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ABSTRACT

Creating a resource in *Diné Bizaad* (Navajo Language) for presenters, learners and speakers of the language was identified as a critical need for success of the UNM Thinking Zinc clinical trial. Difficult Western scientific terminologies needed to be translated into *Diné Bizaad* to enhance understanding by Navajo community members of the possible health effects of exposures to uranium mine wastes. Since Native people are visual and hands-on learners, slide presentations used colorful indigenous and Western graphics to convey scientific concepts underlying the study. Researchers, community liaisons and grassroots people developed the *Diné* translations shown here create a better understanding of how zinc may help repair DNA damage from environmental metals – an outcome consistent with Diné Fundamental Law. We conclude that translating/interpreting English terminology supports positive community engagement and a meaningful dialogue among researchers and people who participate in population-based health studies.

ACKNOWLEDGEMENT STATEMENT

The University of New Mexico sits on the traditional homelands of the Pueblo of Sandia. The original peoples of New Mexico have deep connections to the land and have made significant contributions to the broader community statewide. We honor the land itself and those who remain stewards of this land and acknowledge our committed relationship to Indigenous peoples.

CONTACTS

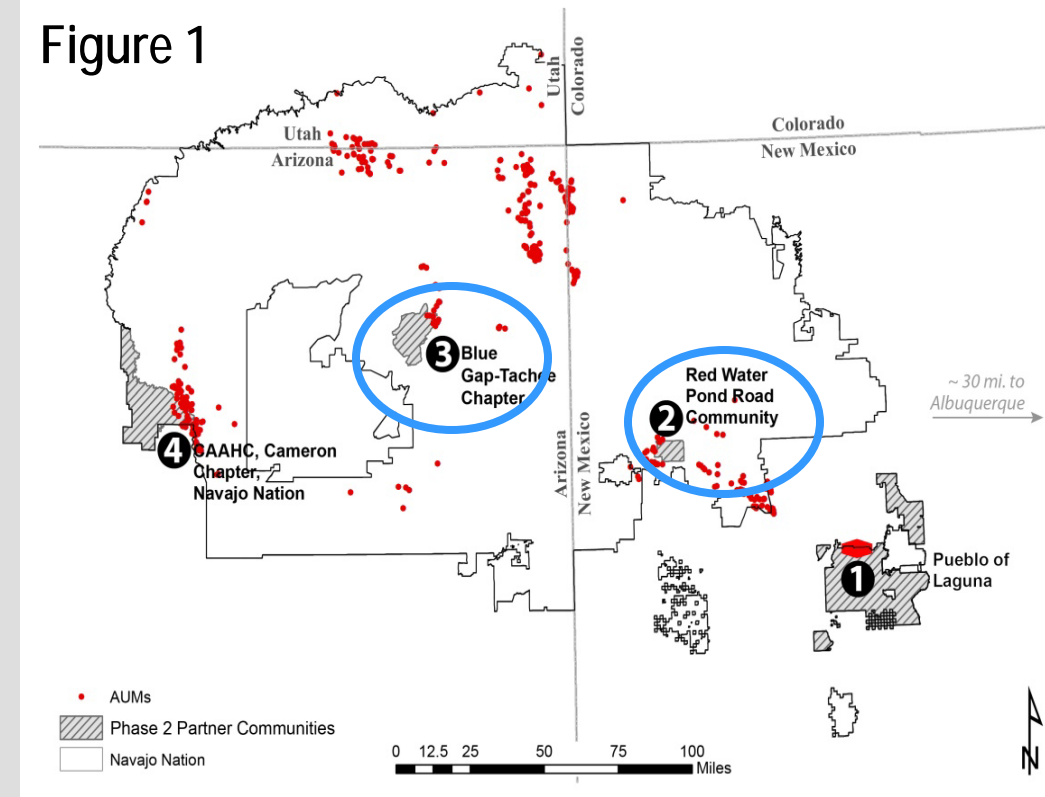
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INTRODUCTION

Thinking Zinc (*Beesh Doot'izh Bantsáhákees*) is a pilot clinical trial testing the hypothesis that taking zinc (Zn) pills at the USDA recommended daily allowance (11 milligrams) may help repair cellular damage from exposures to metals, including arsenic (As) and uranium (U). Thinking Zinc is being implemented in the Red Water Pond Road Community northwestern New Mexico and the Blue Gap-Tachee Chapter in the Central Agency in northeastern Arizona. Both are former uranium-mining areas (sites 2 and 3 in **Figure 1**) where As, U and other metals are present in mine waste and in some drinking water supplies at elevated levels.



The Navajo-speaking study team challenges the notion that *Diné* community members are mainly English speakers and therefore speaking *Diné Bizaad* is a waste of time. Our approach respects the fact that most elderly *Diné* speak their Native language, and that visuals and hands-on instruction enhance their understanding of key concepts

of a study. Translation and interpretation of English scientific terms into *Diné Bizaad* (Navajo language) has been used to explain cancer (Austin-Garrison et al., 2007), geologic terms (Blackhorse et al., 2003), and the legal basis for Diné Fundamental Law (NNC, 2002). In developing the Thinking Zinc study, the Navajo term “zinc” (*Beesh Doot'izh*) was derived from the term used by the Navajo Codetalkers in World War II (Nez and Avila, 2011). This is the first attempt to write a glossary of Navajo terms used in the Thinking Zinc trial.

METHODS AND MATERIALS

The need to design, plan and implement Thinking Zinc in *Diné* communities required the Navajo-speaking research staff to work with community members to address the question of whether a non-placebo clinical trial is consistent with *Diné* cultural traditions embodied in Diné Fundamental Law. Explaining the study in *Diné Bizaad* was considered a prerequisite for conducting the trial. The staff

- Conducted eight work sessions with community members (2018)
- Vetted written and oral Navajo terms in a community outreach presentation
- Developed study name and eligibility requirements with community members
- Held five work sessions with six Navajo-speaking study staff (2019-2021)
- Used Native art to illustrate DNA damage and repair by Zn (**Figure 2**).



Figure 2. Paintings by Zuni artist/biologist Mallery Quetawki depicting DNA repair mechanisms using Native symbolism.

Thinking Zinc Glossary

Selected Navajo language translations of Thinking Zinc English terms developed by the study's Navajo-speaking staff are listed in the table below.

Terms*	Dine Language Translations (English literal translation)
Study Terminology	
Thinking Zinc	Beesh Doot'izh Bantsáhákees (<i>metal, blue, thinking about</i>)
Blue Gap/Tachee	Bis Doot'izh Nídeeshgíizh (<i>dirt, blue, spread apart</i>)
Red Water Pond Road	To'ichíí' Sika' Atiin (<i>Red Water Pond Road</i>) Ahidaazdigai (<i>where the meadows meet</i>)
Clinical trial	Ats'íis baa' aháyaádeé' k' ehgo nabóhwintaah. (<i>body, from where it is cared for, like it, try out</i>)
Community Engagement	Diné t'áa kédahat'íidi bit' ahít' na'anish naha'í'go na'aalkaah (<i>people, all those living there, with together, work, research conduct</i>)
Zinc Study	Beésh doot'izh bóhoo'aah (<i>metal, blue, learn about</i>)
Environmental Terminology	
Abandon Uranium Mining	Łeetso hadaagéed yéegí (<i>uranium, dig out, used to be</i>)
Arsenic	Beésh libá (<i>metal, grey</i>)
Heavy metal	Beésh danidaazii ataa's'ei (<i>metal, heavy, variety</i>)
Metals	Beésh ataa's'ei Nahadzaan yee hadit'ei. (<i>all elements, Mother Earth, is dress with</i>)
Metal contaminants	Beésh bídadíich'aal (<i>metal, contaminants</i>)
Uranium	Łeetso (<i>dirt + yellow</i>)
Health Problems (Aqadahas'á Bee anáhóót'i'l'gíi)	
Cancers	Ats'íis bit'óol dahdiniiseéeh áadóo ba'at'e' hólo yileehgo (<i>body, cell growth, thereafter, bad behavior, gets to be</i>)
Cardiovascular Disease	Ajeéeh baah dahaz'á yileehgo (<i>heart, poor health, gets to be</i>)
Immune Disorder	Ats'íis yich'áah naabaah yéé doo hózhó naalnish da yileehgo (<i>body, protect from, does not fully work, gets to be</i>)
Kidney Disease	Hatsa'áshk'azhí baah dahaz'á yileehgo (<i>kidney, poor health, gets to be</i>)
Skin Problems	Hakagí yeenit'íih (<i>skin, affects</i>)
Health and Biological Terminology	
Biomarkers	Ats'íis bee naalkaah bee íneel'áah (<i>Body, research on, with findings</i>)
Cells	Ats'íis bitsésiléi bik'óó' (<i>Body, precede, seed</i>)
DNA	Ats'íis bik'óó' bits'ániseé bit'óol yee ats'íis hada'nelt'ée (<i>Body, seed, growth, string, body develops</i>)
Enzymes	Ats'íis yee naalnishigíi (<i>Body, work with</i>) Ch'iyáan be'adzil alt'áyiizoo dói y'i'itniih (<i>food nutrient, it separates and sends</i>)
Proteins	Ch'iyáan bit'oo bits'áadóo: ats'i, naa'ooti, ayeézhii, neeshch'íi' ádaatehígíi (<i>food juice, from: meat, beans, eggs, nuts, etc.</i>)

*These English terms and their Navajo translations specific to the Thinking Zinc study represent a sampling of research terminologies the *Diné* staff has developed over the past decade.

IMPLEMENTATION

Work sessions with fluent Navajo speakers proved valuable in refining the study name and design prior to implementation.

- The Navajo translation for “zinc” (*Beesh Doot'izh*, or metal that is blue) was coined by the Navajo Codetalkers (Nez and Avila, 2011)
- The upper end of the eligibility criteria for age was increased to 64 years
- A placebo design was considered inconsistent with Diné Fundamental Law and cultural practices because it connotes lying about a treatment
- The purpose of the study was considered consistent with Diné Fundamental Law that promotes repairing and restoring harmony.

Education about Thinking Zinc and outreach to Navajo communities to promote enrollment in the study benefited from having outreach materials prepared in both English and Navajo. A Navajo-language flyer promoting a weekend community-based collection event is shown in **Figure 3**.

Further, the community slide presentation – which is often given solely in *Diné Bizaad* – uses images of traditional foodstuffs, like blue corn mush and lamb, to illustrate how community members can increase their zinc intake (**Figure 4**).

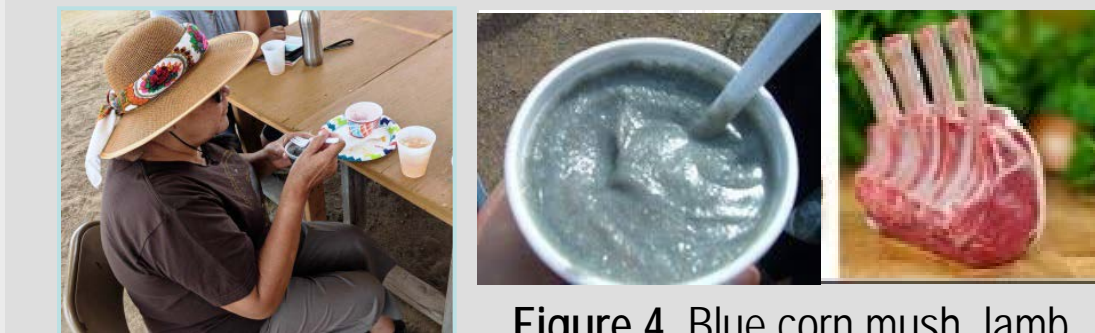


Figure 4. Blue corn mush, lamb

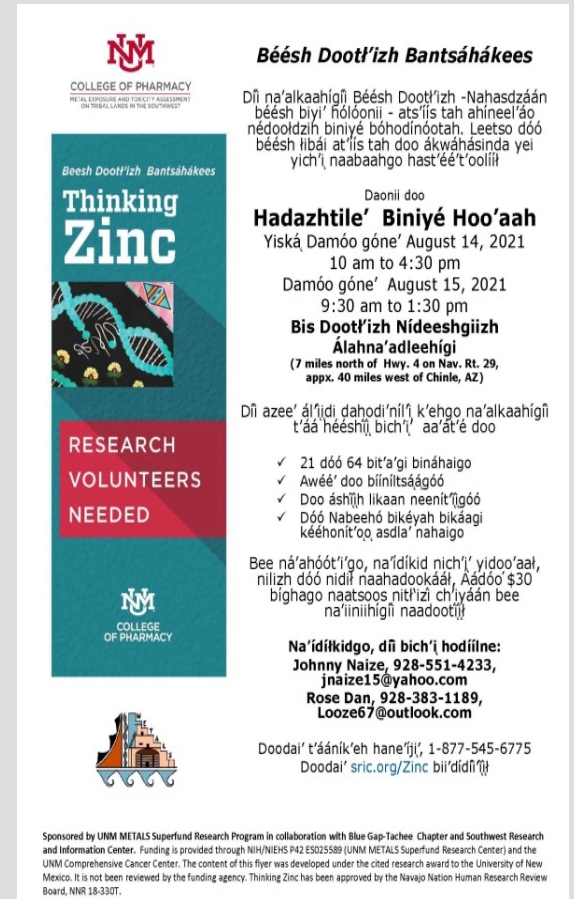


Figure 3. Navajo language is used in community outreach materials

CONCLUSIONS

This collaborative effort of Navajo-speaking research staff and community members resulted in the first elements of Navajo translations and interpretations of key English terms used in the Thinking Zinc clinical trial. The emphasis on Navajo translation supported seven community-based blood and urine collection days and the enrollment of 51 participants in the study through March 2022. Translating and interpreting English terms supports enhanced understanding among *Diné* speakers of the purpose, methods and future results of the study. Translations into *Diné Bizaad* also promote meaningful dialogue among researchers and *Diné* community members who are advisors to and participants in this and other studies.

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