DINÉ HOUSEHOLD WATER SURVEY

Water is Life: Using Data to Empower Diné Communities to Close the Water Access Gap

Research Brief

Key Findings from the Fort Defiance Agency

September 2024

CENTER FOR INDIGENOUS HEALTH

Background

Access to safe, reliable, and affordable water is not just fundamental to health and well-being, but also to culture, dignity, and human rights. Yet, Indigenous communities across the United States (US) continue to face disproportionate challenges in accessing water and basic sanitation compared to other Americans (DigDeep & US Water Alliance, 2020; Deitz & Meehan, 2018; Tanana, Combs, & Hoss, 2021; Tanana et al., 2021). The lack of piped water infrastructure in Indigenous communities underscores the failure of the US government to uphold its trust responsibilities, neglecting its duty to ensure the well-being and equitable treatment of Native American communities and to provide essential resources necessary for their self-sufficiency and development.

The Navajo Nation, among the largest Tribes in the US by population, exemplifies these challenges (U.S. Congressional Research Service, 2024). Mismanaged mining sites, harmful mining practices, and chemical spills have contaminated water sources leading to distrust in the community water system, driving many residents to rely on bottled water (Hoover, J. et al., 2017). Compounding these issues are the impacts of climate change and ongoing disputes over water rights, which further hinder the ability to secure safe and reliable water access. The Navajo Nation's vast geography and inadequate infrastructure force many families to haul water over long distances. This process is time-consuming, expensive, dependent on weather conditions, and potentially unsafe if contaminants are present. Without access to safe and reliable water, unstable water access may lead to rationing which compromises health.

The Johns Hopkins Center for Indigenous Health is conducting a research project that aims to fill the critical gap in comprehensive and current data on water access within the Navajo Nation and to confront the historical injustices that have led to these ongoing challenges.

This research brief presents key findings from initial analysis of the household water needs amongst Diné families living in the Fort Defiance Agency on the Navajo Nation.

Research Objectives

This study aims to conduct a comprehensive water needs assessment across a representative sample of households on the Navajo Nation. Through this approach, it seeks to gather inclusive and accurate data that establishes the true water access experiences of Diné people living on the Navajo Nation.

Primary Research Aims

Aim 1: Estimate the number of Diné households that lack access to piped water and have inconsistent and/or inadequate access to water for all household needs (i.e., drinking, cooking, washing, hygiene and sanitation, farming, gardening, and livestock).

Aim 2: Measure multiple water use behaviors, self-reported water quality, quantity, and reliability experiences, and water insecurity at the household level on Navajo Nation.

Secondary Research Aims

Aim 1: Assess household drinking water quality with direct measurements of contaminants and indicators of water safety.

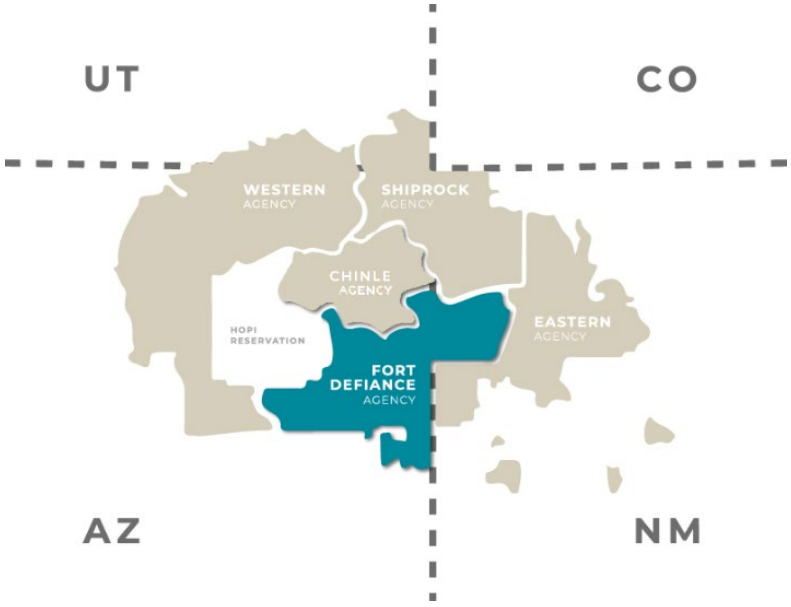
Aim 2: Explore preferences for water access solutions for Diné households.

Aim 3: Explore geographical data related to water access activities of Diné households using geospatial modeling and analysis (e.g., mapping access to different types of water sources, travel distance, etc.).

Planning and Development

Pilot Study Development

A pilot study was necessary to assess the feasibility and effectiveness of the research project. Insights from the successful pilot are now guiding the expansion of data collection efforts across the entire Navajo Nation.

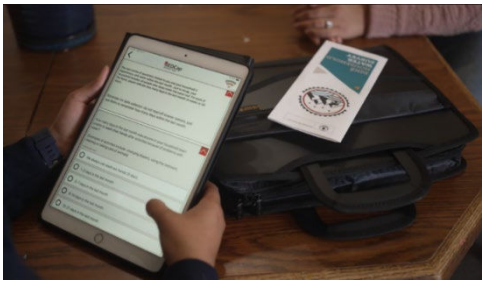


The Fort Defiance Agency—one of the five geographic regions of the Navajo Nation— where approximately 25% of Navajo Nation community members reside, was chosen to pilot the study. This southern region is home to the capital city of Window Rock and includes a variety of diverse landscapes that are representative of the entire Navajo Nation.

From December 2021 to September 2022, the Johns Hopkins Center for Indigenous Health team collaborated with community stakeholders to develop an equitable, culturally responsive research plan and to obtain all local approvals.[1] A participatory household mapping effort was initiated using a combination of satellite imagery, past household data, and a modified ground-truthing approach with collective community knowledge. This technique was used to ensure every occupied household within the Fort Defiance Agency was accounted for and had a chance for random selection. The inclusive sampling strategy was intended to be more comprehensive and representative than those used in previous research.

[1] Local and institutional approvals are required for all research conducted on the Navajo Nation. Prior to beginning study activities, the study received all necessary support and approvals from the local community and Johns Hopkins University. The research protocol was reviewed and approved by both the Johns Hopkins School of Public Health Institutional Review Board and the Navajo Nation Human Research Review Board (NNHRRB) on July 19, 2022 (NNR-22.449).

Methods



This study employs a cross-sectional design utilizing a population-based household sampling methodology. Trained study staff used the generated map of randomly selected households to locate and recruit households.

Data collection involves a culturally tailored, one-time household questionnaire (referred to as a 'survey') administered as an interview by trained Diné staff and offered in both Navajo and English. The survey gathers detailed information about water access experiences by measuring various water use behaviors, self-reported water quality, quantity, and reliability. It also includes details on the sources of water for homes, how the water is used, the resources required to obtain it, and potential solutions to improve water access. Geospatial software is used to map the locations of participating households and their water sources.

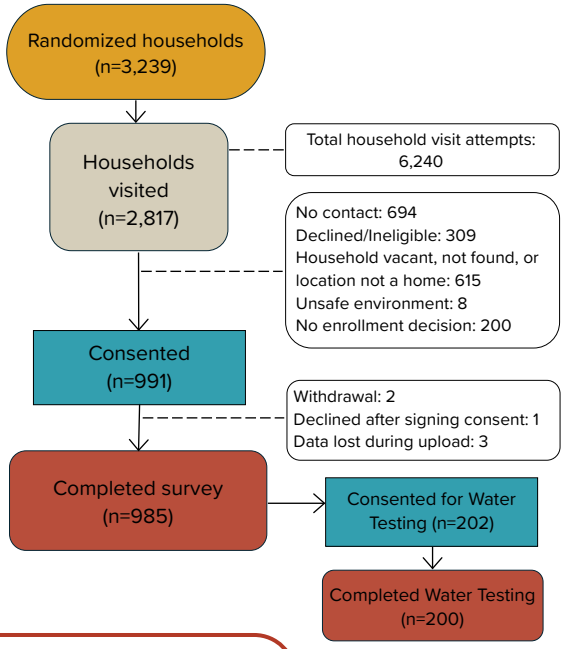
A subset of 200 enrolled households additionally participated in the one-time water quality testing component to measure contaminants of health concern. Collected water samples are tested for metals, per- and poly- fluoroalkyl substances (PFAS), nitrates, free chlorine, total coliforms, and *E. coli* (*Escherichia coli).*

Recruitment and Enrollment

Recruitment and enrollment across the Fort Defiance Agency took place between October 2022 and December 2023. Households were recruited through in-person home visits. To be included in the study, the household had to be located within the Fort Defiance Agency and randomly selected. The head of household had to be willing to participate and at least 18 years old.

In total, 991 participants consented to participate, and 985 participants completed the household water questionnaire. A subset (n=200) completed water quality testing (Figure 1).

Figure 1: Recruitment & Enrollment



985
Surveys

200
Water Quality Tests

Key Findings

The following key findings are based on the initial analysis of the data collected. Please note that data analysis is still ongoing, and further insights may emerge as we continue to examine the information.

Demographics of Surveyed Households

Participant Information	All households N=985 (%)	Households with piped water N=722 (%)	Households without piped water N=263 (%)
Participant Age: Mean (SD)	59.3 (15.2 SD)	59.4 (15.1 SD)	59.1 (15.3 SD)
Tribal Affiliation (Navajo)	951 (96.1%)	691 (95.4%)	259 (99.2%)
# of years lived in home			
< 1 year	30 (3%)	19 (2.6%)	11 (4.2%)
1 – 10 years	246 (24.9%)	180 (24.9%)	66 (25.1%)
11 – 20 years	159 (16.1%)	108 (14.8%)	52 (19.8%)
21+ years	550 (55.8%)	416 (57.6%)	134 (50.9%)
Household Characteristics	All households N=985 (%)	Piped N=722 (%)	Not piped N=263 (%)
Type of home			
Framed House	682 (69.2%)	530 (73.4%)	151 (57.4%)
Trailer/Mobile Home	201 (20.4%)	145 (20%)	56 (21.3%)
Apartment	16 (1.6%)	16 (2.2%)	--
Framed Hogan	63 (6.4%)	25 (3.5%)	38 (14.4%)
Traditional Hogan	8 (0.8%)	2 (0.3%)	6 (2.3%)
Shed-style home	16 (1.6%)	4 (0.6%)	12 (4.6%)
Home lived in:			
Year round	937 (95.1%)	696 (96.4%)	241 (91.6%)
Half of the year	23 (2.3%)	11 (1.5%)	12 (4.6%)
Less than half the year	5 (0.5%)	1 (0.1%)	4 (1.5%)
Only occasionally	20 (2%)	14 (1.9%)	6 (2.3%)
Most frequently spoken language			
Navajo	327 (33.2%)	219 (30.4%)	107 (40.8%)
English	642 (65.2%)	490 (68%)	152 (58%)
Other	15 (1.5%)	12 (1.7%)	3 (1.1%)
# of people in household - Median (Mean)	2 (2.9)	3 (3.1)	2 (2.6)
At least 2 elders (55+) in household	320 (32.5%)	243 (33.6%)	77 (29.5%)
Cell phone coverage			
No	101 (10.3%)	67 (9.3%)	34 (13%)
Yes	884 (89.7%)	655 (90.7%)	227 (87.1%)
Internet access			
No	373 (37.9%)	218 (30.2%)	155 (58.9%)
Yes	612 (62.1%)	504 (69.8%)	108 (41.0%)
Electricity			
No	57 (5.8%)	7 (0.9%)	50 (19.0%)
Yes	928 (94.2%)	715 (99%)	213 (80.9%)

Other Demographic Highlights

- Many households grow trees or have gardens (**37.1%**), raise livestock (**39.7%**), and have farms or agricultural land (**11.5%**).
- Nearly **9 out of 10** families have faced financial difficulties within the last year.

Household Water Access Findings

Basic Water Access

26.7% of surveyed households in the Fort Defiance Agency reported not having piped water access from a community water system.

- The majority (**96.8%**) of piped water is sourced by Navajo Tribal Utility Authority (NTUA).
- Approximately **17%** of homes with piped water report their water was shut off at some point due to inability to pay.
- **33%** of homes without piped water access have a cistern.

Basic Sanitation Access

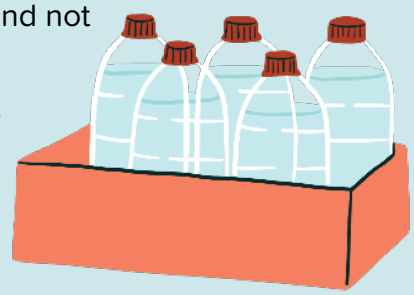
- **46%** of the homes without piped water access have a flush toilet that is not connected to running water.
- **28%** of households use an outhouse as one of their bathroom locations.
    - **52%** of homes with outhouses dig a new pit or move the outhouse at least once a year.

Water Sources

- The most frequently used water sources are bottled water, piped water into the home, windmill/wells, water points (NTUA/Chapter, etc.), and piped water near the home.
- Homes without piped water use more water sources than piped homes, demonstrating the need to diversify their water access.

Drinking Water Access

- The most common primary drinking water source is bottled water, used by **72.4%** of all households.
    - This is consistent across both piped (**72.2%**) and not piped households (**72.8%**).
- Households with piped water mainly use their water for cooking (**83.6%**) rather than drinking (**26.4%**).
- Non piped homes are spending more to access drinking water than piped homes.



- **13.5%** households without piped water report someone going to bed thirsty at least once in the past month (over 3x higher than households with piped water).

Water Hauling

- **41.3%** of households reported hauling water within the last year.
    - *There is a large economic burden for hauling water, including wear-and-tear on vehicles, gas/mileage and time spent hauling.*
- **86%** of households without piped water rely on hauling water, compared to **25%** of households with piped water.
- **35%** of water haulers report water is not always available when they go to haul.
- Burden of water hauling falls on elders. **60.5%** of primary water haulers are 55+ years or older.

- Of households that must haul water, **73%** use less than 13 gallons/person/day and **37%** use less than 4 gallons/person/day, the minimum required for survival.

    Per the humanitarian standards, 13 gallons of water per person per day is the minimum amount of water required for health and dignity.

Water Quality Testing

- Low to moderate water arsenic **(<10 ug/L)** was present in approximately half of drinking water samples.
    - Arsenic is naturally occurring in the environment (i.e., in water, air, and soil). However, it can also enter water supplies through industrial activities like mining and pesticide use. Prolonged exposure to arsenic can pose various health issues, including cancer, cardiovascular disease, skin disorders, and developmental effects.
- Insufficient chlorine levels **(< 0.2 mg/L)** were measured in more than half of the water samples, falling below the EPA Safe Drinking Water Act minimum requirement of 0.2 mg/L.
    - The presence of free chlorine indicates that: 1) enough chlorine was initially added to the water to inactivate disease-causing organisms, and 2) the water is protected from contamination in the distribution system. Low chlorine indicates deficiencies in the drinking water system.
- Nitrate levels complied with EPA's maximum contaminant level (10 mg/L) with a mean detection level of **4.9 mg/L**.
    - A measure of contamination from human sewage, manure, and fertilizers. Excess nitrogen levels can disrupt aquatic ecosystems. Monitoring nitrate levels is crucial for human health, as high concentrations in drinking water can cause conditions like methemoglobinemia, or "blue baby syndrome," especially in infants.
- Most water samples **(97.5%)** were free from *E. coli* contamination.
    - *E. coli* is a type of fecal coliform bacteria that comes from human and animal waste. The presence of *E. coli* can indicate recent fecal contamination, which means there is a risk that pathogens are present. Certain strains of *E. coli* can cause illness (e.g., gastrointestinal problems and waterborne diseases).
- **100%** of samples tested for PFAS were below the EPA maximum contaminant limits.
    - Man-made chemicals known to cause adverse health effects. They are used in various industrial and commercial applications due to their water- and oil-repellent properties. PFAS can enter drinking water through various point and non-point sources.

Water Access Concerns & Recommended Solutions

Top water access concerns reported by households:

- Transportation challenges
- Weather
- Cost of water

Top recommendations to improve water access:

- Build a waterline to my home
- Pave roads in my community
- More free safe water points

We would like to emphasize that data analysis efforts are preliminary and more analyses on water costs, sanitation, water storage, child health, agriculture and livestock, and water insecurity are forthcoming. If you are interested in learning more about our findings or have specific inquiries, please do not hesitate to reach out. We welcome your questions and are eager to share insights as they become available.

Next Steps

Share Study Findings: We will continue to disseminate the findings of this study to the local community, Tribal leaders, stakeholders, and policymakers. This ongoing communication is essential for fostering informed decision-making and driving meaningful action address the identified water access challenges.

Expand Data Collection: Having initiated data collection in the Chinle Agency in April 2024, our next phase involves scaling this research across the entire Navajo Nation.

Conclusion

In conclusion, Johns Hopkins Center for Indigenous Health's efforts to assess and document the household water needs of Diné families across the Navajo Nation represent a crucial step toward ensuring safe, sustainable, and scalable water access. The data gathered will be instrumental in guiding future initiatives and policy aimed at improving water access for all Diné families.

Acknowledgements

We would like to extend our heartfelt thanks to all study participants for their valuable time and thoughtful contributions. Our sincere gratitude goes to the Navajo Nation Human Research Review Board, the Fort Defiance Agency Chapters and Agency Council, and the Navajo Nation Department of Community Development, Navajo Nation Environmental Protection Agency, and the Navajo Nation Department of Water Resources for their support and collaboration. We also appreciate the efforts of the Navajo Area Indian Health Service and the Water Access Coordination Group (WACG) for their essential roles in this research and commitment to improving water access for all Diné families. We thank Lynne Hardy and Ed Cunicelli for their exceptional work in creating the beautiful artwork and photographs used throughout our dissemination efforts. This work would not have been possible without our generous donors, who have been steadfast in their commitment since the project's earliest inception, including the Osprey Foundation, DigDeep, the Macauley Foundation, Rotary Club of Towsontowne, and our private donors. Finally, we are deeply grateful to our JHCIH study staff for their unwavering dedication and for creating a respectful and supportive environment that allowed participants to openly share their water access experiences.

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