

## ▶ DIRECT FROM ATSDR

# The Navajo Birth Cohort Study

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**Editor's Note:** As part of our continuing effort to highlight innovative approaches to improving the health and environment of communities, the *Journal* is pleased to publish a bimonthly column from the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR, based in Atlanta, Georgia, is a federal public health agency of the U.S. Department of Health and Human Services (HHS) and shares a common office of the Director with the National Center for Environmental Health at the Centers for Disease Control and Prevention (CDC). ATSDR serves the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances.

The purpose of this column is to inform readers of ATSDR's activities and initiatives to better understand the relationship between exposure to hazardous substances in the environment and their impact on human health and how to protect public health. We believe that the column will provide a valuable resource to our readership by helping to make known the considerable resources and expertise that ATSDR has available to assist communities, states, and others to assure good environmental health practice for all is served.

The conclusions of this article are those of the author(s) and do not necessarily represent the views of ATSDR, CDC, or HHS.

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## Background

The Navajo Nation encompasses more than 24,000 square miles across three states—New Mexico, Utah, and Arizona—and is the largest Alaska Native/American Indian Reservation in the U.S. From 1944 to 1986, hundreds of uranium mining and milling operations extracted an estimated 400 million tons of uranium ore from Navajo lands. These mining and processing operations have left a legacy of potential exposures to uranium waste from abandoned mines/mills, drinking water and soil contamination, and homes and structures built with mining waste (U.S. Environmental Protection Agency [U.S. EPA], 2014).

Uranium is a naturally occurring radioactive metal and may cause adverse health effects related to both its radiological and chemical properties. As a heavy metal, uranium damages the kidneys at higher exposure doses and accumulates in kidney tissue and bone (Agency for Toxic Substances and Disease Registry [ATSDR], 2013). Several research studies have examined environmental and occupational exposure to uranium and associated renal effects (Arzuaga, Rieth, & Cooper, 2010; Hund et al., 2015). Limited and inconsistent data exist, however, concerning uranium exposure and adverse birth and reproductive health outcomes (Brugge & Buchner, 2011; Domingo, 2001; Hindin, Brugge, & Panikkar, 2005). More research is needed to understand if environmental uranium exposure may pose health risks during critical windows of human development. These investigations are particularly critical in populations that are disproportionately affected by heavy metal environmental exposures or who have a history of adverse pregnancy and birth outcomes.

American Indians and Alaska Natives experience considerable disparities in maternal and infant health outcomes compared to the general U.S. population (Alexander,

TABLE 1

### Navajo Birth Cohort Study Primary Partners Roles

- Agency for Toxic Substances and Disease Registry
  - » Program oversight
  - » Office of Management and Budget clearance
  - » Epidemiological support
  - » Biomonitoring analysis
- University of New Mexico
  - » Primary investigator
  - » Project oversight and coordination
  - » Protocol development
- Navajo Nation Department of Health
  - » Community outreach and engagement
  - » Survey and developmental assessments administration
- Navajo Area Indian Health Service
  - » Clinical coordination
  - » Participant recruitment
  - » Medical record abstraction

Wingate, & Boulet, 2008). Compared with non-Hispanic whites, American Indians/Alaska Natives have a higher prevalence of birth defects and infant, neonatal, and post-neonatal mortality (Canfield et al., 2014; Wong et al., 2014). In the Navajo Nation, the infant mortality rate is 8.5 deaths per 1,000 live births, compared to 6.9 deaths per 1,000 live births among all races in the U.S. population. In addition, postnatal mortality rates for Navajo infants are 2.1 times higher than the U.S. (Indian Health Service, 2003).

### Study Overview

The Agency for Toxic Substances and Disease Registry (ATSDR) and its collaborating partners—the University of New Mexico Community Environmental Health Program (UNM-CEHP), the Navajo Nation Department of Health (NNDOH), and the Navajo Area Indian Health Service (NAIHS)—are conducting a prospective birth cohort study to better understand the potential relationship between exposure to environmental contaminants (i.e., uranium and other heavy metals) and reproductive birth outcomes in the Navajo Nation. Known as the “Navajo Birth Cohort Study (NBCS),” this collaborative research effort is being conducted under approval and review of Navajo Nation human research review board (NNHRRB). As the

FIGURE 1

### Study Logo Created by Navajo Birth Cohort Study Team Member Sandy Ramone



funding agency, ATSDR provides oversight, epidemiological support, and biomonitoring analysis through the Centers for Disease Control and Prevention's Division of Laboratory Sciences. NBCS is a cooperative research agreement, and UNM-CEHP serves as the principal investigator institution. To conduct this large-scale study, ATSDR has also partnered with the NNDOH and NAIHS (Table 1). Additional study collaborators include the Southwest Research and Information Center (SRIC), Navajo Nation Growing in Beauty Program (GIB), Navajo culture and language specialists, Navajo Nation Environmental Protection Agency, ATSDR Region 9, and the U.S. Environmental Protection Agency (U.S. EPA) Region 9. SRIC, through a UNM-CEHP sub award, conducts home environmental assessments and community outreach. GIB provides coordination and early intervention for infants with identified birth defects and developmental delays. Study questionnaires, outreach materials, and logo (Figure 1) were specifically developed for this study in collaboration with Navajo media and cultural specialists. UNM's Navajo multimedia specialist, in conjunction with NNHRRB review, regularly develops and ensures that social media and other outreach materials are culturally appropriate. All questionnaires and outreach materials have been field tested for

cultural/language appropriateness and are reviewed by NNHRRB.

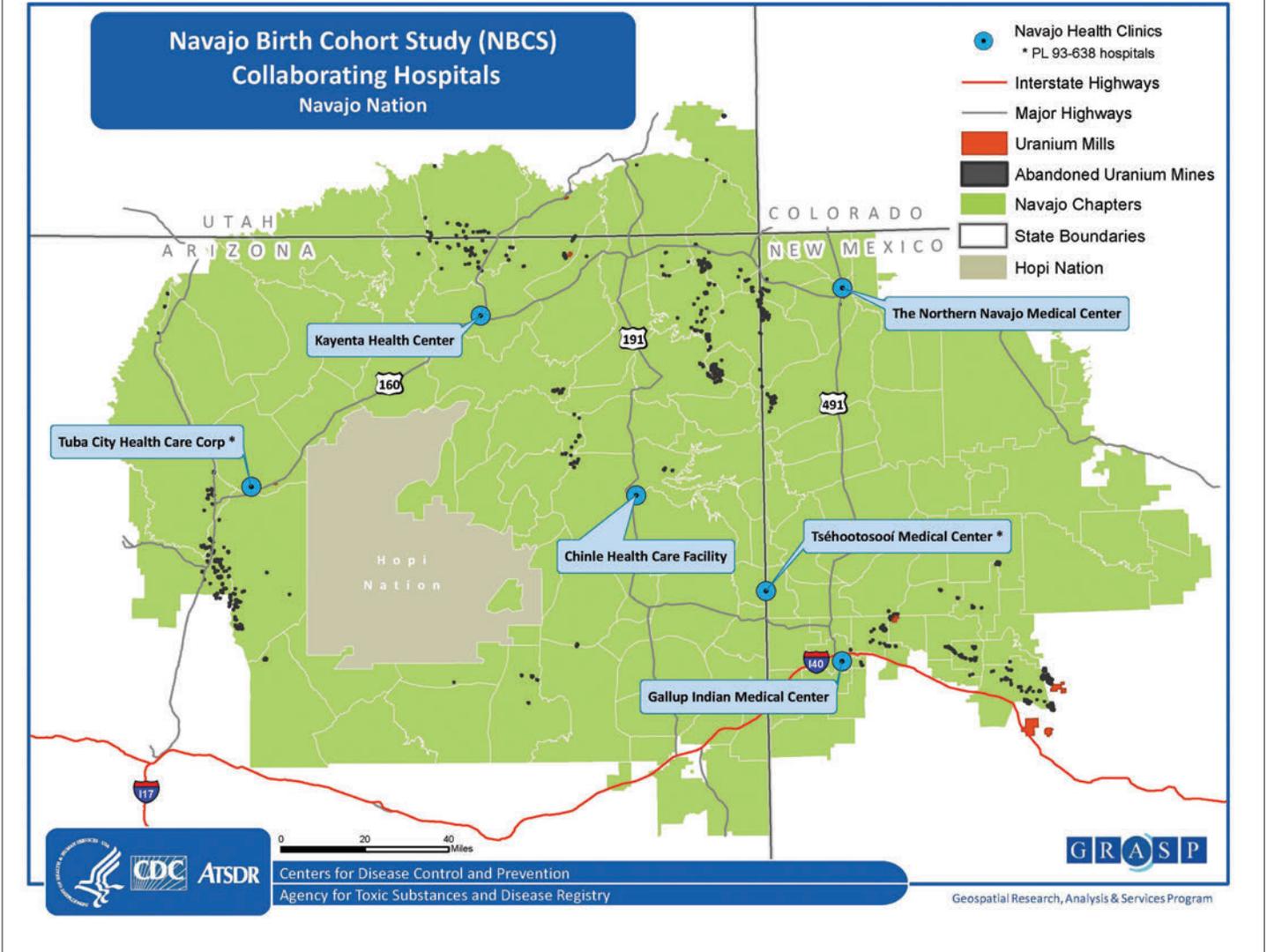
NBCS is the first prospective epidemiologic study of pregnancy and neonatal outcomes in a uranium-exposed population. The study involves recruiting Navajo mothers, assessing their exposure to uranium and other heavy metals during pregnancy, and conducting follow-up assessments of their children post birth to evaluate any associations with birth defects or developmental delays. Potential NBCS participants must be pregnant, between the ages of 14 and 45, have lived on Navajo Nation for at least five years, and plan to deliver at one of the five Indian Health Service (IHS)/PL638 hospitals (Figure 2) in the study. They also must agree to have their child assessed for developmental delays at 2, 6, 9, and 12 months post birth. The IHS/PL638 hospitals were chosen to represent the range of exposures to abandoned uranium mines and the highest frequency of deliveries on the reservation. Fathers also have the option to consent to participate in the study and complete an enrollment survey.

Exposures are assessed through biomonitoring, environmental home assessments, and questionnaires. The results of the biomonitoring analysis of 36 metals/metalloids such as uranium, arsenic, lead, and mercury are reported to each participant and added to their medical records with consent. Home environmental assessments include gamma radiation surveys, indoor air radon tests, and dust wipe analysis. Questionnaires include questions on demographics, occupational history, water use, diet, and other confounding factors. Pregnancy, birth, and infant health outcome data are obtained from participants' medical records, postpartum surveys, and infant developmental assessments such as the Ages and Stages Questionnaire.

NBCS is the primary epidemiological study of a five-year multiagency plan to address health and environmental impacts of uranium contamination on the Navajo Nation. Initiated in 2008, this plan includes partners from U.S. EPA, Bureau of Indian Affairs, Nuclear Regulatory Commission, Department of Energy, IHS, and ATSDR. In September 2014, a second five-year plan was renewed with the goals to continue to investigate environmental health risks on the Navajo Nation (U.S. EPA, 2014).

FIGURE 2

Map of Navajo Nation With Study Clinics and Former Uranium Mining/Mill Sites



**Study Accomplishments**

Since initiation of study recruitment in February 2013, over 450 mother-infant pairs and over 100 fathers have been enrolled. Study participants receive report-back letters on their biomonitoring and home environmental assessments results to inform them of uranium and other heavy metals in their bodies and in and around their home environment. Various culturally appropriate study outreach methods have been conducted including Facebook posts, YouTube videos, newsletters, public service announcements, radio ads, chapter meetings, health fairs, confer-

ences, and community awareness walks. It is estimated that these targeted outreach events have reached more than 30,000 people since September 2013. To facilitate appropriate cultural sensitivity and to promote community engagement in the study, over 20 local Navajo professionals have been hired and extensively trained on environmental home assessments, uranium environmental health impacts, and survey administration. These trainings may contribute to capacity building and sustainability of future community-based participatory comprehensive research studies initiated by the Navajo Nation.

NBCS provides several benefits to participants and to the Navajo community. Direct participant benefits include the following: 1) home and biological assessments to identify any serious contamination, and if identified, the family will be referred to the appropriate agency for further environmental testing and consultation; 2) information on community-based infant services and programs, including Women, Infants, and Children and First Things First; and 3) referrals to GIB, the Navajo Nation early intervention program for children with identified developmental delays. The study will also provide broad

public health benefits for Navajo communities through outreach and education on the importance of prenatal care, investigation of environmental prenatal risks, earlier assessment and referral for infants with suspected developmental delays, and a comprehensive assessment of nutrient values and reproductive health outcomes. The information generated by this study may be of value in developing programs and policies to mitigate environmental uranium exposure and to implement effective public health prevention and intervention strategies. 🐾

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## Did You Know?

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