
| Western Equine Encephalitis |
| La Crosse Encephalitis |
| Ehrlichiosis |
| Alpha-gal Syndrome |
| Rocky Mountain Spotted Fever |
| Diseases with vectors that may spread to Vermont by the end of the century under a higher emission scenario | Dengue |
| Zika Virus |
| Chikungunya Virus |
| Disease that have competent vectors or may in the future have competent vectors in Vermont, but are unlikely to become established in Vermont despite a vector presence | Yellow Fever |
| Malaria |
| Chagas Disease |
| Rift Valley Fever |
| Diseases that may be present in Vermont or may spread to Vermont in the future but whose link with climate changes expected in Vermont is tenuous | Batonellosis |
| Rabies |
| Hanta Virus |
| Leptospiriosis |
| Plague |
| Valley Fever |
| Anthrax |
| Q Fever |
| *Source: Vermont Department of Health* | |

Infectious Disease History

Pandemic influenza, considered to be a global outbreak, spread quickly around the world and was observed in 1918, 1957, 1968 and in 2009 with the novel H1N1 strain. The 2009 H1N1 outbreak, though not considered a serious threat to Vermont, still affected some Vermonters. The great influenza epidemic of 1918 killed millions worldwide and would likely cause hundreds to thousands of deaths in Vermont should a similar outbreak occur today. It is anticipated that a more serious strain of the usual flu will occur some year and that vaccines might not be ready in time to combat rapid spread.

Lyme disease continues to pose a significant and growing threat to Vermonters. Cases have been tracked by the Vermont Department of health for several decades (Figure 60). Habitat shifts and changes in climate continue to create favorable conditions for pathogen-carrying ticks to proliferate.

The COVID-19 pandemic beginning in 2020 led to a complete disruption of daily life within Vermont. A state of emergency was issued on March 13th, 2020 by Governor Phil Scott to help ensure Vermont had the resources necessary to respond to the COVID-19 public health emergency. In the following weeks, a series of executive orders were issued restricting activities likely to result in transmission or use up valuable medical resources. Some of these included restricting visitor access to long term care facilities, suspending in person PreK-12 education, closure of bars and restaurants, suspension of elective and non-essential medical surgeries, interstate travel restrictions, and limits on non-essential gatherings. COVID-19 restrictions stayed in effect until June 14th, 2021 when 80% of Vermont’s eligible population (those 12 and older) received at least one dose of COVID-19 vaccine, in accordance with the State’s Vermont Forward Plan[[2]](#footnote-3). As of [insert date], there were a total of 152,618 cases and 929 deaths due to COVID-19 in Vermont[[3]](#footnote-4). Lessons learned include systems vulnerability to novel pandemics, and the need for planning for future disease threats. The State of Vermont will continue to develop infectious disease mitigation strategies to better prepare for future outbreaks.

Infectious Disease Trends

According to the Centers for Disease Control (CDC), the number of reported cases of vector-borne infectious disease more than tripled between 2004 and 2016[[4]](#footnote-5).

Infectious diseases that fall into the first threat classification category, such as West Nile Virus (WNV) and Eastern Equine Encephalitis (EEE), maintain a presence in New England. Access to long periods of heat (see: Extreme Heat) and abundant precipitation (see: Inundation Flooding & Fluvial Erosion) provide the perfect habitat for these mosquito-borne diseases. Perhaps the most significant trend in infectious disease vulnerability in Vermont is that of tickborne diseases, including Lyme disease, anaplasmosis, and babesiosis. For example, Vermont ranked highest in the United States for Lyme disease incidence in 2019, though this ranking changes annually. Additionally, Vermont’s increase in forest cover could provide a more suitable habitat for ticks and their hosts, which may lead to further spread of Lyme disease in the State. Outdoor workers and recreationalists are especially vulnerable to tickborne diseases, as exposure to ticks is greater. Tickborne diseases are more prevalent in the southern and western halves of the State, as the warmer climate contributes to longer periods of tick activity.

[Fig 60, VT yearly cases of lyme reported]

[Fig 61, reported lyme disease cases map (1996, 2018)]

An incident that contaminates water supplies or results in people eating spoiled food could have significant health implications. Animals infected with the rabies virus present localized threats. The potential for infection of Vermont’s commercial animal population with foreign animal diseases such as, foot and mouth disease, brucellosis, or highly pathogenic avian influenza viruses could cause widespread economic problems. A health threat could also potentially result from an act of bio- or agro-terrorism.

Given increasing trends for global travel, several diseases not typically observed in Vermont may be introduced by infected travelers. For example, the Zika virus, transmitted from infected mosquitoes to humans, received international attention during an outbreak in 2015 and persists today. The CDC and Vermont Department of Health recommend pregnant women, or women attempting to become pregnant, not travel to areas of the world where Zika is present[[5]](#footnote-6), as the virus can pass from mother to fetus, causing potentially significant birth defects.

The Steering Committee considered the probability of a plausibly significant infectious disease outbreak event to be Likely, with the major impacts felt by people, followed then by major direct and indirect impacts to the economy.

Vulnerability

People

People who are most vulnerable to infectious disease include immunocompromised individuals, elderly and young populations, and healthcare workers. Due to weakened immune systems or compounding factors of other illnesses or stressors these populations are at heightened risk of infection and death.

Pandemic can also impact people in ways other than infection; increased transmission rates through certain vectors can cause disruption to daily life and mental health consequences due to disruptions and fear of infection. Infections can quickly overburden available beds within healthcare facilities. During the COVID-19 pandemic the U.S. faced rapidly escalating demand due to staff availability and burnout, limited space and supplies, and shortages of personal protective equipment (PPE) for health care providers. Insufficient intensive care unit (ICU) bed availability and increasing community case burden have also been implicated as risk factors for poor COVID-19 patient outcomes[[6]](#footnote-7). Densely populated areas were often centers of outbreaks, where even the largest hospitals can be overwhelmed. Even with fewer infections, rural areas may be less equipped for pandemic response due to lack of bed space, staffing and other resources.

Built Environment

The daily operations of society can be upended by pandemics. This can include shifts in demand of certain resources such as fuel, with less people commuting to work due to stay at home orders. Lockdowns resulted in an increase in the demand for delivery services, bolstering those sectors while brick and mortar stores experienced a reduction in revenue as people opted for E-commerce [[7]](#footnote-8). Utility services also needed to adapt to changing demand patterns in a remote world. Increases in waste generation from homes due to lockdown and social distancing measures coupled with panic retail buying at the beginning of the pandemic were observed. An increase in the use of single use products to contain the spread of COVID-19 saw an additional load placed on waste management services[[8]](#footnote-9). With office work shifting more towards remote options during the pandemic, utilities and telecom providers saw increased demand for high-speed internet in order to maintain usual business operations. On the other hand, as a higher percentage of the workforce tele-commuted the demand for office space declined significantly, resulting in businesses revisiting their leases and rentals of office space. A decline in the demand for physical office space can impact the market for new commercial construction. The long-term implications of changing demand are still unfolding, as businesses expand post-COVID and cautiously step into a new workplace norms[[9]](#footnote-10).

Natural Environment

The natural environment provides habitat for many vectors of disease that impact human, livestock, and pet populations. Species such as mosquitoes, ticks, and fleas can host infectious diseases harmful to humans such as malaria, Lyme disease, and plague[[10]](#footnote-11), so environments that favor these vectors also increase the potential for disease outbreaks. Coronaviruses that cause MERS and SARS originated in animals and made the jump to humanity. However, the origin of the recent COVID-19 pandemic has not been conclusively identified at this time[[11]](#footnote-12). Diseases that are able to jump from wildlife to humans can also jump from humans to wildlife. This was seen with the infection of whitetail deer and other species of animals with COVID-19, though no deer in Vermont tested positive for the virus[[12]](#footnote-13).

Economy

Infectious disease and large-scale pandemics can cause disruptions to daily life and economic activities that can negatively impact the local and statewide economy. Following COVID-19 and Governor Scott’s emergency order on March 13th, 2020, the service sector in Vermont experienced 77% of all unemployment claims. High unemployment increased the incidence of households falling behind on rent or mortgage payments. Vermont saw statewide revenue shortfalls with the tourism industry taking a particularly hard hit[[13]](#footnote-14). The economic impact of the pandemic was felt most keenly by those without financial safety nets. Low-income Vermonters were less likely to have remote work options. A UVM study reported that 16% of Vermonter’s were concerned about their ability to pay for necessities like food and rent, 19% used savings to cover monthly spending and 10% said they had reduced ability to buy fresh fruit and vegetables[[14]](#footnote-15). Pandemic response actions such as lockdowns and social distancing orders worked well to slow the spread of disease, but economic impacts on the livelihoods of thousands of Vermonters were of significant magnitude and duration.

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| CLIMATE CHANGE  Some infectious diseases that fall into the first threat classification category identified in Table 38 (i.e. currently present in Vermont and which may be exacerbated by climate change) are increasing in incidence in New England. For example, with both temperature (see: Extreme Heat) and precipitation (see: Inundation Flooding & Fluvial Erosion) expected to increase in Vermont, mosquito vector activity will likely increase, as well as the vector’s period of activity, lengthening seasonal risk of mosquito-borne diseases. For example, between 1964 and 2010, Eastern Equine Encephalitis (EEE) cases have become more common in New England, though they remain constant in the southeastern states.  Perhaps the most significant trend in infectious disease vulnerability in Vermont is that of Lyme disease, which ranked the highest incidence in the nation in 2019. The Vermont Department of Health reports that the number of reported cases of Lyme disease have increased dramatically over the last decade, and with shortening winters, the potential for infection through tick bites continues to grow. Additionally, Vermont’s increase in forest cover could provide a more suitable habitat for ticks and their hosts, which may lead to further spread of Lyme disease in the State. Outdoor laborers and recreationalists are especially vulnerable to tick bites that may cause Lyme disease. Lyme disease is reported more commonly in the southern and western halves of the State, where warmer climate may contribute to longer periods of vector activity.  Climate change can increase the range of diseases and their vectors and increase rates of infection. Warmer temperatures allow more diseases and their vectors to venture further north where harsh winters temperatures previously inhibited expansion. |

Infectious Disease Current Capabilities and Mitigation

The Vermont Department of Health regularly updates its website with news, events and reports that users can utilize in consideration of infectious disease mitigation[[15]](#footnote-16). VDH has ongoing preparedness activities to respond to infectious disease outbreaks.

Given the Steering Committee’s “Likely” ranking of infectious disease outbreak in the hazard assessment, largely in part due to the recent COVID-19 pandemic which greatly impacted Vermont and highlight areas in health and public safety policy and infrastructure that could be improved on. There are no actions in this plan that specifically address infectious disease mitigation. However, several strategies and actions are included under the goal of creating a common understanding of – and coordinated approach to – mitigation planning and action. These focus on data acquisition and dissemination of all hazards, as well as increasing public awareness of the hazards that Vermont faces. Increasing community resiliency through awareness and provided support in the form of funding and technical assistance.

We recognize the possibility that FEMA guidelines will change during the five years when this plan will be in effect, allowing for broader use of Public Assistance and/or Hazard Mitigation Assistance funding with respect to mitigating public health system vulnerabilities and resiliency in responding to infectious disease outbreaks and similar public health emergencies. In the event of such increased flexibilities, Vermont will endeavor to take advantage of the opportunities provided.

1. http://www.healthvermont.gov/sites/default/files/documents/2017/01/CHPR\_Sept7\_2016.pdf [↑](#footnote-ref-2)
2. https://governor.vermont.gov/covid19response [↑](#footnote-ref-3)
3. https://coronavirus.jhu.edu/region/us/vermont [↑](#footnote-ref-4)
4. https://www.cdc.gov/vitalsigns/pdf/vs-0518-vector-borne-H.pdf [↑](#footnote-ref-5)
5. https://wwwnc.cdc.gov/travel/page/zika-information [↑](#footnote-ref-6)
6. https://www.forbes.com/sites/williamhaseltine/2021/07/26/overwhelmed-us-hospital-systems-a-look-into-the-future/?sh=83b675b7c62a [↑](#footnote-ref-7)
7. https://www.census.gov/library/stories/2022/04/ecommerce-sales-surged-during-pandemic.html#:~:text=According%20to%20the%20most%20recent,to%20%24815.4%20billion%20in%202020. [↑](#footnote-ref-8)
8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7447614/ [↑](#footnote-ref-9)
9. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9670738/ [↑](#footnote-ref-10)
10. https://www.cdc.gov/ncezid/dvbd/index.html#:~:text=Vectors%20are%20mosquitoes%2C%20ticks%2C%20and,around%20for%20thousands%20of%20years. [↑](#footnote-ref-11)
11. https://www.niaid.nih.gov/diseases-conditions/origins-coronaviruses [↑](#footnote-ref-12)
12. https://www.biorxiv.org/content/10.1101/2023.04.25.538264v1 [↑](#footnote-ref-13)
13. https://ljfo.vermont.gov/assets/Subjects/Economic-Impacts-on-Vermont/52498f2da7/Economic-Fallout-of-the-COVID-19-Pandemic-in-New-England.pdf [↑](#footnote-ref-14)
14. https://www.uvm.edu/news/story/uvm-survey-pandemics-impact-falling-disproportionately-lower-income-groups [↑](#footnote-ref-15)
15. http://www.healthvermont.gov/disease-control [↑](#footnote-ref-16)