

**Assessing SARS-CoV-2 Disease Morbidity within the Navajo Tribal Nation in relation to
the Reduced Access to Equitable Water Infrastructure and Health Policy**

by

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Abstract

Public health is defined as the science of protecting and improving the health of people and their communities (Prevention, 2023). The access to clean water and basic sanitation infrastructure is critical to public health and the health of a community. Lack of or limited access to uncontaminated water and associated waterway infrastructure within the Navajo (Dine) Nation is resulting in higher rates of infectious disease morbidity among indigenous community members.

The Navajo Nation is a federally recognized tribe with over 200,000 enrolled members, making it one of the largest in North America. The treaties of 1849 and 1868, signed by both the Navajo and the U.S (United States) federal government, ensured the U.S. recognized the Navajo Nation as a self-governing entity and were supplied with the adequate resources to be self-sufficient from the U.S federal government. The Navajo tribal reservation land spans across areas of Arizona, New Mexico, Utah, and is entirely situated within the lower portions of the Colorado River Basin. Due to extreme climatic conditions, water scarcity is resulting in increased water competition. The effects of reduced water access and associated resources exacerbated the threat of Sars-CoV-2 (Covid-19) on the Navajo reservation.

The main aims of this paper include addressing the water crisis faced by the Navajo and how the reduced access to potable water increases the burden of infectious diseases, referencing Covid-19 and Hantavirus events on Navajo Nation as framework. Additionally, discussing the

relationship between tribal and federal government entities and how that has led to gaps in the current public health policies. The intended outcomes of this essay are to address the adverse public health impacts associated with the lack of access to clean water on Navajo Nation in relation to government-to-government (i.e., U.S. Federal Government and Tribal Governments) policy interactions.

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Preface

This thesis essay would not be possible without the support of my committee and advisors.

Dr. Jeremy Martinson, my primary advisor on my essay committee. His role offered guidance throughout the brainstorming and writing process of this review.

Tina Batra Hershey, my committee member, provided advice on my essay topic, reviewing drafts, and providing helpful comments about my topic's direction.

Dr. Joshua Mattila, my laboratory principal investigator, though he did not serve a role in the editing process of this essay, his encouragement and advice on the thesis writing process itself was invaluable.

Note: The term “Indian” used in this essay mirrors the meaning of the term within the courts and other legal bodies.

1.0 Introduction

During this century, disciplines across public health have launched most of the United States (U.S.) into modernity; however, there are still areas in the U.S. without access to the most basic of necessities. The Navajo (Dine) tribal reservation, also referred to as the Navajo Nation, has some of the highest levels of water contamination compared to other federally recognized indigenous reservations and non-tribal land in the United States (Ingram, 2020). The Dinéyah, homeland of the Navajo people is marked by four sacred peaks Blanca Peak to the east, Mount Taylor to the south, the San Francisco Peaks to the west, and Hesperus Peak to the north (Credo, 2019). The federal boundaries of this reservation were set up with the interests of American ranchers (settlers) in mind. This resulted in the Navajo being pushed to the driest, least abundant area of their ancestral homeland; worsened by the ongoing drought due to increasing climatic temperatures.

Uranium and arsenic are the two major contaminants often detected in reservation wells; while these elements are naturally occurring in the geology of Northeastern and Southern Arizona their abundance in the water table has been exacerbated by commercial mining conducted by U.S. mining companies from 1944 through 1986 (Figure 1), (Ingram, 2020), (Credo, 2019). Many U.S. tribal reservation households suffer from a lack of or decaying water infrastructure resulting in contamination from natural or commercial sources (Tanana, 2021). Current estimates indicate 48% of all Native American and Alaskan Native (AI/AN) reservation households do not have access to clean potable water and/or sufficient sanitation (Tanana, 2021). In addition, indigenous households are 19 times more likely to not have indoor plumbing or running water in comparison to white households in the United States (Tanana, 2021). More specifically, in the Navajo Nation, this

statistic is higher, at 67 times more likely to not have access to running water in homes (Ingram, 2020), (Tanana, 2021).

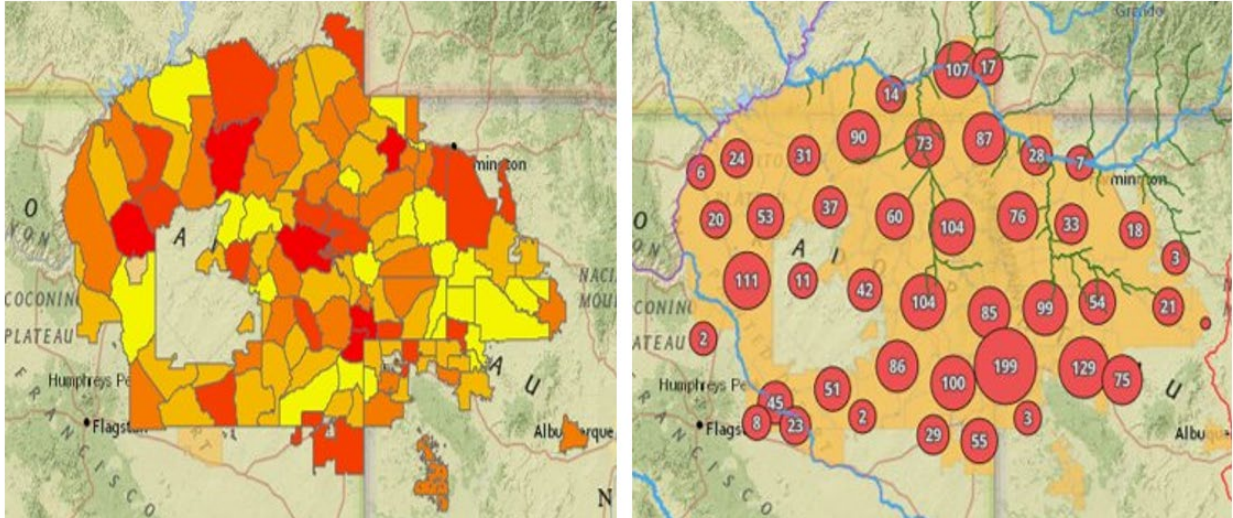


Figure 1: This depiction represents population density distribution across Navajo Nation compared to the number of abandoned mines on the reservation land. The image to the left shows the population density per zoned area. The darker the color the higher the population density, red being the darkest color. The image to the right depicts the amount of mines present per zoned area on Navajo Nation.

A clear public health emergency took place during the height of the SARS-CoV-2 (Covid-19) pandemic as basic forms of sanitation rely on clean, accessible water sources (Tanana, 2021). According to a 2021 publication on systemic racism translating into public health standards, AI/AN individuals were 3.5 times more likely to contract Covid-19 in comparison to white-identifying individuals (Tanana, 2021).

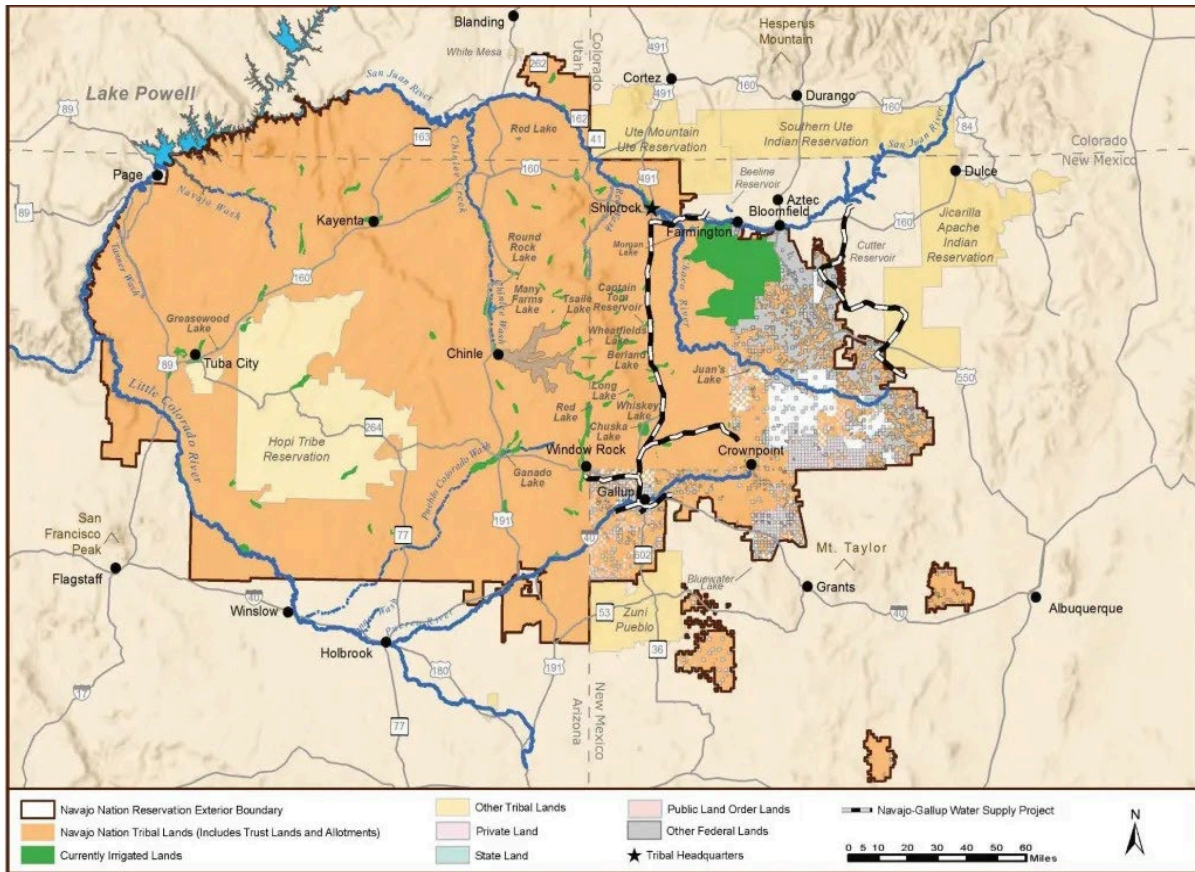


Figure 2: This figure depicts Navajo (Dine) Nation reservation, part of the Diné'tah ancestral land including the major reservation waterways, land topography, and surrounding non-native land (Project, 2022). The mixture of pink, blue, and gray patchwork on this area of land is a combination of federal, state, and independent land trusts (non-native land ownership) (Project, 2022).

This essay aims to address the high Covid-19 morbidity and mortality outcomes in context of the water crisis faced by the Navajo Nation by analyzing research assessing the impacts of the Covid-19 pandemic on the Navajo (Dine) Nation (Figure 2) and discussing the “government-to-government” interactions between the federal government and Navajo tribal government.

2.0 Methodology

Initially, the first database search was conducted to determine the location and area of the Navajo Nation and the percentage of reservation households without clean water through the Navajo Nation Department of Water Resources. Additional information was collected through online search databases on the incidence and prevalence of Covid-19 and where those values were highest within the reservation area. Multiple databases were accessed including Google Scholar, PubMed, and the University of Pittsburgh Library open-access database. Supplemental information was collected through government organizations, such as the Centers for Disease Control (CDC), The World Health Organization (WHO), and The Department of the Interior Bureau of Indian Affairs. References were created and stored with EndNote software. The Navajo (Dine) Nation was selected as the focus of this paper due to the substantial number of reservation residents who do not have access to clean water. Presently, it is estimated that one-third of Navajo Nation residents are without access to clean water due to previous commercial mining conducted by the U.S. government and increased scarcity of water resources from the Colorado River Basin (EPA, 2023). In addition to water access, the number of SARS-CoV-2 cases in the Navajo Nation is higher in comparison to the surrounding areas (CDC, 2023).

After the target population and area were identified, a search strategy based on keywords and phrases was implemented. Some of these included terms such as “epidemiology of SARS-CoV-2 and Covid-19”, “Native American and Covid-19”, “Navajo Nation and Covid-19 rates”, “Navajo Nation and SARS-CoV-2 transmission rates”, “reservation lands and access to potable water”, “public health policy and Navajo Nation”, and “environmental justice issue and the Navajo Nation.” These searches produced 300-500 identifiable references, which were narrowed down

through exclusion and inclusion criteria: the research articles referenced had to be published between the years 2000-2023, peer-reviewed, and full-text products. The additional sources cited throughout this essay were federal funded public health and government agencies, including the Centers for Disease Control and Prevention (CDC), the National Institute of Health (NIH), World Health Organization (WHO), and The Department of Interior Bureau of Indian Affairs (BIA). Criteria used for evaluation were based on factors that would provide the most current and pertinent sources to this topic (i.e.: time (year), relevance to Covid-19 cases and transmission, and specific to infectious events on Navajo Nation) (Figure 3). In total, 20 papers were reviewed and used to address the gaps in current literature. Article sources were collected, stored, and formatted using Endnote to create the bibliography (Figure 3).

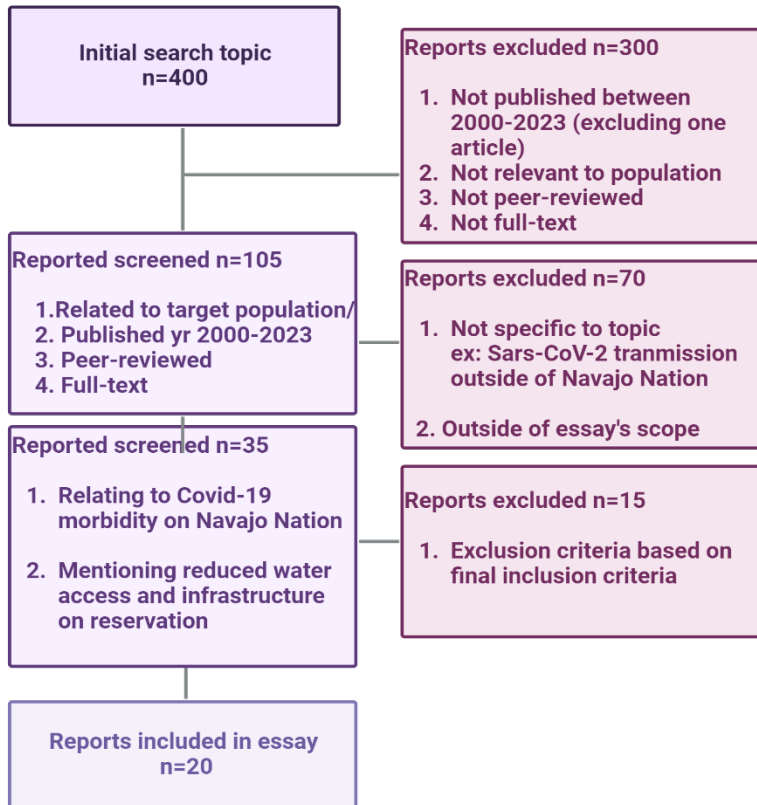


Figure 3: This is a flowchart representing the general process of the exclusion and inclusion criteria used to develop this literature review.

A notable limitation of this review is the scarcity of information available regarding indigenous rights and sovereignty in a research-based context. Hence why this essay utilized the combination of literature and policy review to address the notable gap found amongst some of infectious disease cohort studies. Another limitation was the lack of literature on developing state environmental policy to solve the current water crisis being faced by the Navajo Nation. From this literature search's outcomes with the applied search criteria, a problem and its significance within public health was identified.

3.0 Problem Statement and Significance

Environmental injustices are significant, and often the result of a series of complex, intertwining issues that disproportionately affect black and indigenous people around the globe. The U.S. EPA defines environmental justice as “the fair treatment and meaningful involvement of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies” (Emerson, 2021). To achieve environmental justice and/or health equity, all individuals need to have the same protections from health hazards and access to the policy-making process for creating a healthy environment to live in (Emerson, 2021). Infectious disease morbidity and mortality are influenced by three major factors: host, vector, and environment characteristics. Previously, experts observed these three factors in isolation, whereas presently, they are acknowledged as interconnected in their effect on health outcomes. This relationship could be compared to the philosophy of One Health, which is represented as the connection between the health of animals and humans within the shared environment. Furthermore, the framework of One Health is built from indigenous knowledge, which is important to recognize in the context of in this essay. This comprehensive review emphasizes the need for an applied One Health approach in both infectious disease research and environmental health policy, as well as highlighting the importance of indigenous sovereignty within public health and associated fields of study.

4.0 Research

4.1 The Disproportionate Impact of Covid-19 on Navajo Nation

At the time of writing this, the United States population remains far away from adequate Covid-19 vaccination compliance (CDC, 2023). According to the CDC, only 66.5% of the total U.S. population has received a 2nd dose of the recommended two dose Covid-19 vaccine schedule (CDC, 2023). The U.S. vaccination rate does not compare well to other nations of similar or larger population size, for example, China which has a 2nd vaccination dose compliance rate of over 95.0% (CDC, 2023). Vaccine non-compliance continues to be a major problem in the U.S. even after the introduction of the lifesaving Covid-19 vaccination series and its subsequent boosters, which has only prolonged the presence of this disease in the states well into 2023.

Predictably, the spread of Covid-19 was not distributed equally with the start of the pandemic in early 2020. Factors influenced by structural racism and colonial violence have continued into the present and have led to considerable health disparities among black and indigenous populations (Ruckelshaus, 1984), (Bambra, 2022). As a result, these disparities are reflected in the lack of fundamental human rights, including access to adequate health care services, clean water, and standard housing conditions (Bambra, 2022). Presently, these disparities continue to negatively influence the health of Navajo Nation residents and exacerbate public health emergencies, as seen with the Covid-19 pandemic.

The official Navajo Nation emergency response began in late February 2020 before any cases were confirmed on reservation land. The first case of Covid-19 was confirmed on March 17, 2020, resulting from a church event, and quickly spread to other Dine communities. However,

even with these protections in place Navajo Nation per-capita infection rates surpassed that of more populated regions such as New York in a few months (Emerson, 2021). In fact, during the height of the pandemic (Early 2021), it was estimated that there were 29,386 cases, meaning 16.9% of Navajo Nation had Covid-19 (Denetclaw, 2022). As a notable limitation with any disease reporting metric is the underestimation of the actual number of cases that took place, this number may have been even higher.

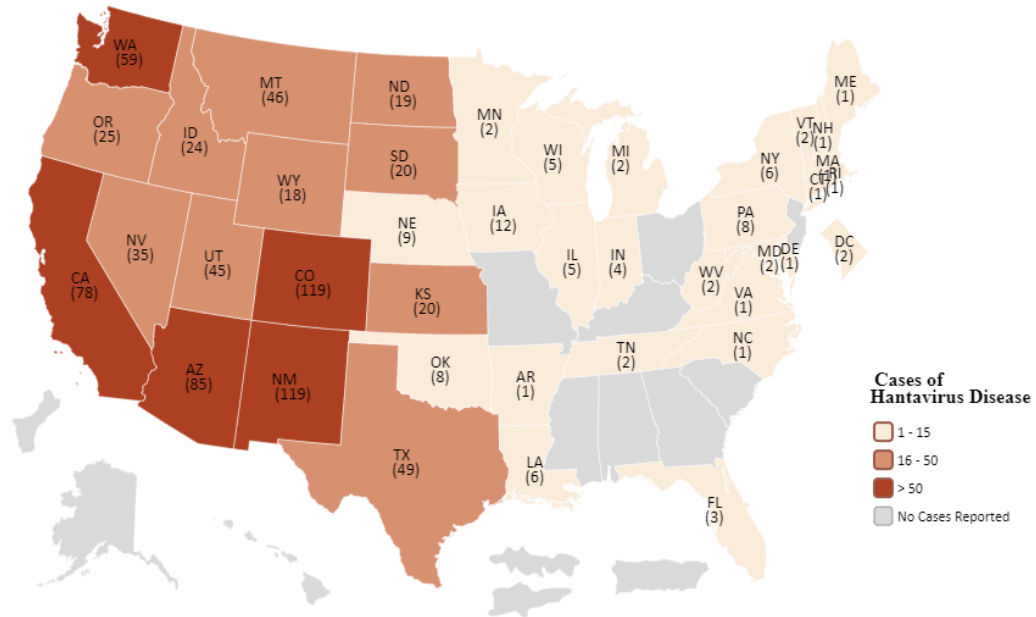
4.2 The Navajo Nation Water Crisis in Relation to Infectious Disease Morbidity and Morality

As of 2023, there are over five-hundred abandoned uranium mines in the Navajo Nation area responsible for contamination of groundwater and other water sources used by tribal communities (Thompson González, 2022). In addition to uranium, elevated levels of arsenic, manganese and other elements associated with former mining operations have been detected within Navajo water sources (Thompson González, 2022). Furthermore, climate change is an additional consideration in a harsh, arid environment like Arizona, limiting tribal members' ability to access clean, safe water and associated resources. In addition to public health and considerations, the reduced access to water affects cultural practices like the harvesting of white sage.

Compounding factors such as overcrowded households, language barriers among older generations, and lack of complete water systems have contributed to the higher incidence of Covid-19 on Native American reservations in previous literature. The article, American Indian Reservations and Covid-19: Correlates of Early Infection Rates in the Pandemic, analyzed Covid

rates in Native American reservation populations in the lower 48 states, including the Navajo Nation (Rodriguez-Lonebear, 2022). Data collection was conducted using Covid-19 incidence data from online databases and repositories of reported deaths of Native American tribal members per reservation household (Rodriguez-Lonebear, 2022). Additionally, researchers linked the incidence data to the 2018 five-year American Community Survey (ACS) to apply reservation and homeland characteristics to the incidence death data reviewed (Rodriguez-Lonebear, 2022). The results found that out of the 287 reservations analyzed, 60% of the population living on a reservation is of Native American ancestry, the median age is 34, and female and male identifying individuals are spread evenly across the populations (Rodriguez-Lonebear, 2022). Average household size on reservations is three persons and the household income in reservation households is \$20,000 lower than the average U.S. household income (Rodriguez-Lonebear, 2022). Furthermore, the average of incomplete indoor plumbing facilities in the U.S. is 0.4%, whereas on native reservations the average is 0.6% (Rodriguez-Lonebear, 2022). This statistic was found to be 17% greater on the Navajo Nation reservation, with 18% of households being without or having incomplete plumbing (Rodriguez-Lonebear, 2022). The lack of complete or partial plumbing facilities was an expounding factor for Covid-19 transmission and cases per 1000 people (Rodriguez-Lonebear, 2022). From this analysis, they noted that household overcrowding was not as much of a consequential factor as previously hypothesized and described in previous literature (Rodriguez-Lonebear, 2022). While some households on reservations may opt out of plumbing for cultural or personal reasons, providing spaces for running, potable water and other forms of reliable disinfection should be prioritized for these communities (Rodriguez-Lonebear, 2022). In addition to Covid-19, the Navajo reservation area's geography and climate allow Sin Nombre viral transmission, which causes Hantavirus Cardiopulmonary Syndrome (HCPS). In North American,

there are four rodents that act as the vectors of hanta viruses and three of which reside in the four-corner's region of the U.S (CDC, 2023). An individual with HCPS will develop flu-like symptoms (i.e., fever, malaise, vomiting, and diarrhea), these will progress into respiratory distress, coughing, and eventual cardiopulmonary arrest (Joyce, 2022). Due to the severe nature of HCPS, immediate diagnosis and treatment is needed within 24 to 48 hours (about 2 days) or death is likely to result (Joyce, 2022). Hantavirus and Covid-19 can also co-infect human hosts and due to the similar symptoms and challenges associated with Hantavirus diagnosis, the development of an effective screening tool was crucial and the central focus of one of the papers reviewed. Reported cases of hantavirus are considered rare, with only 624 confirmed cases detected within a 20-year surveillance period, disproportionately affecting Navajo residents (Joyce, 2022) (Figure 4). In fact, the Navajo compose 18% of all National Notifiable Disease Surveillance System (NNDSS) reported cases while only accounting for 1.7% of the total U.S. population. Sin Nombre, otherwise referred to as Hantavirus, is vector-borne infectious disease harbored in the urine of rodents that can infect humans and has an associated mortality of over 40% if proper treatment is not given (Joyce, 2022).



All cases were confirmed between 1993-2021 and met the NNDSS case definition applicable at the time of reporting. Included in the sum total are 31 historical cases that occurred prior to 1993, but were confirmed retrospectively. Five cases had presumed exposure outside the United States.

Figure 4: This figure depicts the Map of US Cumulative Cases of Hantavirus by State through 2021 starting from 1993, which met NNDSS case criteria. The “four corners” area of the U.S. has a high incidence of reported hanta virus cases which includes the states of Arizona, New Mexico, Colorado, and Utah. This area also houses the majority of Navajo Nation. Reporting of annual information is delayed due to the Covid-19 pandemic.

4.3 Federal and Tribal Government Water and Environmental Policy Interaction

Tribal sovereignty is the inherent authority of tribal nations to govern themselves within the borders of the United States of America (Ordway, 2021). However, tribal sovereignty exercised

in policy and implemented by government entities is often the cause for issues directly and indirectly affecting tribal nations, including the water crisis faced within Navajo Nation (Ordway, 2021). Examples include the three instances where the Navajo Nation petitioned both state and federal levels of government for increased water sovereignty and monetary resources to accomplish much needed forms of water infrastructure intervention implementation: the initial complaint filed by the Navajo in 2003 to the U.S. District Court for the District of Arizona, the 2017 hearing at the United States Court of Appeals for the Ninth Circuit, and the eventual Supreme Court case hearing held in the summer of 2023.

4.4 The Winters Doctrine

The Winters Doctrine drafted following the 1908 Supreme Court hearing, *Winters vs. The United States* was the first document to recognize Native American water rights under U.S. law (Brougher, 2011). According to this doctrine, when the U.S. Congress reserves land, they must also allocate water reserves so that the intended purpose of the land is fulfilled (Brougher, 2011), (Him, 2023). One of the issues with the interpretation of this doctrine is that it did not supply an empirical formula to determine the appropriate amount of water needed for reservations, and so it is up said proceeding judicial body to quantify the extent of tribal water rights (Him, 2023). Without a standard method of calculation, the courts are tasked with determining the amount of water needed on federally reserved tribal land. However, this non-standardized approach to this policy does not consider nor encompass the dire situation more than one-third of Navajo Nation residents face daily.

4.5 Outline of Articles for The Treaty of 1849 and The Treaty of 1868

The Treaty of 1849, composed of eleven articles, was the first treaty between the US government and the Navajo. Each of the treaty's articles interpretation can be summarized as the following (Library, 1849).

Article I. Navajo under the authority of the United States.

Article II. Continual peace exists between native and non-native peoples.

Article III. Laws regulating trade and peace are now binding for the Navajo people.

Article IV. Navajo must deliver the murder or murders of M. Garcia to the U.S.

Article V. Captives and stolen property must be delivered to the U.S. by 9th Oct 1850.

Article VI. Citizens of the U.S. committing outrages upon the Navajo shall be subjected to the penalties of law.

Article VII. Free and safe passage through Indian territory.

Article VIII. Military posts and agencies to be established.

Article IX. The United States to adjust territorial boundaries.

Article X. Donations, presents, and implements to be given.

Article XI. This document is binding after being signed by both represented parties and to receive and liberal construction.

The Treaty of 1868 was an additional treaty between the U.S. government and the Navajo which defined the series of provisions needed for agricultural resources, distribution of land, and delineation of reservation. Each of the treaty's articles interpretation can be summarized as the following (States, 1868).

Article I. Cessation of war and wrongdoing.

Article II. Delineation of reservation land.

Article III. Construction of a warehouse, agency building, carpenter, and blacksmith shops, schoolhouse, and chapel.

Article IV. Assignment of an agent reporting to the Commissioner of Indian Affairs.

Article V. Distribution of land to individuals.

Article VI. Compulsory education for children.

Article VII. Provision of seeds and agricultural implements.

Article VIII. Other provisions given to the Navajos.

Article IX. Allowing the construction of railroads, military posts, and roads within reservation territory. No attacks on U.S. citizens or their belongings.

Article X. Conditions for validation of any future treaties.

Article XI. Provisions for the Navajo to return to the delineated reservation land.

Article XII. Appropriations of monies.

Article XIII. Agreement to make the reservation a permanent home to the Navajo.

4.6 The U.S. and the EPA 1984 Indian Policy

The mission of the United States Environmental Protections Agency (U.S. EPA, EPA) is to protect both human and environmental health. The main functions of the EPA include ensuring clean water, air, and land resources for all Americans, advocating for national efforts to reduce environmental risk informed by scientific evidence, and assuring that all parts of society have access to informational resources to manage community health (Emerson, 2021). In terms of government-to-government interactions between the EPA and tribal nations, the EPA 1984 Indian Policy sets the precedent for interactions and relationships between federally recognized tribes and

this government agency (EPA, 2023). The EPA 1984 Indian Policy emphasized two main points: (1) “that the Federal Government will pursue the principle of Indian ‘self-government,’ and (2) “that it will work directly with tribal governments on a “government-to-government" basis.” Tribal governments should be directing the decision making for matters pertaining to reservation land and populace above all other forms of U.S. polity (Ordway, 2021), (EPA, 2023). The reservation’s major water sources include parts of the Colorado River Basin (CRB) and 20 surface-level aquifers; due to dwindling groundwater reserves and prominent levels of dissolved heavy metals, their use and reliability is varied (Office of Environmental Policy and Compliance, 2021). Additionally, the two major tributaries of the CRB, the San Juan and Little Colorado Rivers, are both used by the Navajo and by non-reservation areas, which further depletes the available water for reservation residents. To address the water crisis faced on the reservation, the case filed by the Navajo Nation to determine whether the federal government was liable to supply aid and support to secure clean, reliable water was recently decided by the US Supreme Court (Lin, 2023). The 2023 *Arizona vs. Navajo Nation* case was an appeal in the case brought by the Navajo against the United States Department of the Interior, the Secretary of the Interior, The United Bureau of Reclamation, and The Bureau of Indian Affairs in 2003. The 2003 complaint alleged that the National Environmental Policy Act (NEPA) was violated per the “breach of trust claim” since the water needs of the reservation were disregarded by the federal government (Lin, 2023). The breach of trust claim asserted that the trustee (the federal government) was in violation of the duties defined in The Treaty of 1849, The Treaty of 1868, and The Winter’s Doctrine between the U.S. government and Navajo. Thus, regardless of intended malice or negligence on the part of the trustee, if the claim is determined true, beneficiaries (Navajo) could receive remedy to accommodate for the breach of trust (Lin, 2023).

The State of Arizona intervened as a defendant, along with several other entities, at the U.S. State Court of Appeals in the Ninth Circuit in 2017. The Ninth Circuit determined that the Navajo Nation lacked evidence on the NEPA claim but could proceed with the “breach of trust” argument (Team, 2021). Additionally, since a breach of trust claim does not fall under sovereign immunity* and that claim is outside the governance of the district courts, the *Arizona vs. Navajo Nation* case went before the U.S. Supreme Court and was consolidated with the 2003 *Dept. of Interior vs. Navajo Nation* case (Lin, 2023).

4.7 *Arizona vs Navajo Nation* Supreme 2023 Court Case

The challenges faced by the Navajo regarding water sovereignty are evident from a recent U.S. Supreme Court decision. In a 5-4 decision on 6/22/2023, the Court ruled that the Treaty of 1868 which established the Navajo Reservation reserved adequate water resources to fulfill the purpose of the reservation, however the United States was not responsible for taking affirmative steps to secure water for the tribe (Schwartz, 2023). Meaning, The United States Supreme Court ruled against the Navajo Nation in the water rights dispute, holding that the U.S. government did not owe an affirmative duty to the Navajo Nation to secure water, while reversing the 9th Circuit decision. Thus, based on that reversal, the Navajo are prevented from pursuing the current and additional lawsuits claiming the federal government is responsible for asserting the tribe’s water rights, with the current legislation provided at The Supreme Court 2023 Case (Jones, 2022). The Courts decision did note that Congress and the President could enact laws for “assisting citizens including the Navajos” in this area with their water needs (Schwartz, 2023). Additionally, the Court noted that moving forward the Navajo lack any clear legal route to secure, or even inquire

about their reserved water rights (Schwartz, 2023). The U.S. Supreme Court's decision will further exacerbate the current water crisis on the Navajo Nation reservation, where one-third of the 175,000 residents do not have access to potable and safe drinking water. However, this number is estimated to be higher due to previous underreporting in previous U.S. census population surveys. In 2021, 400,000 Navajo enrolled in the CARES Act Hardship Assistance Program, the most accurate population count to date (cite). Furthermore, the 2023 Supreme Court ruling is a significant hindrance for indigenous sovereignty and environmental justice during a time when water scarcity across Turtle Island (North America) continues to intensify, particularly in the Colorado River Basin.

5.0 Implications for Public Health

5.1 Research

Future research in this area of public health has positive implications regarding the connection between environmental racism and health outcomes within marginalized communities. As the environmental outcome's body of research grows and as technology advances at the molecular and statistical levels, the ability to predict, prepare, and lessen the effects of infectious disease outbreaks on marginalized populations is becoming more accepted within academia. With a greater understanding of infectious disease emergence, prevention, and a One Health approach to research and policy, preventative strategies can begin to reduce the present effects of Covid-19 and future infectious disease outbreaks in the Navajo Nation. The intended purpose of this review will help researchers consider the gaps in knowledge from a multidisciplinary standpoint to address environmental racism in context to specific communities and infectious disease emergence.

5.2 Policy

Policy could have negative or positive implications within this area of public health regarding environmental racism and its association with poor health outcomes. Environmental racism's adverse influence among low-income and/or marginalized communities regarding infectious disease population outcomes is an urgent problem due to climate change and lackluster remediation efforts. Additional funding targeting need-based areas will help afflicted

communities, such as the Navajo Nation. Furthermore, a One Health approach should be applied to policies and the public health research that informs them, particularly in reference to infectious disease population outcomes. This review is intended to be used a guide for public health entities at all levels to understand the importance of cultural competence when drafting legislation and recommendations to nations impacted by environmental racism. Additionally, indigenous peoples need to be at the fore front of these institutional changes and conversations. To further emphasize, the impacts of current and future climate change events have serious public health implications on infectious disease outcomes, especially in marginalized communities and policy procedures need to be implemented to address it.

5.3 Discussions

The Covid-19 pandemic was a global public health emergency, but for many indigenous communities, it was a catastrophe. A series of compounding factors lead to these negative outcomes, including lack of potable water, indoor water infrastructure, lack of coordination between state and tribal governments, and improper communication between public health agencies like the Center for Disease Control (CDC) and World Health Organization (WHO). This essay aims to address the high Covid-19 morbidity and mortality outcomes in context of the water crisis faced by the Navajo Nation by analyzing research assessing the impacts of the Covid-19 pandemic on the Navajo (Dine) Nation and discussing the “government-to-government” interactions between the federal government and Navajo tribal government.

A lack of clean water to disinfect and maintain a level of general hygiene during an infectious outbreak is an impossible situation. Unfortunately, the current state of the Navajo

reservations' wells and aquifers is due to the mishandling of the land by the U.S. government decades prior during the mining boom on Navajo land. Furthermore, many subsequent interactions between tribal and the federal government entities and associated policies are inconsistent with previously agreed treaty expectations (i.e., 1868 Treaty and 1849 Treaty).

Per EPA Indian policy of 1984, EPA should have been involved in overturning the *Arizona v. Navajo Nation* Supreme Court decision according to point three of this policy document.

“The agency will take affirmative steps to encourage and assist tribes in assuming regulatory and program management responsibilities for reservation lands (Ruckelshaus, 1984).”

However, one could argue the point that the Supreme Court’s decision was outside of the delegation and reach of the EPA agency. Point four of this policy would reinstate this federal agency's responsibility to advocate the removal of legislative and procedural entities impeding current efforts for clean water on Navajo Nation.

“The agency with take appropriate steps to remove existing legal and procedural impediments to working directly and effectively with tribal governments on reservation programs (Ruckelshaus, 1984).”

However, the U.S. Supreme Court’s ruling violates The Treaty of 1849, The Treaty of 1868, and the Winter’s Doctrine supporting the federal government’s involvement in securing water access to the Navajo.

In addition to specific research with a focus on indigenous and environmental health, climate change policy with prioritization of indigenous health must be drafted and enacted sooner rather than later. Humans, particularly corporations with influence in oil, mining, petroleum processing, synthetic fiber fabrication, and non-renewable energy services, must be held accountable for their direct impacts on the progression of climate change to our current state of

climate emergency. Furthermore, policy makers and researchers in all aspects of public health need to work collaboratively to better understand the future of the contaminants entering both our water system and food webs. Climate change is preventable and should not be taken lightly, and the impact on the Navajo Nation's access to water represents the potential for other areas to be similarly affected. Infectious disease morbidity and mortality outcomes are not excluded from a warming climate. As global temperatures increase due to unaltered production and pollution standards, seasons will be altered and so will the life cycles of disease vectors such as mosquitoes. The next ten years is the defining period for what the world will look like for current and future generations from public health research and policy perspectives. Public health prevention will be aimed at lessening the severity of current and potential re-emerging microbes from the impact of climate change on the environment and people.

5.4 Conclusions

As we progress into 2024, Covid-19 is a public health burden for the globe and there are other emerging pathogens with pandemic potential. Like most infectious agents, Covid-19, as well as Post-Covid Syndrome, affects all people regardless of demographic characteristics and socio-economic status. However, as discussed above, there are certain host and environmental factors associated with higher viral transmission and disease morbidity and mortality. Moving forward, indigenous cultural competency and incorporation of indigenous knowledge must be prioritized in research with a specific focus on indigenous populations and environmental policy. This review addresses the under representation of indigenous people and knowledge among public health research despite being a highly impacted population within the field of public health.

5.5 Land Acknowledgement

Acknowledgment of land is a public statement of the name of a place's native inhabitants.

It honors Native people's historical relationship with the land

Pittsburgh is Osage, Shawnee, and Monongahela land.

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