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SPECIAL REPORT

Health Equity, Environmental Justice, and American Indian and Alaska Native Communities: A Short Report

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Abstract **Environmental public health hazards present unique challenges for American Indian and Alaska Native (AI/AN) communities due to their close cultural, physical, and spiritual associations with the environment. To raise visibility of these challenges among environmental public health professionals, this report summarizes findings from studies, news articles, and case studies. We categorized five major environmental public health challenges that affect AI/AN communities: climate change, environmental health hazards, air quality, water quality, and environmental prenatal exposures. A general explanation of each environmental health issue is articulated with contextual history, statistics, and reports. Discussion of these categories is followed by case studies of AI/AN communities affected by these environmental health challenges. Lastly, we point to efforts by Indigenous communities and allies who are working to improve AI/AN environmental public health within the U.S.**

Keywords: American Indian communities, Alaska Native communities, environmental health risks, environmental public health challenges

Background and Needs Statement

The U.S. government identifies 574 federally recognized Indian Nations in 36 states, including 220 nations in Alaska (U.S. Census Bureau, 2022). According to the U.S. Census Bureau (2022), the population of Native Americans was 6.79 million, which is approximately 2% of the U.S. population. American Indian and Alaska Native (AI/AN) people have been marginalized throughout history, punctuated by the recent emphasis on health equity and environmental justice (Institute for Tribal Environmental Professionals [ITEP], 2021). Connection to the natural world is integral to AI/AN communities and Indigenous identities. The state of the natural world is directly connected to Indigenous mental, physical, and emotional well-being. Climate change and environmental degradation have threatened ways of being for AI/AN communities. Multiple systemic factors have exacerbated this situation, such as a lack of funding, poor access to technical resources, legacies of colonialism, and discrimination (ITEP, 2021).

Despite these challenges, over the past few decades there have been major health successes within Indian Country. According to the Indian Health Service (IHS, 2014), maternal mortality rates have been reduced by 19% since 1972. More recently, a report published by the Centers for Disease Control and Prevention (CDC, 2023) in the wake of the COVID-19 pandemic found that compared with all other U.S. Census race and ethnicity groupings, AI/AN people "had the greatest increase in life expectancy from 65.6 in 2021 to 67.9 in 2022, regaining 2.3 years of their 6.2-year life expectancy loss between 2019 and 2021." Also, many tribal communities are implementing progressive health policies that enable culturally tailored health initiatives such as the integration of Traditional Indian Medicine (Warne & Frizzell, 2014). Despite these strides for AI/AN public health in evolving health policy and public health initiatives, access to healthcare and disparate health outcomes are a continual challenge within Indian Country.

The effects of environmental health challenges are compounded by systematic barriers to health equity for AI/AN people. According to the National Center for Health Statistics, approximately 40% of the AI/AN population resides in rural areas (Villarroel et al., 2020). The lack of healthcare infrastructure increases travel time to an average of 17 min from the nearest hospital compared with 12 min and 10 min for suburban and urban residents, respectively (Lam et al., 2018). Additional barriers to healthcare access other than travel time to IHS facilities include long wait times, a lack of or limited access to transportation, and the lack of availability of culturally or linguistically appropriate healthcare professionals (Adakai et al., 2018).

Furthermore, AI/AN people are underrepresented in public health professions

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(National Institutes of Health, n.d.). Overwhelming mortality rate disparities also exist for AI/AN people compared with other racial groups. On average, AI/AN male individuals die 12 years earlier than White male individuals, and AI/AN female individuals die 13 years earlier than White female individuals (Gorzig et al., 2022). Disparate healthcare infrastructure and health outcomes have increased the vulnerability of AI/AN communities to environmental health impacts.

AI/AN communities often face increased environmental health burdens and disproportionate environmental health risks compared with the average U.S. population (Hoover et al., 2012). Indian Country stands at the forefront of numerous environmental health challenges. Indigenous-led solutions that incorporate traditional knowledge prompt questioning, reflection, and paradigm shifts in conventional Western approaches to environmental health solutions.

The purpose of this report is to raise visibility among environmental public health professionals of these burdens and the often unseen cultural and systematic effects of environmental health hazards on AI/AN communities. This report identifies prominent environmental risks, concerns, and implications to AI/AN communities. We categorize the effects of a changing climate and environmental degradation into five categories: climate change, chemical exposures, air quality, water quality, and environmental prenatal exposures. We conclude with general recommendations. The basis of this report is derived from scholarly articles, reports, survey results, and other publicly available resources.

Climate Change

Climate change is characterized by deviations from historic climate data, including but not limited to rising global air temperatures, extreme and more frequent hydrologic events, rising sea levels, and increasing ocean temperatures (ITEP, 2021). Although climate impacts often are evaluated individually, climate change threats occur simultaneously and result in compounding health impacts (Crimmins et al., 2016).

Increases in average air temperatures and extreme temperatures affect AI/AN health at individual and community levels. According to CDC (2024a), extreme heat is responsible for approximately 1,220 deaths per year in the U.S. Heat causes the most weather-related deaths compared with other hazards such as tornadoes or hurricanes (Erdman, 2023). Prevalent rates of poverty disadvantage AI/AN communities. As an example, households with less financial privilege are unable to access heating or cooling elements to adapt to temperature extremes (Gronlund, 2014).

The U.S. Energy Information Administration estimates that 14% of households on AI/AN tribal lands do not have access to electricity, which is 10 times the national average (Stone, 2014). Without access to electricity, AI/AN communities lack reliable sources of power for fans or air conditioners to help cope with extreme temperatures. According to a report by the U.S. Environmental Protection Agency (U.S. EPA, 2021), AI/AN people live in areas with the highest rates of labor hour losses attributable to extreme temperatures.

The cumulative effects of climate change can be articulated in a case study of melting sea ice in Alaska. Warming temperatures have a significant negative effect on the infrastructure central to Indigenous Peoples' livelihoods (U.S. Climate Resilience Toolkit, n.d.). Approximately 40% of federally recognized tribes in the U.S. (220 of 574) live in communities located in Alaska. The Arctic has warmed 3.8 times faster than the rest of the planet (Hersher, 2022). On the Alaskan coastline, sea ice acts as a buffer from storms that erode coastlines. Climate change has resulted in more frequent and more severe storms, increased permafrost thaw, changes in the timing of snowfall, seasonal ice melt, and freezing of lakes (U.S. Climate Resilience Toolkit, n.d.). Additionally, melting sea ice has forced AI/AN communities to relocate due to loss of infrastructure, culture, and safe conditions for hunting or fishing (U.S. Climate Resilience Toolkit, n.d.).

The Alaska Native village of Kivalina has had to relocate due to the warming climate (U.S. Climate Resilience Toolkit, n.d.). Kivalina historically resided on a barrier island protected from storms by sea ice. Storm surges caused by melting ice and rising waters have eroded much of the island. The relocation of 400 residents has led to innumerable social, emotional, and economic burdens. Coastal erosion has more than doubled from 2002 to 2007 along a 40-mi stretch of the Beaufort Sea in Alaska (Weinhold, 2010). Thawing of permafrost (i.e., permanently frozen soil along coasts and rivers) is being reported throughout the Northern Hemisphere. As of April 2015, more than 30 Alaska Native villages are either in need of or already in the process of relocating entire villages (U.S. Climate Resilience Toolkit, n.d.). Poverty and place-based livelihoods are additional barriers that prevent AI/AN communities from relocating (Hunt et al., 2021).

Climate change has limited access to traditional subsistence lifestyles, which has led to food insecurity for AI/AN communities (U.S. Climate Resilience Toolkit, n.d.). Food security is defined as having access to enough nutritious food for all household members to maintain an active, healthy lifestyle. A scoping review of 30 studies estimated that 46% (weighted average) of AI/AN people were food insecure (Nikolaus et al., 2022). In comparison, 10% of U.S. households are considered food insecure (Economic Research Service, 2025).

The shift from traditional lifestyles and diet, persistent poverty, food insecurity, cost of nontraditional foods, and poor housing conditions contribute to increasing health problems among AI/AN people (U.S. Climate Resilience Toolkit, n.d.). In North America, the highest proportion of Indigenous Peoples who practice traditional subsistence lifestyles is in Alaska, and 80% of this population's diet is secured from their immediate surroundings (Weinhold, 2010). Salmon species are among the most important traditional foods, but because they are a cold-water fish, their survival is particularly vulnerable to increasing water temperatures. Climate-mediated increases in water temperature threaten cold-water species, such as salmon and trout (Vinyeta et al., 2015).

Pacific Northwest nations have already had to manage decreased salmon availability due to pollution, overharvesting, and dams. Climate change, however, might pose a greater challenge of access to these crucial species (Vinyeta et al., 2015). For example, coastal nations such as the Swinomish in Washington are experiencing decreased availability of shellfish and salmon resources due to warming water temperatures (Breda, 2024). Along with increasing water temperatures, food insecurity in Alaska Native communities is caused by permafrost thaw and can result in ice cellars or icehouses (that are traditionally

used to store subsistence food) thawing (U.S. Climate Resilience Toolkit, n.d.). Food thawing can lead to contamination, foodborne illness, and dependence on store-bought foods that are more expensive, less healthy, and nontraditional (U.S. Climate Resilience Toolkit, n.d.). Decreasing access to traditional and healthy foods results in increased reliance on processed foods, ultimately affecting the prevalence of diabetes, obesity, and other metabolic syndromes or chronic diseases (Tribal Public and Environmental Health Think Tank, 2018).

Climate change has amplified wildfire intensity and frequency due to a combination of extreme heat and drought. These conditions give rise to wildfires that are difficult to fight, leading to increased losses and escalating costs (National Wildlife Federation, 2011). In 2022, 68,988 wildfires burned 7.6 million acres of land in the U.S., and more than 40% of those wildfires were in Alaska (Congressional Research Service, 2023). Wildfire smoke caused poor air quality throughout the U.S., affected air travel, and caused damage to the affected communities (Timsit & Livingston, 2023). Moreover, wildfires threaten traditional ceremonies and food availability for AI/AN communities. Members of the Klamath nations in Chiloquin, Oregon, are concerned about their ancestral territory and way of life and were unable to engage in ceremonies or hunt in 2020 due to wildfires (Flaccus & Howard, 2021).

A study conducted using data from the 2000 U.S. Census found that slightly more than 3% of the total U.S. population live in high flood-risk areas as defined by the Federal Emergency Management Agency (n.d.). Floods are associated with the second deadliest of all weather-related hazards in the U.S., accounting for approximately 98 deaths per year (CDC, 2024b). Because 40% of federally recognized tribes live in Alaska, a large proportion of AI/AN people could be affected by flooding related to coastal erosion in Alaska (U.S. Climate Resilience Toolkit, n.d.).

Drought and subsequent dry conditions can increase the probability of wildfires, dust storms, extreme heat, and reduced water quality and quantity (CDC, 2024b). Many AI/AN nations honor water as a foundation of their subsistence, treaty rights, way of life, and economies (National Wildlife Federation, 2011). Alternately, drought poses a threat to tribal communities as water shortages become more frequent and severe. Drought affects agricultural production and sources of food, and water sources can be the root of conflicts between AI/AN nations and surrounding communities (Gilio-Whitaker, 2019).

Furthermore, water and rain scarcity affect corn yields, drive sheep and wildlife to forage farther for water and food, and in some cases force AI/AN families to rely on nontraditional sources of drinking water (Hunt et al., 2021). Droughts can increase wildfire frequency and intensity, which affects homes, safety, medicinal and culturally important species, and cultural sites in AI/AN communities (U.S. Climate Resilience Toolkit, n.d.).

Environmental Health Hazards

We define environmental health hazards as substances that can cause adverse health effects, which include natural or human-made hazards such as toxic waste, radiation, pesticides, and chemicals. Historically, the U.S. government has taken many years to respond to and address community health concerns (Manjeshwar, 2021). The failure of the U.S. government to uphold treaty rights for Native lands has led to a history of environmental contamination for many AI/AN communities (Lewis et al., 2017). Indigenous Peoples are disproportionately impacted by industry and natural resource extraction (Scheidel et al., 2023). Growth of extractive industries, accumulation and disposal of wastes, and residential and commercial developments have created exposure risks to hazardous substances (U.S. EPA, 1989). Environmental health hazards can be ingested, inhaled, or absorbed through different mediums such as the soil, water, and air.

Uranium mining is associated with a wide range of human health risks, including respiratory disease, kidney disease, hypertension, and an increase in developing comorbidities (Lewis et al., 2017; National Research Council, 2012). In the Southwestern U.S., AI/AN communities are exposed to uranium due to the proximity of mining sites to their lands (Hoover et al., 2012). After approximately 50 years of uranium mining on Navajo lands, the expended mines were abandoned. In some cases, radioactive mine tailings remain exposed, becoming airborne and contaminating nearby water sources and ecosystems (Gilio-Whitaker, 2019).

In one Navajo cohort study, 27% of participants had high levels of uranium in their urine compared with 5% of the U.S. population (Morales, 2016). In Washington, two open-pit uranium mines remain on the Spokane Indian Reservation and are associated with increased cancer rates in nearby communities (Gilio-Whitaker, 2019). The Columbia River on the Hanford Nuclear Reservation in Washington was contaminated by the disposal of radioactive materials from uranium processed for the nuclear weapons industry from 1943–1987. According to Gilio-Whitaker (2019), the Yakama Nation and surrounding communities have elevated rates of cancer and rare birth defects that might be associated with the legacy of uranium tailings. The Yakama Nation is bordered on three sides by Superfund sites, areas designated by the U.S. government as the most contaminated and polluted locations in the country. The Yakama people rely heavily on fish from an area called Portland Harbor, which is a Superfund site. The harbor is heavily contaminated by petroleum, pesticides, and other toxic chemicals at levels dangerous to human health, forcing the Yakama people to restructure their way of life. For more than 30 years, the Yakama Nation has advocated for the cleanup of Portland Harbor, with little success (Manjeshwar, 2021).

Coal is a nonrenewable energy source that is widely used in combustion to generate electricity. Burning coal emits large amounts of hazardous substances into the atmosphere. Exposure to coal mine dust predominantly affects coal workers and causes health issues including a spectrum of respiratory diseases, chronic obstructive pulmonary disease (COPD), and lung cancer (Go & Cohen, 2020). Similar to their exposure to uranium, AI/AN communities are exposed to environmental contaminants because of the proximity of coal-fired power plants to their lands (Hoover et al., 2012). Massive coal deposits and the largest coal strip mine in the U.S. border Northern Cheyenne land in Montana, causing poor air quality, respiratory diseases, and low birth rates (Gilio-Whitaker, 2019). A total of four coal-fired power plants are located adjacent to Northern Cheyenne tribal land. The ground and surface waters on the Hoopa Valley Reservation in California are contaminated with acid drainage from mines,

tailing wastes, and active and inactive surface mines (U.S. EPA, 1989).

Polychlorinated biphenyls (PCBs) are a group of synthetic chemicals that cause both cancerous and noncancerous effects (U.S. EPA, 2025). PCBs were manufactured in the U.S. between 1929 and 1977 (U.S. EPA, 2025). The manufacturing of PCBs stopped in 1976 when the Toxic Substances Control Act was passed because of the evident harmful effects to the environment and human health. Despite this stop in production, the 2014 National Health and Nutrition Examination Survey determined that Asian, Pacific Islander, Native American, or multiracial groups had the highest blood PCB values for people ages 12–30 years (Xue et al., 2014).

Moreover, aluminum factories have contaminated the St. Lawrence River in New York, which is a traditional source of fish for the Mohawk Nation at Akwesasne (Manjeshwar, 2021). As a result of the contamination, the Mohawk people have been exposed to bioaccumulated PCBs, which are recognized as risks for diabetes and cancer and can have negative effects on neurological, immune, reproductive, and endocrine systems (U.S. EPA, 2024a). A study found that older adults (defined in this study as ages 47–79 years) from the Mohawk Nation experienced much higher rates of cognitive decline attributed to significantly higher levels of blood PCBs compared with other age groups (Sasaki et al., 2023).

The Tribal Lands Assistance Center (TLAC) is a resource center for Native communities to receive technical assistance for challenges caused by environmental contamination. TLAC is a product of collaboration of U.S. EPA, the Tribal Waste and Response Steering Committee, the Tribal Superfund Working Group, and the Institute for Tribal Environmental Professionals. TLAC provides all federally recognized tribes with training for professionals and officials to lead culturally driven decisions to determine how a contaminated site might be used or restored. Enabling tribal jurisdictions to pursue legal action is a key step in rectifying the disproportionate impacts of environmental contamination on Native lands.

As an example, for nearly a century a lead-smelting company released dozens of toxic chemicals, including mercury, into the Columbia River on the Confederated Tribes of the Colville Reservation in Washington (Gilio-Whitaker, 2019). In 2004, a lawsuit began against the smelting company and resulted in the Colville Nation winning a $193 million settlement in 2012. The Colville Nation used the funds to restore the contaminated land and pay individual settlements to its members.

Air Quality

Air pollution has led to excess morbidity and mortality from a variety of health impacts (Manisalidis et al., 2020). Negative health effects linked to particulate matter (PM) exposure include the development or exacerbation of chronic lung problems, heart attacks, hospital admissions, and emergency department visits for heart and lung disease (ITEP, 2021). In particular, cardiovascular disease occurs at significantly higher rates among AI/AN individuals than in White individuals and is the leading cause of death among AI/AN populations (Espey et al., 2014). Chronic and acute exposures to air pollution have major negative impacts on human health (Manisalidis et al., 2020). As of 2019, ambient air pollution was the sixth-leading risk factor and top environmental factor for deaths worldwide and is estimated to have caused 4.2 million premature deaths (World Health Organization [WHO], 2024). Air pollution is estimated to cause between 1,000 and 4,300 excess premature deaths nationally per year by 2050 (CDC, 2024c). A 2021 study funded by U.S. EPA found race to be a significant factor in exposure to air pollution, with data showing that people of color experience 75% of the overall exposure (Tessum et al., 2021).

Mortality related to air quality is also affected by low socioeconomic status (Josey et al., 2023). An analysis of mortality and $PM_{2.5}$ exposures using Medicaid data found that structural racism and low socioeconomic status compound to create disproportionate mortality (Josey et al., 2023). Despite known exposures among AI/AN populations, as well as elevated risks stemming from prevalent comorbidities and socio-vulnerabilities, there is a gap in the literature investigating these impacts. The effects of air quality are a concern for Indian Country; however, few epidemiological and exposure studies exist.

A study that used Medicare data found that all-cause mortality with yearly, increasing $PM_{2.5}$ exposure was higher among Native Americans than the general population (Di et al., 2017). Further, Di et al. (2017) noted that the data set had wide confidence intervals and that many Native Americans use other healthcare and insurance services.

In a study by Li et al. (2022), various $PM_{2.5}$ models were created that compared predicted ambient air quality between American Indian-populated counties and non-American Indian-populated counties from 2000–2018. The researchers found that compared with non-American Indian-populated counties, the American Indian-populated counties had higher rates of $PM_{2.5}$ according to an adjusted model. By the end of the study period, $PM_{2.5}$ levels declined in both counties. The rate of decline for $PM_{2.5}$ levels during the study period, however, was significantly greater in non-American Indian-populated counties. Overall, there is a gap in both epidemiological and air quality exposure studies for AI/AN communities. Li et al. (2022) suggest that a lack of federal air quality monitors in rural, remote areas where tribal nations tend to be located is generally a limitation of air quality studies.

There are gaps in air quality throughout Indian Country (Watson et al., 1997). Typically, federal air quality monitors are placed in urban, populated areas. Many Indigenous Peoples, however, live in rural regions. The lack of air quality data is partially attributed to inadequate equipment and insufficient funding for equipment to monitor air quality (ITEP, 2021). Necessary equipment such as data loggers, wind and temperature sensors, and nephelometers (i.e., $PM_{2.5}$ monitors) are examples of equipment that is essential to monitor air quality in communities.

A narrative by Carol Kriebs from the Kootenai Tribe of Idaho expressed that equipment failure is happening across Indian Country, and funding is needed to upgrade air monitoring equipment (ITEP, 2021). Kriebs explained that the data logger used at the Kootenai Tribe of Idaho was so outdated that it was no longer serviceable. The replacement equipment they received from the Idaho Department of Environmental Quality was also in the process of being phased out.

Tribal members of the Nottawaseppi Huron Band of the Potawatomi in Michigan do not receive specific funding for air quality monitoring. Given the disparities in health outcomes for tribal communities

and the emerging connections between air quality and COVID-19 risks, more research; improved air quality; and a focus on addressing social, environmental, and health justice concerns are warranted (ITEP, 2021).

Indoor air quality (IAQ) is also a concern for Indigenous public health, as many homes burn wood for heat. The resulting exposure to $PM_{2.5}$ and volatile organic compounds (VOCs) has been associated with respiratory illness (Morris et al., 1990; Robin et al., 1996). From 1998–2008, AI/AN children younger than 5 years had 1.6 times the hospitalization rate for lower respiratory tract infections than the same age group in the general U.S. population (Foote et al., 2015).

In Alaska, a few home-based interventions have been researched to improve IAQ in Alaska Native households (Short et al., 2024; Singleton et al., 2017). Singleton et al. (2017) provided education about IAQ and collaborated with these households to improve leaky wood stoves and increase ventilation in the houses and then monitored changes in IAQ and respiratory symptoms of children who had lung conditions. They found that parents reported fewer occurrences of runny nose, cough between colds, wet cough, wheezing with colds, wheezing between colds, and school absences. In 2019, the Yukon-Kuskokwim Health Corporation introduced a pilot program that provided education and HEPA air purifiers to families with children who had chronic lung issues (Short et al., 2024). By interviewing representatives from participating households, the researchers assessed how well the HEPA purifiers were accepted and used. All respondents noted health improvements in their children. The results suggested that in-home air purifiers were a sustainable and feasible option for Alaska Native households.

Although air quality in general has improved in the U.S., AI/AN communities continue to experience higher pollution levels and slower rates of improvement. These communities face additional challenges due to outdated equipment and limited air quality monitoring in rural areas. Efforts to address IAQ (e.g., providing home-based interventions) have shown promise in improving health outcomes for children with respiratory conditions. There remains a major need, however, for more epidemiological and exposure research, better monitoring, and targeted interventions to address these environmental and health concerns in Indigenous communities.

Water Quality

For many AI/AN communities, water is integral to their cultural and community practice. "Water is life" is a common view among many AI/AN people (Tanana et al., 2021). Prioritizing access to water in Indian Country is a key public health measure. Decreased water quality and quantity affect the traditional way of life due to the combined effects on drinking water, food, culture, and the ability to perform traditional ceremonies (U.S. Climate Resilience Toolkit, n.d.). Additionally, contaminated water and poor sanitation are linked to the transmission of various diseases and expose individuals to preventable health risks (WHO, 2023).

According to a U.S. EPA study (2022), 95% of the U.S. population receives at least some of their drinking water from a community water system, and 92% of those water systems did not report standard violations. Historical and contemporary breaches of treaty rights with tribal water rights have resulted in insufficient infrastructure (Powell, 2024; U.S. Climate Resilience Toolkit, n.d.). Access to safe running water is a major challenge for many tribal jurisdictions in the Southwest. One study found that 13% of Alaska Native people and approximately 25–40% of people from the Navajo Nation still rely on hauling water, which is inconvenient and makes water more susceptible to waterborne diseases (Gilio-Whitaker, 2019).

For example, a study that examined infectious disease rates for several waterborne diseases in Alaska Native homes found higher respiratory and skin infection rates in homes without piped water access (Hennessy et al., 2008). According to IHS, approximately 7.5% of AI/AN homes did not have safe drinking water or basic sanitation in 2013 (Tribal Public and Environmental Health Think Tank, 2018).

Out of all the freshwater consumed in the U.S., approximately 77% is derived from surface waters, including reservoirs, lakes, and streams. Numerous AI/AN lands are in rural areas and are highly dependent on surface water sources. Aside from access to water, contamination is another issue related to water safety. Both environmental contamination and climate change have largely affected the availability of safe drinking water. Furthermore, chemicals such as heavy metals (e.g., uranium, arsenic) and per- and polyfluoroalkyl substances (PFAS) have contaminated drinking water sources among Indigenous communities nationally (Erdei et al., 2019; Jones et al., 2020; Tanana et al., 2021). Additionally, a 2017 study revealed that exposure to low-level inorganic arsenic in well water is linked to impaired neuropsychological functioning among American Indian elders throughout the Western U.S. (Gilio-Whitaker, 2019).

The Clean Water Act (CWA) of 1972 was implemented to regulate the discharge of pollutants into U.S. waters and set quality standards for surface waters (U.S. EPA, 2024). Existence of this law, however, does not guarantee compliance. In New Mexico, for example, the Pueblo of Isleta is affected by discharges in the upstream entities of Albuquerque, Santa Fe, Rio Rancho, and Kirkland Air Force Base that violate the CWA (Gilio-Whitaker, 2019). These discharges make the water unsuitable for religious ceremonies and everyday use. Toxic contaminants (e.g., arsenic, untreated sewage water, aluminum, PCBs, lead) raise questions about the health of people who eat crops irrigated with the same contaminated water.

Another example is the San Juan River, which flows through the Navajo Nation in northern New Mexico. The river was contaminated when an abandoned gold mine spilled 3 million gallons of acidic wastewater containing iron, aluminum, manganese, lead, copper, and other heavy metals into the Animas River, which is a tributary of the San Juan River (Gilio-Whitaker, 2019). The spill turned the water a yellow-orange color and contaminated underground wells used for drinking water. The Navajo Nation and other communities need these rivers for ranching and irrigation purposes. As a result of the spill, crop damage to Navajo Nation farms was widespread and approximately 2,000 Navajo people were affected. The Gold King Mine, which was managed by U.S. EPA, admitted responsibility and agreed to pay $4.5 million in emergency costs to state, local, and tribal governments. In 2017, however, U.S. EPA claimed that a legal analysis determined that they had no obligation to pay damage claims due to sovereign immunity (Finley, 2017).

Environmental Prenatal Exposures

Exposure to environmental contaminants is concerning, particularly to adults of reproductive age, pregnant individuals, and children. Exposure to contaminants can negatively affect fertility, development in utero, pregnancy outcomes, and child health (Sunyach et al., 2018). The environments where pregnant individuals live, work, and spend time can influence both their health and the health of their unborn children. AI/AN people have almost twice the infant mortality rate as non-Hispanic White people and are 50% more likely to die from complications related to low birthweight (Office of Minority Health [OMH)], 2021). In this study, the AI/AN infant mortality rate was 8.2 per 1,000 live births and 4.6 per 1,000 live births for people who self-identified as White (OMH, 2021). With regard to environmental contaminants, AI/AN female individuals have a higher risk for medical conditions, including reproductive cancer and miscarriage, as well as a higher risk of giving birth to babies with birth defects and intellectual function impairments (Gilio-Whitaker, 2019). In 2008, the U.S. Department of Health and Human Services reported that AI/AN infant mortality was 44% higher than in the previous decade (Gilio-Whitaker, 2019).

Lakota female individuals have experienced high rates of miscarriage and reproductive cancers due to the effects of uranium contamination (Hoover et al., 2012). Uranium mining contamination has affected the Oglala Lakota, and studies have reported radiation in groundwater and surface water sources in the Pine Ridge Indian Reservation, an Oglala Lakota reservation in South Dakota (Hoover et al., 2012).

In 1986, PCB contamination in the St. Lawrence River resulted in an advisory for the Mohawk Nation at Akwesasne to stop eating local fish (Hoover et al., 2012). Although PCB levels have since declined among the local population, levels are still elevated when compared with the general U.S. population. Significantly higher levels of PCBs were found among Mohawk Nation adolescents who were breastfed as infants. Compared with girls of similar age in the general U.S. population, Mohawk Nation girls were more likely to have reached puberty at 12 years of age, which could be from the estrogenic effects of PCBs (Hoover et al., 2012).

The Navajo Birth Cohort Study is a collaborative research partnership of the Navajo Nation, researchers at the University of New Mexico, and the Agency for Toxic Substances and Disease Registry within CDC (Hunter et al., 2015). Navajo female individuals who were concerned about their reproductive health from uranium pollution were the impetus behind this cohort project, which is the first prospective cohort study to examine the association between heavy metal levels and birth outcomes in a population that has been exposed to uranium. Ongoing efforts of tribal, academic, and government partnerships aim to inform tribal policy and empower tribally driven public health initiatives. Furthermore, the Navajo Birth Cohort Study strives to create linguistically and culturally appropriate questionnaires informed and approved by the Navajo Nation Human Research Review Board. These research efforts are exemplary of interagency research partnerships that bring tribal direction and input to the forefront.

Limitations

This report is limited to focusing only on the environmental public health hazards found to have significant and documented effects on AI/AN communities. Therefore, we might have underrepresented the array of environmental public health hazards associated with environmental health, health equity, or environmental injustices in these communities. This report is also limited to the health impacts related to environmental health. While we made efforts to thoroughly search the literature for connections between environmental public health and AI/AN communities, publications might have been missed, and additional environmental public health impacts might exist beyond the connections included in this report.

It is also noteworthy that many environmental health professionals in tribal jurisdictions focus on public health practice rather than research-based approaches. For several important environmental health topics, research and statistics were either missing or very limited. Thus, environmental health themes were determined by the availability of data and narrowed down for conciseness here. Additionally, the referenced case studies show only one person's or one community's perspective. It is important to note that other individuals and communities might have different viewpoints, perceptions, or experiences.

Conclusion

The disproportionate burden of exposures shouldered by AI/AN communities represents serious, persistent health and environmental problems. These challenges warrant a corrective action plan that reflects our nation's commitment to optimal health, safety, and financial security for its residents. The intimate traditional ecological knowledge that these communities possess represents an important insight into local environments and natural ecosystems. Incorporating regionally specific, traditional ecological knowledge should be considered a tool to use in future climate change adaptation, mitigation planning, and resolution of related environmental health concerns.

Another critical step the environmental health community can take to address longstanding disparities is to expand efforts to cultivate and support the next generation of AI/AN professionals in this field. Increasing the representation of AI/AN individuals in environmental public health is essential to ensuring that tribal communities are not only included but also positioned to lead in the research, management, and decision-making processes that directly impact their health and environments. Investing in education, training, and career development opportunities tailored to AI/AN populations will help build a more equitable and effective environmental health workforce. We recommend that future environmental health research and management continue to celebrate and model these strength-based approaches (O'Keefe et al., 2023).

Climate change is an escalating global crisis with profound effects not only on the environment but also on human health, including mental health (Walinski et al., 2023). Studies have documented various mental health issues arising from climate change such as increased suicide rates due to rising temperatures, post-traumatic stress disorder (PTSD) from severe storms, and acculturation stress linked to climate-induced relocation (Padhy et al., 2015). This intersection between mental health and environmental health is a burgeoning area of study, and Indigenous communities worldwide have begun to lead research initiatives that validate their lived

experiences (Vecchio et al., 2022). Notably, a global review by Vecchio et al. (2022) highlights the absence of studies from the U.S., underscoring the untapped potential for impactful research in this region. Given that this field is nascent, there is a significant opportunity to achieve meaningful progress by adopting Indigenous-led, strengths-based approaches and solutions.

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continued on page 34

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