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Apeksha Dighe

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PH 460: Concepts in Climate Change & Public Health Preparedness

Heidi Honegger Rogers, DNP, RN, FNP-BC, APHN-BC
Mary Pat Couig, PhD, MPH, RN, FAAN
Joanna Katzman, MD, MPH

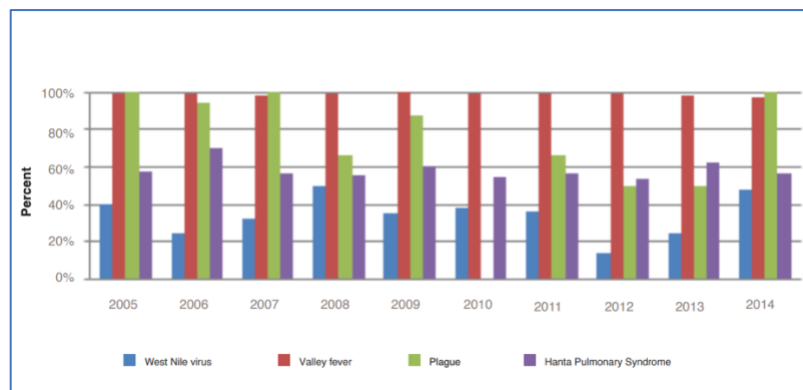
The Critical Issue of Vector-Borne and Respiratory Disease (Part 1)

Since the 1950's, the carbon dioxide levels in the Earth's atmosphere, along with greenhouse gasses have been steadily increasing, causing a rise in global temperatures, warming oceans, and melting ice sheets at an alarming rate. Regions around the world are starting to experience the various effects of this climate change including prolonged seasons, extreme weather including droughts, flooding, wildfires and hurricanes, and rising sea levels (Shaftel,2020).

These environmental changes will give way to emerging infectious disease, and more widespread respiratory disease which thrive with changes brought forth from climate change. Specific environmental changes include prolonged seasons, loss of biodiversity, tolerable winters, deforestation, and increased contact with livestock – events that also lead to climate change (Lustgarten,Abrahm,2020). Prolonged seasons and milder winters allow disease carrying vectors such as mosquitos and ticks to survive in the environment for longer, and thus, allow more opportunities for infection. Due to deforestation and degrading environments, rodents and larger mammals are making their way into human populated areas and bring disease into communities. In addition, changing the environment to sustain agriculture and livestock for a growing human population promotes the spread of disease (Lustgarten, Abrahm,2020). The seemingly science fiction notion of bacteria thawing and becoming once again infectious is also a real possibility. For example, in 2016, in Siberia, permafrost melted three times more than usual. Scientists in this region have evidence to believe that corpses buried under the permafrost layer a little over 100 years ago have the potential to cause new infections as this permafrost melts and is carried into a nearby river (Hawken, 2016). Various studies show that globally every year, about five new infectious disease emerge. According to the CDC, seventy five percent of new viruses spread to humans through animals. With the continuation of these practices, new disease will continue to emerge and spread (Lustgarten, Abrahm, 2020).

In New Mexico specifically, in sixth place for fastest warming in the United States trends are already observed for milder winters, droughts, and a drier environment. These conditions are expected to worsen which will give way to increased risks for disease. This is due to the environment becoming less hospitable to rodents and other disease spreading vectors, which will migrate towards human populated areas for food and shelter (Kolivras, Korine N., and Ndreu C. Comrie, 2004). The southwestern part of the United States, encompassing New Mexico, Arizona, Nevada, and Utah, are particularly prone to hantavirus, plague, dengue fever and valley fever, and West Nile virus as these diseases are spread by rodents and mosquitoes.

The figure below depicts the incidence of these disease over an eleven-year period, in the Southwest region of Arizona, California, Colorado, Nevada, New Mexico, and Utah. (Roach, 2017).



Valley fever, which is caused by a fungus that is present in soil, can be spread by wind and dust during dust storms. In addition to spreading infectious disease, fine dust also contributes to respiratory illnesses, heart attacks, and respiratory disease such as COPD (Chronic Obstructive Pulmonary Disease) and asthma (Engelthaler, 1999). Heavy metals in the dust further perpetuate these diseases. With a drier, dustier climate, we can expect rates of these disease to increase. We can conclude that globally and specifically to the Southwestern region of the United States, many variables part of the climate have a large impact on the emergence and spread of disease (Achakulwisut, Pattanun, et al, 2019). As the climate continues to warm and the Southwest region is expected to experience long drought periods, and a dustier, dry environment leading to higher rates of lung disease, infectious disease, along with significant health impacts.

Expected Impacts of Increasing Vector-Borne and Respiratory Disease Due to Climate Change (Part 2)

The implications of climate change across the United States will impact everything from fisheries and farms, to infrastructure such as railroads, highways, and electric grids, and importing and exporting prices. (Paskus, 2018). In the Southwest United States, an area already accustomed to experiencing fires, heat waves and drought, these disasters will continue to increase in frequency and severity. Along with these problems, as mentioned above, infectious disease and respiratory problems will also be on the rise. A specific population that is susceptible to infectious disease and increasing respiratory disease are the Native American Tribes living in the Southwest area. According to the Fourth National Climate Assessment, Vol. II, Native Americans, with 1.5 million people in the Southwest, are the most susceptible population to these problems brought on by climate change as native lands have restricted water and other resources, and higher exposure to dust and particles (Gonzales, 2018).

The indigenous population has disproportionately high rates of disease such as obesity, liver disease, Type II Diabetes, COPD and asthma. Rates of hospitalization for this population is already 20 to 40 times higher for zoonotic disease than it is for the general population in the United States. Zoonotic disease, meaning disease that are contracted from animals either directly or indirectly, are increased in tribal populations compared to the general U.S. population. This is because some traditional tribal practices involve animals and animal products, creating opportunities for infection between human and animals (Norton-Smith, 2016). All of these factors coupled together are reasons as to why the Native American population in the Southwest is more susceptible to climate change related difficulties than other populations.

Many people on the Navajo Nation are struggling to hold on to traditional roles and practices of herding livestock for financial means, as owning cattle is an important aspect of the Navajo culture and supplements many individuals' incomes. (Hueffer et al. 2013). Navajo Nation members are growing more and more concerned about losing their traditional practices and culture, as droughts are causing rivers and water bodies to dry up. The spread of disease in the Navajo Nation is of particular concern and may give insight into how and why future disease outbreaks may spread. COVID-19, a novel coronavirus has ravaged Navajo Nation, and these high rates of infection and mortality have been explained by poorer overall health compared to the general U.S. population, along with the lack of access to resources. In addition, social circles are tight and many family members often live under one roof or live across the street. This makes social distancing difficult. In May 2020, the Navajo Nation had the highest infection rate of COVID-19 in the entire country. (Katol, 2020).

Historical atrocities towards the Native population, along with socioeconomic and ecological problems, isolation, discrimination, poverty and cultural barriers have set Native American populations in the Southwest up for failure. Already high rates of respiratory disease, worry over losing one's culture, contact with livestock, and the lack of access to resources are already a recipe for disaster. With the

climate changing in addition, and bringing on more problems, planning for public health emergencies and adversities will be beneficial for the future for this population.

Mitigation and Preparation Strategies to Combat Vector-Borne and Respiratory Disease (Part 3)

To prepare for the adverse impacts of rising infectious disease and respiratory disease due to climate change in New Mexico, and for the Navajo reservation, several measures will be required on state and local levels.

There are several measures which are applicable on large scale national levels, as well as on state levels. Vector borne disease are projected to increase in the Southwest due to climate change, and although there are not widespread methods to control vectors such as mosquitos in large urban areas, there are strategies that mitigate illness outbreaks. Increasing and improving methods of surveillance in the field for pathogens will be a starting point for prevention strategies. This will involve increasing research efforts, especially in areas of medical entomology, which is the field of study for vector-borne disease, along with epidemiologists, and ecologists. (Petersen, 2016).

Vaccine development and country-wide access to these vaccines is another mitigation strategy for vector-borne disease. Currently in the United States, vaccination for disease such as Dengue Fever and West Nile Virus are not available for widespread use since these diseases are not currently posing major threats. On the individual level, people can prepare for preventing vector-borne disease is by using insect repellants. (Petersen, 2016). These strategies are effective on nationwide, and state levels.

In the 2019 New Mexico Climate Strategy, it is outlined that New Mexicans are already experiencing higher rates of asthma and heat-related illnesses. Preparation and mitigation strategies described include developing regulations that protect individuals that work outdoors from heat related illnesses and utilizing electronic billboards to warn NM residents of extreme weather events that might exacerbate health conditions. For example, billboards might warn about dust storms and droughts. These state specific strategies are being developed by various organizations including the NM Department of Transportation, Department of Health, Homeland Security, and NM Emergency Management. The Department of Health is responsible for evaluation and development of planning to combat and prevent vector-borne disease in New Mexico, and planning is underway. (Ely, 2019).

Air quality is another major factor that must be considered when discussing prevention and mitigation of disease in New Mexico. According to (Anderson, 2009), “Three of the five highest causes of terminal illness and death in New Mexico will be exacerbated by climate change: heart disease, stroke and chronic lower respiratory disease.” The NM Climate Strategy of 2019 states that the oil and gas sector are working to reduce methane emissions under the Air Quality Control Act. These harmful emissions contribute to air pollution, which exacerbate health conditions. The transportation sector is also working to incentivize electric vehicles to reduce these greenhouse gas emissions, as this is the second largest contributor in NM after the electricity sector, which is also working to reduce emissions. (Ely, 2019).

For the Navajo Nation specifically, preparations for climate change are in place for this community as well. Many Native Americans are pushing for their rights to finally be recognized as sovereign nations. This recognition will provide access to technological resources along with the financial resources that states in the U.S. have access to (Weinhold, 2010). This will create a stable foundation that has been lacking for many years in terms of economic resources, jobs, overcoming poverty, and will be important for understanding and addressing climate change and the problems it brings forth through education. Children are beginning to be taught about climate change in early elementary school, and how this will impact farming practices and sustainability on the Navajo Nation. (McGill, 2014). In addition, Native People gain knowledge about the environment through the Traditional Ecological Knowledge (TEK), which is knowledge about the environment and impacts people have when there is direct contact between people and their environment. This knowledge of biology integrated with other systems is unique

to indigenous communities as this information is passed down from generation to generation. (UCS Science Network, 2018).



(Adapted Houde, 2007)

Sustainable Recovery from Vector-Borne and Respiratory Disease (Part 4)

Much of the focus of this paper has been to identify how and why various disease arise as a result of climate change, their effects on the population in the Southwest and New Mexico specifically, and what measures can be taken to reduce disease occurrence. As these ongoing efforts are necessary to have a livable environment, we must also look to the future to understand what is needed to thrive for the coming years.

Various Directives in the NM Executive Order from 2019 put forth by Governor Michelle Lujan Grisham aim to address and curb these emissions by 2030. The executive order has goals to cut greenhouse gas emissions from the Oil and Gas Sector, set a standard of 50% statewide for renewable energy by 2030 and 0% by 2050, and strives to have transportation mostly electric. (Goldstein, 2020). These measures will lessen air pollution and decrease harmful health impacts and allow New Mexico to transition to an economy dependent on renewable energy instead of fossil fuel. Greenhouse gas reduction and reliance on renewable energy resources could bring an influx of flowing water and have effects on temperature, which in turn may reduce the abundance of mosquitos. (Portier, 2010).

Lessening the effects of climate change will only go so far. Measures to be environmentally resilient in New Mexico are outlined by major themes in (Funk, 2016). The first is to take steps that are in place to reduce the risk of wildfires in various communities, and to learn from communities that have experienced fires. The next step is to figure out how to distribute water resources so that no community is suffering while others have a surplus of resources. Next is to have monitoring systems in place for extreme weather including droughts and flooding so individuals such as farmers and ranchers have maximum time to make difficult decisions and take proper precautions. Also listed are measures to manage resource planning and funding. (Funk, 2016).

Overall in the United States, public health and healthcare infrastructure has greatly improved, combining organizations, health workers, and evidence-based knowledge to address a wide array of disease. This infrastructure includes infectious disease and water quality monitoring, prevention programs for cancer, asthma, and other common chronic disease, immunizations, and injury prevention practices. (Healthy People, 2020). Surveillance systems for infectious disease are incredibly important for disseminating information about global and local disease outbreaks and toxin exposures. This allows health officials to have adequate time to prepare for outbreaks and focus on prevention efforts. (ISID, 2020). In addition to surveillance systems, there are several alert systems in place both nationally and locally that allow public health officials to quickly get important messages to the mass public. In New

Mexico specifically, there are text apps in place in various communities such as AlertMe, that gives day-to-day updates and alerts for our area.

To thrive in an environment where vector-borne disease and respiratory disease are at higher rates than we see today, the health care system will have to increase capacity, and public health responses will have to expand. Perhaps state officials can follow suit of the CDC, and their strategies to address vector-borne disease. This would involve developing a statewide workforce that addresses a variety of vector-borne disease, and skilled laboratory and epidemiologic personnel. (CDC, 2019). In addition, changing the very structure of the medical and public health sectors may be necessary, as the “A Human Health Perspective On Climate Change” report states that, “The types of advice offered to patients with chronic conditions and the infrastructure to support them may need to be adapted to protect against climate-induced changes that may make these individuals more vulnerable.” (Portier, 2010). In addition, awareness of airway disease early on, and using air conditioners, knowing air quality on a day by day basis, and incorporating information about air pollution early on will be beneficial. Climate change will bring on many changes on a global, national, and local level. The path to community survival is dependent on a complex web of understanding climate change, developing effective and feasible strategies for preparation and mitigation, adapting to a changing environment, and ultimately, learning how to thrive in a changing world.

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