**ABSTRACT**

Creating a resource in Dine Bizaad (Navajo Language) for presenters, learners and speakers of the language was identified as a critical need for success of the Thinking Zinc clinical trial. Difficult Western scientific terminologies needed to be translated into Dine Bizaad to enhance understanding by Navajo community members of the possible health effects of exposures to uranium mines. Since Native people are visual and hands-on learners, slide presentations use colorful indigenous and Western graphics to convey scientific concepts underlying the study. Researchers, community members and grasping Navajo people who translated the Dine transcriptions show here create a better understanding of how zinc may help repair DNA damage from environmental metals – an outcome consistent with Dine 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.

**INTRODUCTION**

Thinking Zinc (Beesh Dootł’izh Bantsaahke) 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, a Diné Bizaad speaking community in northeastern New Mexico and the Blue Cap-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 Dine community members are mainly English speakers and therefore speaking Dine Bizaad is a waste of time. Our approach respects the fact that the elderly Dine who speak their Native language, and that visuals and hands-on instruction enhance understanding of key concepts of a study. Translation and interpretation of English scientific terms into Dine 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 language. (Navajo language) has been used to explain cancer (Austin-Garrison et al., 2007). 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 embedded in Dine Fundamental Law. Explaining the study in Dine Bizaad was considered a prerequisite for conducting the trial. The staff included:

- Conducted eight work sessions with community members (2018)
- Written and oral Navajo terms in a community language 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)

**SELECTED NAVAJO TRANSLATIONS**

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

<table>
<thead>
<tr>
<th>Terms*</th>
<th>Dine Language Translations</th>
<th>Study Terminology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinking Zinc</td>
<td>Beesh Dootł’izh Bantsaahke</td>
<td>Study Terminology</td>
</tr>
<tr>
<td>Blue Cap-Tachee</td>
<td>Bis Dootł’izh Nohonhigah (dirty blue, spread apart)</td>
<td>Study Terminology</td>
</tr>
</tbody>
</table>

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**ACKNOWLEDGEMENT STATEMENT**

The University of New Mexico sits on the ancestral homelands of the Navajo, Hopi, and Western Apache. The original peoples of New Mexico have deep connections to the land and have made significant contributions to the disciplines of science. We honor the land itself and those who remain stewards of this land and acknowledge our committed relationships to indigenous peoples.

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**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 Dootł’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 Dine Fundamental Law and cultural practices because it connotes lying about a treatment.
- The purpose of the study was considered consistent with Dine Fundamental Law that promotes repairing and restoring harmony.

**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 Dine Bizaad also promote meaningful dialogue among researchers and Diné community members who are advisors to and participants in this and other studies.

**BIBLIOGRAPHY**


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