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A Walk in Two Worlds: An Indigenous Health Research Mentorship Model Developed from the Experiences of Mentors and Mentees in a Cancer Research Education Program Aimed at Increasing Representation of American Indians/Alaska Natives in Cancer Research and Healthcare Professions

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**A Walk in Two Worlds: An Indigenous Health Research Mentorship Model
Developed from the Experiences of Mentors and Mentees in a Cancer Research
Education Program Aimed at Increasing Representation of American
Indians/Alaska Natives in Cancer Research and Healthcare Professions**

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Abstract

The National Cancer Institute promotes workforce development programs that aim to increase representation of American Indian/Alaska Natives in health science and research careers. One such program, Youth Enjoy Science at the University of Nebraska Medical Center, has employed American Indian/Alaska Native youth in mentored cancer research internships from 2017 to 2022. The primary purpose of this study was to examine mentor and mentee experiences of participation in Youth Enjoy Science research education internships to learn from their stories. We conducted semi-structured interviews with current and former Youth Enjoy Science mentees (n=8) and mentors (n=8). We analyzed and collectively re-storied the data into narrative form based on emergent themes. We propose a conceptual model of Indigenous health research mentorship that recognizes inclusivity and mutuality as primary values of mentorship, with diversity and cultural humility as indicators of inclusivity, and resilience and trust as indicators of mutuality. Although this new model holds exciting implications for increasing Indigenous representation in health research, the model should be further studied and empirically validated.

Introduction

American Indian and Alaska Native (AI/AN) populations experience significant health disparities (Indian Health Service [IHS], 2019; Kruse et al., 2022; Villarroel et al., 2020; Zuckerman et al., 2004). The National Cancer Institute (NCI) has recognized increasing representation of AI/ANs in the health science and research fields as one approach to addressing these health disparities. In 2016, approximately 2% of the U.S. population identified as AI/AN (U.S. Census Bureau, 2017) yet only 0.5% of total full-time faculty members at U.S. medical schools and teaching hospitals identified as AI/AN (Association of American of Medical Colleges [AAMC], 2019). A history of abuse in research and a lack of cultural awareness in academic health institutions compounds this problem (Hodge, 2012; Stiffarm & Lane, 1992; Thornton, 1987). Indigenous methodologist, Linda Tuhiwai Smith (Ngāti Awa and Ngāti Porou, Māori) refers to the word 'research' as "one of the dirtiest words in the Indigenous world's vocabulary," adding that when mentioned in Indian country, research "stirs up silence, it conjures up bad memories, it raises a smile that is knowing and distrustful" (Smith, 2012, p. 1). Earning trust in research involves addressing historically oppressive systems and requires collaboration between AI/ANs and non-AI/ANs to embrace Indigenous worldviews and support culturally responsive methods (Burgess et al., 2020; Walters & Simoni, 2009; Walters et al., 2019).

The Association of American Indian Physicians (2018) suggests that health disparities stem from a lack of exposure to AI/AN health professionals and a scarcity of faculty who can provide culturally relevant mentorship and support. The NCI-funded Youth Enjoy Science program at the University of Nebraska Medical Center (UNMC-

YES) aims to increase AI/AN representation in health science and research fields through programming that emphasizes cultural relevancy. UNMC-YES pairs AI/AN students with AI/AN and non-AI/AN mentors in cancer research education. UNMC-YES offers paid cancer research internships to high school and undergraduate students who identify as AI/AN and express an interest in health professions and/or science, technology, engineering, or mathematics (STEM). These internships are housed in research laboratories at the UNMC Eppley Institute, the University of Arizona Cancer Center, or the UNMC College of Public Health. Mentees are matched with a mentor based on their expressed interests and location.

Nebraska is home to six tribes and represents the ancestral homelands for many Indigenous peoples including the UmóⁿHoⁿ (Omaha), Ponca, Santee, Ho-Chunk Winnebago, La^ko^ta, Pawnee, Cheyenne, Arapaho, Meskwaki, Otoe-Missouria, Ioway, Kaw, Wichita, Kickapoo, and Delaware Nations (Swanton, 1952). AI/ANs comprise 1.5% of the Nebraska state population (U.S. Census Bureau, 2019). The Nebraska urban AI/AN population is representative of various nations from across the IHS Great Plains region and beyond. Since 2017, a total of 21 AI/AN mentees have worked with mentors as UNMC-YES cancer research interns at the Eppley Institute and College of Public Health. These mentees identify as from the following Indigenous nations: CWY^ʌ D^ʒ^ʌ/Cherokee Nation, Oglala La^ko^ta, Osage Nation, Si^ca^ŋgu La^ko^ta, Ho-Chunk Winnebago Tribe of Nebraska, Eastern Band of Cherokee, Crow Agency, Hopi, Cheyenne River Sioux, UmóⁿHoⁿ/Omaha Nation, Santee Sioux, Keetoowah Cherokee, Menominee, and Creek Sioux.

Arizona is home to 22 tribes and represents the ancestral homelands for many Indigenous peoples, including the Akimel O’odham, Pee Posh, O’odham and the Yaqui Indian Communities (Swanton, 1952). AI/ANs comprise 5.3% of the Arizona state population (U.S. Census Bureau, 2019). The Arizonan urban AI/AN population includes representatives of nations from across the Southwest region and throughout the U.S. Since inception of the program, a total of four AI/AN mentees have worked with mentors as UNMC-YES program cancer research interns at the University of Arizona Cancer Center. These mentees identified as: CWY^A/Cherokee, San Carlos Apache, Diné/Navajo and Acoma Pueblo/Diné.

Although there are a number of existing models of health research mentorship, and even one mentorship model that is specific to First Nations mentor behaviors (Murry et al., 2021), there is no existing Indigenous health research mentorship model that conceptualizes mentorship as a relationship among either Indigenous or non-Indigenous mentors and Indigenous mentees in the U.S. (Schunk & Mullen, 2013). There are few studies that capture the lived experiences of mentors and/or mentees in health research education programs that serve AI/AN populations (Jones et al., 2019; Lee et al., 2018; McMahon et al., 2019; Segrest et al., 2010). The primary purpose of this study was to examine mentor and mentee experiences of participation in UNMC-YES research education internships to enhance AI/AN health research education in the U.S.

Methods

The five core researchers who developed the conceptual design of this study were all females; four of the five had experience working in biomedical sciences (two

were current lab scientists) and all five had experience working in public health (three were current public health scientists). All were affiliated with the UNMC-YES program; one was a principal investigator (PI), one was the program manager, one was the external evaluator, one was a current intern, and one was a former intern. Over 50% of the authors on this paper identified as Indigenous.

Through purposive sampling, researchers identified 14 mentors and 25 mentees who were eligible to participate in the study. Mentee eligibility for participation included: a minimum of sixteen years of age and self-identification as an AI/AN with experience being a current or former participant in the UNMC-YES program cancer research internship program. Mentor eligibility included a minimum of 19 years of age and self-identification as a mentor with at minimum one year of experience and expertise in recruiting, retaining, and mentoring students in the UNMC-YES research education program. All contactable eligible participants were formally invited via email to participate in an interview. The research team obtained informed, written consent from all participants. Participation was strictly voluntary, and participants were ensured that deciding not to participate in this research study would not affect their relationship with study personnel or UNMC-YES. Mentee participants were provided a \$50 gift card for participation. This study was reviewed and approved by the UNMC Institutional Review Board (IRB).

Mentors (n=8) and mentees (n=8) were interviewed by one of three members of the research team, which included two program mentors and the external program evaluator. The sample size of 16 was sufficient to reach saturation to the point of repetition (Sandelowski, 1995). All interviews followed a semi-structured interview

protocol developed by the five core researchers described above. The approximate 20 interview questions were informed by both researchers' lived experience and scholarly literature (Murry et al., 2021; Liaw et al., 2016; Walters and Simoni, 2009). Interviews lasted approximately 45 to 60 minutes in duration. Questions asked to mentors included: "How would you describe your role as a mentor to this intern student?," "Is there anything that you do in your role as a mentor that specifically acknowledges Native-American culture?," and "How would you describe your experience of being a mentor with YES interns?" Questions asked to mentees included: "What are your thoughts about pursuing a research career?," "How would you describe your internship experience in terms of communication of cultural knowledge between you and your mentor?," and "How would you describe your overall experience with mentors in the YES program?" To eliminate bias, no mentees were interviewed by their current or previous mentors. All interviews were audio recorded and transcribed verbatim. Participant names and identifying information were removed from transcribed data to achieve anonymity.

Our methodological approach centers on storytelling, a traditional and culturally acceptable approach to communication and learning among AI/ANs (Cajete, 2005; Cajete, 2008; Iseke, 2013). Transcribed data were analyzed by employing a deductive-inductive content analysis approach to collectively re-story mentor and mentee experiences by organizing key codes into narrative elements (characters, setting, actions, problems, and solutions). See Table 1. Data within each element was analyzed for common threads, resonant metaphors, and patterns of expression that demonstrated emergent themes. Table 2 details our analytical approach. Development

of the narrative involved community member-checking (with four UNMC-YES mentees and four UNMC-YES mentors) to increase the validity of qualitative findings (Fusch & Ness, 2015). Mentees and mentors discussed the accuracy and resonance of the interpreted data and study analyses, and reporting was modified accordingly. Following Indigenous methodologies, we sought to privilege Indigenous voices (Bessarab & Ng'Andu, 2010; Smith, 2012) by integrating extensive mentee participant quotes and precise language. We report our findings according to the story elements from a problem-solution narrative structure as defined in Table 1.

Results

In the process of collectively re-storying the mentors' and mentees' experiences, a conceptual model of Indigenous health research mentorship was developed (Figure 1).

Characters: Circular Relationships

The relationships among the circle of characters involved in health research mentorship reflects the Lakōta teaching, *Miṭākuye oyas'īṅ*. This Lakōta teaching translates roughly to "all my relatives", meaning that no matter our differences we are all part of a bigger picture and what happens to one person can have a lasting impact on many people. UNMC-YES mentorship was not just a relationship between two people (mentee and mentor) but rather a relationship among many peoples, including AI/AN elders, AI/AN community members, family members, support program personnel, principal investigators, post-doctoral researchers, graduate assistants, lab technicians, and research interns. Both mentors and mentees described a complex, multilevel network within the UNMC-YES program.

The mentors interviewed included adult medical school faculty, post-doctoral researchers, and graduate assistants who were leading cancer research projects. One of the eight mentors interviewed identified as AI/AN and seven, although not Indigenous, did represent diverse backgrounds. Some mentors specialized in community-based, public health research (n=2) while others specialized in lab-based, biomedical research (n=6). All mentees interviewed self-identified as current or former AI/AN students with an interest in pursuing a health research career. The mentees interviewed included students who participated in biomedical internships (n=2), students who participated in public health internships (n=2) and students who participated in both biomedical and public health internships (n=4). Mentees were high school and undergraduate students. Some mentees had some background education in STEM topics while others had very little; one outlier did report, “I went to a specialty high school and I was enrolled in an advanced bioscience program that had more like laboratory access.”

Mentors described mentees as “very curious,” “very hard-working,” and “really wonderful people... with a commitment to what they're doing.” As mentors noted, “their [mentees'] overall biology experience [was] limited” and they were “starting from a very low scientific research knowledge.” One mentor shared, “we had to really backtrack far back in because that level of technical, and also scientific basis for each technique, was not familiar to [the mentee].” One mentor noted:

[The mentees] were all interested in connecting and learning more about who they are and how that relates to their studies and the work that they do. So, our Native culture and, and, and Native scholarship, can support what they're doing and the way that we see and do, and understand things.

In general, mentees expressed gratitude for mentors' expertise and experience. There was particular mentee appreciation for mentors' Indigenous perspectives. One mentee said, "the mentors in this program are just wonderful" and most agreed, referring to them as "awesome," "amazing," "understanding," "open," "welcoming," "down to earth," "so nice," and "very influential." Mentors and mentees described their relationship as "close," "caring," and "encouraging." One mentee explained, "working with [the mentor] was fantastic, my experience was really good." A few mentors, however, noted that mentees seemed intimidated by them, stressed out by them, or avoided direct contact with them. Moreover, two mentees noted that the individuals who they identified as their mentors (PIs) were not present, available, or responsive, with one saying, "My mentor ...really didn't come into the lab at all. So [the mentor] had graduate students teaching me." Notable is the mentee's perspective that the graduate student was not formally in the role of a mentor. Depending on the size of the laboratory and the duties that a laboratory PI had, the task of teaching/mentoring interns was, at times, of necessity, delegated to graduate students. As one mentee described it, "I'm basically there to support the grad student that I mentor with, and that grad student is there to support the principal investigator there. And so that's kind of like how I fit into the lab."

Multiple mentees acknowledged the internship as an opportunity to gain support and be exposed to a network of resources through relationship building. Mentees identified people from community organizations, including artists, cultural educators, social workers, and secondary school teachers who partnered with the UNMC-YES program as mentors in their research education. Mentees and mentors also identified

family members as influential characters in the mentees' experiences of health research. In some cases, mentees identified their ancestors, relatives, and tribal nations as motivation and support for their pursuit of research and many acknowledged the desire to give back to their community. For example, one mentee explained:

I always knew specifically within my tribe, my community and probably a lot more, lung and liver cancer are very prominent, and I always knew that. And so I think that kind of connected me more to this cancer research.

Another mentee described wanting to follow in their mother's footsteps, saying, "I feel like I have a bit of an obligation to go as far as I can, kind of like feels like it's like passing the torch in a way." One mentor shared this desire to 'pay it forward', saying, "I have had a lot of really great mentors throughout my academic journey and professional journey, and so I really hope that I can be that kind of mentor for students, that I've had in my experience."

Settings: Navigating Diverse Places and Times

A Native Hawaiian proverb, 'O ke kahua ma mua, ma hope ke kūkulu, meaning "The site [foundation] first, and then the building," emphasizes the importance of the characters' place, time, purpose, intentions, and worldviews. It was evident that mentors and mentees recognized shared purpose in increasing AI/AN representation in health research careers, with one mentor stating, "I think the goal of the program is to get kids that don't necessarily have access to opportunities to work with researchers." One mentee testified that participating in the UNMC-YES mentorship "kind of elevated [their] opinion on research, pursuing a research career." Similarly, mentees saw the importance of representation and diversity in health research to address health inequities. One mentee described:

It was really hard to get good health care and really the only health care we could get was like Indian health clinics. And I don't know, I personally always just had a problem with them. I feel like they're really understaffed and underfunded... If I'm going to an Indian health clinic, I would rather be treated by a doctor that looks like me and knows like kind of my experiences, rather than a White doctor because it's always a White doctor and then like the receptionist or something is Native.

Mentors and mentees worked in lab-based and/or community-based settings.

The length in which mentors and mentees participated in mentorships varied widely, ranging from between several months to more than four years. Acknowledging the realities of working during the SARS-COV-2 pandemic, many mentees and mentors reported working virtually as part of the internship experience. One mentee who started an internship at the beginning of the pandemic explained, “with COVID and everything, I haven't- I haven't even seen the lab, sadly.” Overall, mentees and mentors described diverse research settings and adequate space and resources for learning opportunities.

Mentors expressed a desire to support underrepresented minorities in health research. As one mentor explained, “I think as an educator... we all feel passionate about bringing up and training underrepresented, you know, minority students.” Another mentor explained, “it's always a great opportunity to see them (mentees) leave the lab and actually want to continue in the lab.” Some mentors made an effort to approach the mentorship with cultural relevance, acknowledging AI/AN culture, however, a few were not made aware by the YES program that the YES mentees identified as AI/AN students.

Mentees reportedly participated because they perceived the internship to be a “good opportunity” that could “encourage lives of other people and help other people.” Many mentees expressed gratitude for the mentorship, the mentors and the structure of

the program. Mentees described a flexible work commitment to their participation and schedule, which, they reported, allowed them to prioritize family and other commitments when necessary. In some instances, this flexibility “was really huge for [the mentee];” one described the ability to “re-schedule” as supportive of their ability to participate. Mentors and mentees were overwhelmingly satisfied with their mentorship experience; one mentee stated, “[The mentors] were always respectful, respectful of my time... and they just really wanted the best for me and I could tell that.”

Actions: Working Together

The word *gadugi*, in Cherokee, meaning “people coming together as one and working to help one another,” reflects the actions of both mentors and mentees.

YES Internships

Mentees participating in biomedical research detailed variation in lab techniques and cancer education as significant components to their experience. Mentees performed a variety of techniques including western blotting, immunofluorescence, cell culture, and transfection. One mentee explained, “I just kind of like pipette a lot of stuff all day I kind of just culture cells in a petri dish.” Another mentee explained that prior to the internship they “had no clue at western blotting,” and recounted, “I have definitely learned new things from this internship.” One mentee who worked in labs at two different universities experienced two different approaches to western blotting:

I came to [2nd University] and they had a different setup. Like a different approach, they did a dry transfer, which I had never done before and at [1st University] we had always used pre-made gels and at [2nd University] we had to make our own.

Another mentee shared, “I've learned a lot... the biggest thing I've learned is just like how research is conducted and then like medical ethics.”

Mentees participating in public health research detailed a community-based approach to addressing cancer through conducting community readiness assessments, scoping reviews, or art-based research. One mentee described:

I did interviews with a cancer patient. They had every single kind of skin cancer that you can imagine. So I did eight interviews, personal interviews... I researched the subject matter of all kinds of cancers and wrote reports on it. And — and then I did arts-based research where I did drawings... and paintings related to the ... to the cancer itself.

Some mentees described gaining research experience in both biomedical and public health settings:

I've done multiple things. So for my first project, I was in a lab doing lab work and assisting with research in that way. And then my second one, it was more community-based research. So it was like interviews and recordings and going through transcripts and then helping write.

YES Mentorship

Some mentors were engaged in guiding mentees' self-exploration as Native scientists and scholars. As one mentor stated:

[The mentees'] eyes have been opened to the world of, of research and how, how vast and diverse and how much opportunity there is out there to be involved in research... I think they've also learned what they bring to the table and how they can specifically contribute. So, what their strengths are and — I think overall, they've just kind of learned more about themselves and what their interests are, what they're able to do, what they want to do, and how that can — how that works with who they are, and their cultural background.

Mentors described the development of mentees' expertise in health research “in terms of their understanding of what research is, in that you devise questions, that you perform techniques, that you confer with other people.” One mentor described how “[the mentee] was able to come up with [the mentee's] own projects for a while and kind of, direct those under [the mentors'] supervision,” “[the mentee] was able to read scientific

papers and kind of develop ideas from that” and “[the mentee] was actually able to participate in manuscripts that we’ve submitted.” Multiple mentees attended conferences not only as an audience member but also as a presenter. Manuscript preparation and authorship were also commonly described by both mentees and mentors as a part of the research experience. Proficiency in lab technique was also described in one mentor’s statement: “[the mentee] did a lot of, I think, like western blots and stuff, so [the mentee is] pretty proficient in those.” Additional examples of mentor and mentee activities are provided in Table 3.

In addition to research mentors, mentees engaged with UNMC-YES partners in community events that supported their development as Native scholars. Some learned about Indigenous culture through traditional methods of knowledge generation such as artmaking, talking circles, and storytelling. One mentee described a mentor “that always brings the Native spirit into it,” noting, “every meeting that we have, we always do a Native poem or somehow we bring the Native culture always into what we’re learning,” and shared that this was “definitely a great aspect.” One mentee described that through UNMC-YES they “really [got] connected, you know, in the Indigenous community.” Mentors helped connect mentees to local cultural experts, artists, health care professionals, and other community members who supported the mentees in unique and individualized ways. As one mentee described:

I would say just inviting the cultural specialists in was definitely something that, you know, putting it emphasis on our identity as Native people just like, you know, not let us forget that we are Native that was something that was very important.

Mentees also appreciated opportunities to share what they were learning by serving as mentors themselves. Mentees and mentors participated in various

community outreach events (e.g., tabling booths at powwows, teaching science lessons in schools, presenting workshops at community gatherings, and exhibiting research at art shows and local health fairs) that Native youth attended. One of the mentees described “examining pediatric cancer” in relation to environmental carcinogens in waterways and how “one of the projects [that mentee] worked on was a citizen science project with the youth,” that tested “nitrate levels in the water, the lead levels and just a variety of other factors that could increase the chance for pediatric cancer.” Another mentee said:

There was one (event) that we did and we had all children come up to us and we were working with these kids on different methods of, you know, how they can protect themselves and how to teach them not to smoke and just seeing the joy in the children's eyes... hands-on doing experiments...I really miss that part of it.

The same mentee commented, “what worked for me is the way I was able to relay the knowledge that I have learned to the children ...that has definitely worked for me.”

Another mentee discussed “trying to be a role model for people, especially like Native students.” One mentee explained this as an iterative learning cycle, “just like talking to students and helping them learn about what cancer research is. It helped me get a better understanding of it as well.” Mentee opportunities to serve in the role of a mentor were highly valued.

Problems

Although the data overwhelmingly evidenced very positive experiences for both mentors and mentees, some problems did arise. Mentors and mentees described problems that stemmed from divided approaches to cancer research internships. This black or white, either-or, thinking was described in mentorship opportunities (biomedical vs. public health research), approaches to research (Western vs. Indigenous

perspectives), context (personal vs. professional), and roles and responsibilities (expert vs. novice). See Table 4.

Biomedical vs. Public Health Research

Mentorship research experiences were, at times, isolating and limited by the separation within and between lab-based biomedical sciences and community-based public health research. Mentees' research interests and career choices were influenced by the exposures they had through mentorship. As one mentee explained, "I was interested in going to medical school, but now I'm leaning more towards biological research." Another mentee made clear, "you have mentors so your mentors can help guide you into what field ... that you need to go to." Some mentors and mentees reported experiencing isolation and commented on the need for more mentors, more mentees, and more collaboration across disciplines. One mentee said, "there's a lot of turnover in the lab that I worked at... for about a year, like the last half of the year that I worked, there, I was there with almost no one else in the lab." Mentees did not report meeting with each other regularly or having exposure to mentors from other disciplines.

UNMC-YES internship research experiences were dependent on mentor backgrounds and the mentee interests. Mentors' focused specializations and mentees' general career uncertainty reportedly made it challenging to recruit and/or retain mentees. Four of the eight mentees interviewed reported asking to shift from biomedical to a public health internship or vice versa. Mentors also recognized a need to offer a diverse spectrum of activities that bridge the public health/biomedicine divide. Mentors and mentees alike expressed an interest in developing more connections between not only the research but also the mentors and mentees in public health and biomedicine.

Western vs. Indigenous Perspectives

Mentors and mentees engaged in research experiences that, at times, operated under the assumption that Western and Indigenous values, worldviews, methods, and ethics were incompatible, or competing priorities. Mentors and mentees highlighted difficulties in finding ways to integrate Western science with Indigenous science. Research protocol often requires anonymity, blinding of data, and fidelity to an exact process to prevent bias; whereas Indigenous protocol values names and stories of identity, fosters reflexivity, and adaptations that respond to context. Some mentors and mentees described public health research as being more aligned with Indigenous worldviews and biomedical research as more aligned with Western perspectives.

When asked to describe their role, one mentor said, “I viewed myself as kind of just trying to teach technique and basic lab stuff.” Another mentor described efforts to “create new pathways and break molds or...decolonize academia in some ways.” At times, the program’s aim to offer culture-based mentoring was not communicated to mentors and when asked if they acknowledge Native American culture, some mentors clearly answered “no,” others chose not to answer this question, and one explained, “we didn't do anything that focused on that (culture).” Some mentees described mentors as not fostering their Indigenous identity through the research experience and other mentees said, “there was a lot of emphasis on Native, like Native approaches to science.” Still, some mentors described a desire to make the mentorship more culturally relevant to the AI/AN students. One mentor noted, “I think there are things over time that I can learn from others in our program... For example, about whether there are additional ways of instruction related to lab science from an Indigenous perspective. I

think it's more obvious to me what that means from the public health side and the clinical side. I have less understanding of what that may mean from the lab side.” Understandably, not all mentors were experts in biomedical research and laboratory techniques and most mentors had little familiarity with AI/AN culture or Indigenous research methods. Although Western and Indigenous perspectives, practices and pedagogies can complement one another, mentors or mentees were not provided strategies to promote the integration of the two.

Personal vs. Professional

Mentors and mentees engaged in research experiences, at times, without recognizing the connections between personal and professional interactions, expectations, and responsibilities. Some mentors described very close personal relationships with their mentees. For example, one mentor reported being invited to be a bridesmaid in a mentee’s wedding. Other mentors reported strictly professional relationships with their mentees. For example, one mentor said, “I don't think we got very close over the whole procedure. I think I honestly made [the mentee] kind of nervous. So, [the mentee] didn't seem like [the mentee] was super-open to talking to me — with me about things.” Interestingly enough, more than one mentor recalled not being aware of the mentees’ Native background. In fact, one mentor said, “I don't know if when I started this program that I was aware it was oriented towards exclusively, like Native American students.” Multiple mentees said that they were not certain if their mentors even knew that they identified as Native because their personal background never came up in conversation. A PI commented, “we (the mentee and I) didn't talk that much” and a postdoc said, “we (the mentee and I) didn't see each other very often.”

Overall, mentors expressed a desire to “know more background information about the trainee,” including future goals and expectations for the internship.

Mentees’ personal and professional experiences paralleled that of the mentors. One mentee said, “I didn't exactly know what I was going to be doing, so I guess kind of like setting those expectations would have been a little nice in the beginning.” Mentees and mentors expressed that there were times when personal situations (e.g., having a baby, class schedules, illnesses, transportation issues, or other jobs) affected the mentees’ ability to participate in the mentorship and interact with colleagues. Moreover, personal background (e.g., family structure and history, cultural background, and lived experiences) influenced mentees’ relationships with their colleagues and their research. However, due to the professional nature of the internship program, at times, there was little room made for personal interaction, limiting the sharing of mentor/mentee perspectives and expectations.

The following is a good example of how these problems manifested between a mentor and mentee. As described by the mentor, a mentee “had another job” and “treated this internship as a sort of job... So, clock-in/clock-out.” The mentor also saw their relationship as purely professional, and when asked to describe their relationship, stated, “I guess I'm a professor to [the mentee] [laughs]. [The mentee] is an intern to me. What else? I guess, that's pretty much it.” The mentor described how the mentee “would just pour the cells instead of actually pipetting up,” reasoning that the mentee “was driven by, ‘I need to get this thing done’.” The mentor identified this as a lack of interest in the “academic pursuit” and “some sort of like a learning curve in terms of how we interact in a professional setting, and how science is done, and what science is

about.” The mentor also revealed that the mentee “doesn't really wanna readily engage in interactions with [the mentor] ... [the mentee] goes directly to the grad student. [The mentee] has a good relationship with [mentee's] graduate student... So, maybe [the mentee] is intimidated.” This same mentor shared, “I'm not quite clear what [the mentee's] goal is through this research program... I haven't really spoken to [the mentee] explicitly about what [the mentee's] goal is, in terms of getting this research experience. At some point, I guess, I'll have to have that talk.” Beyond this, the mentor expressed a lack of knowledge about the UNMC-YES program aims, stating, “I'm not sure what the end point outcome that the program is looking for.” Opportunities to build personal and professional communication between mentor and mentee was not an emphasis of the UNMC-YES program. In some situations, the absence of a strong relationship between mentors and mentees hindered understanding of research team organizational structure and clarification of roles and responsibilities.

Expert vs. Novice

One mentor reported that “the biggest hurdle is, kind of, [the mentees'] lack of experience when they start.” Some mentors described being comfortable with meeting mentees where they were at. Others described a need for students to have previous research experience, background in science, and/or a major in a science field. This was evidenced in the following mentee report that described a mentor with high expectations:

[The mentor] wasn't super responsive to questions or like very really mentoring me. The graduate students who I worked with were amazing while they were there. But once they left, that was kind of like trying to figure things out on my own, which was which was really difficult... I don't think personally, I need like 24-7 supervision, but there were just some really like. There would be situations where I would have questions and they just weren't really answered ever. And I

wasn't sure like I would be asked to do a new technique but never shown how to do it. And then there would be frustration when it wasn't going well. And still, no one would show me how to do it. So I was trying to go based off like a kind of incomplete protocol by myself. And that part was hard... We had to make our own (gels). But the protocol, like when you got to the portion where to make the gel, there wasn't enough. It just said 'for appropriate gel' with no other instructions on what that meant... I had never done that with these like instruments, and it was a different approach. So I was like, I don't know how to do this. And [the mentor] would just tell me, 'Well, read the protocol' and that's what I was doing, the protocol is incomplete, and then [the mentor] told me, 'Well rewrite the protocol so that it is complete.' I said, 'I already don't know how to do it.' So that was frustrating...I'd be the last person leaving the building, and my gel didn't work and I'm here till eight o'clock. I just want to cry."

One mentor similarly explained that the "scientific basis for each technique was not familiar to [the mentee]." On the other hand, most mentors were not familiar with Indigenous understandings of science. Mentees and mentors also questioned how to integrate Native American culture into lab practices. Overall, mentors had expertise in research, but many had no prior training or experience in mentoring AI/AN students, and some had no mentoring experience in general. As one mentor explained:

...it might be a cultural aspect, I'm not really sure, but they are different interns...a YES mentee, can be completely different than undergrad mentees that I'm used to. So, had I known that from the beginning, I would have had different ways of training [the mentee] rather than putting [the mentee] through the regular undergrad training method.

Although mentees were very novice researchers, most had experienced mentoring AI/AN students and could support identifying ways to include culture in the mentorship. Overall, mentors and mentees had varying experience, expertise, and comfort levels related to research, Indigenous methods, and mentorship. Notably, mentors and mentees were not provided any programmatic training prior to jumping into the mentorship.

Solutions

In Diné philosophy, Hózhó is the pervasive harmony of all things and the universal task for us to emulate this balance within ourselves and the situations we are presented, whether they be multidimensional or simply between two positions. Establishing practices that foster inclusivity and mutuality between mentees and mentors proved to address the problems described above. We identified two overarching themes (inclusivity and mutuality) and four sub-themes (diversity, cultural humility, resilience, and trust) related to solutions in this story. See Table 4. In describing the UNMC-YES mentorship, one mentor said that it is “an opportunity for Native people to shine” and elaborated, “you know, it’s an opportunity for us to grow and learn, and contribute.” These findings inform the proposed conceptual model of Indigenous health research mentorship which suggests centering relationships that recognize inclusivity and mutuality through diversity, cultural humility, resilience, and trust in all mentee/mentor interactions and activities. See Figure 1 and Table 5.

Inclusivity

Inclusivity, or the practice of providing equal access to research education and career opportunities and resources for AI/AN students who might otherwise be excluded or marginalized, is at the heart of the UNMC-YES program. This theme was acknowledged by mentors and mentees alike. Mentors recognized the program as a “good opportunity to get in students that most likely wouldn’t have research experience otherwise,” and mentioned that UNMC-YES will “give them those opportunities at a pretty young age, so hopefully, they get engaged.” All mentees identified as AI/AN and some identified as “low-income,” “first generation” college students. Some mentees were interested in the sciences while others were not. In fact, one mentee shared, “I

wasn't necessarily in the science field...I just believed it would give me a better opportunity to explore a field that I never would've considered in the past...I wasn't necessarily afforded this opportunity back home. So, you know, it's a chance." Another mentee said, "it [the mentorship] provided me a way to get into research like a foot in the door... it really did offer me an opportunity that I had been trying to get to for a while."

Mentors welcomed a diverse spectrum of students, from high school students to undergraduates, from STEM majors to art majors, and from students with a long-standing interest in pursuing a career in research to students with no initial interest. To help establish a more equitable playing field, all mentees in the internship program were paid for their time and effort, matched with a mentor (or multiple mentors) and supported with resources. We found that the UNMC-YES mentorship program's inclusivity was supported by diversity and cultural humility.

Diversity

People representing different fields of research, families, communities, schools, and nations reported working together to build the AI/AN workforce in health research. Interestingly, mentees voiced the importance of recognizing how biomedicine and public health are related and how scientific discoveries can be applied to health promotion. The potential for mentorships to include exposure to different research career paths or multiple fields of research was made very clear when one mentee said:

[The mentors] kind of like opened my eyes to what health care could be. It didn't have to necessarily be something that was so specific, so narrow. It's actually something that's very broad. And there's like a bunch of different things you can do with it, do with within health care. So in a way, they kind of exposed me to some of the different things I could do.

Mentors suggested that students should “have more options” or exposure to “every aspect of sort of biological research or biomedicine and biology, including the research side of things.” Although not the way the program was originally designed, half of the mentees gained diverse exposures to research in both biomedical and public health internships. Moreover, exposure to various lab techniques and/or research methodologies helped sustain more long-term mentorships.

Cultural Humility

Cultural humility is vital to culture-based programming. As one mentee explained their mentor “understood where [they] were coming from” and “that's what drew [the mentee] to this program because [the mentee] was like, these people know where I'm coming from and they understand.” Another described their mentor, saying, “they aren't specifically Indigenous, but they come from the respect of being Indigenous.” More mentee understanding of where mentors were coming from was supported by conversations about the big picture, how lab personnel was organized, how specific lab techniques performed relate to the overall study design or how the research questions relate to the community. Another example of cultural humility was shared in the following description of a mentor by a mentee:

I feel like [the mentor] is very well versed in that kind of stuff. [The mentor is] very understanding. I feel like [the mentor is] very educated, which I feel like when you talk to like, like, like non-Indigenous or [non-]Native people, it's really hard to find people that are so like educated. I feel like within the YES program, I see all the time like they, they kind of all are very understanding of boundaries like respectful of culture and just know a lot about it.

An excellent demonstration of mentees' cultural humility was also noted in the following mentee comment:

When people ask me about it, I mean, it's kind of like, it's just like the opportunity to, you know, like really like do cancer research. And like, obviously, everyone's always like, Oh, so like, you're going to cure cancer? And I'll kind of - be like, no, like, it's more like figuring out like the stigma around cancer and like, what causes cancer, like preventing cancer.

Some mentees reported writing biographical statements, which helped establish their positionality. Acknowledging and locating one's views, values, and beliefs in relation to the research process proved to benefit both mentors and mentees and allowed them to better relate to one another. As one mentor explained, "It's really awesome to have – to be surrounded by, by peers, colleagues, students that understand you and are aligned with your ways of being, and knowing, and doing."

Mutuality

Mutuality, or the shared goals, roles, responsibilities, thoughts, feelings, and actions between mentors and mentees in the UNMC-YES mentorship experience, was identified as the second overarching emergent theme. Ultimately, as one mentor summarized it, "all the things that would support the mentors will support actually the interns as well." Mentors acknowledged the reciprocity between the program and the participants, recognizing that not only does the program offer a "...good opportunity to get in students that most likely wouldn't have research experience otherwise" but "It's also an opportunity for biomedical science and for cancer in particular, to benefit from the input and participation of these people who might not otherwise participate." Beyond this, the mentorship was also described as of "mutual benefit" to mentors and mentees. One mentor explained, "I love working with students and learning with them, from them, growing together and building our – building our Native collective workforce."

Mentees expressed a sense of belonging or being a part of a research community, noting, “I would definitely like some merch that says, like [institution] logos so you can like, really represent.” Another commented, “I like to tell people that I'm a researcher.” In their recommendations for ways to improve the mentorship, both mentees and mentors identified ways to support each other. For example, pairing mentors with mentees that have “shared interests,” offering “upfront, something of an introduction, for mentee as well as for mentor,” and engaging in a mutual process. One mentor suggested:

It will be good if like we can get connected to the mentees in earlier phase to tell them like we are going to give a project to you. Or like what we expect from them is like the amount of effort or like um, yeah, like what they're expecting from us and what we are expecting from them...it is actually an easy fix.

The UNMC-YES mentorship program benefitted from developing non-hierarchical opportunities for mentors and mentees to experience the mentorship process mutually through resilience and trust.

Resilience

One mentor explained the importance of resilience in mentorship, mentioning, “it is normal way to have a lot of failures before we have a like a successful experiment. So you can look at, learn how to handle, with how failures, how to just to deal with it.” From an Indigenous perspective, one way to promote resilience is through strengthening connections to culture and community. Some mentors encouraged mentees to learn more about who they are and where they come from, and to include that in writing biosketches or biographies. An emphasis on researcher positionality supported mentee development of research ethics and resilience at the same time. One mentor described working to ensure that “it's (the mentorship is) all somehow related to who they

(mentees) are and who they (mentees) wanna serve and, and why that's important to them." Another discussed "helping [the mentee] to understand the bigger picture of what it means to be a researcher, and how to develop yourself, in a way that will help you achieve those long-term goals, whatever those long-terms may be." This was evident in one mentee's comment, "I've always wanted to be a healer and so that for me is rooted in like my cultural background."

A strong personal and professional relationship among mentors and mentees supports tailoring research projects to the mentee's/mentor's background, interests, and goals. Mentees described forming personal and trusting relationships with mentors; one explained, "it's just a strong — I think it's a professional relationship and an academic relationship, but it's also personal too." Mentees appreciated the opportunity to discuss personal topics with mentors such as, "being able to talk about home," "how hard college can be," or "health issues." One mentee said, "[the mentor has] been basically kind of like a friend in a way. So, I'm glad to have that relationship with [the mentor], and it's like that with all of my other lab mates in my specific lab."

Mentors and mentees described the mentorship as "flexible," "adaptable," and "accommodating." This was evidenced when mentees commented on the ability to "re-plan something else" in response to a mentee's schedule or interests. Some mentees described the adaptability of scheduling, appreciating that "there's not a set schedule" and noting, "it's very flexible which is something I really need." In addition to flexibility in scheduling, mentors and mentees reported adaptability in settings (e.g., transitioning from a lab-based internship to public health). One mentee described resilience in their approach to the mentorship itself, saying, "you should try and just see if you could see

how it evolves.” Another explained the mentors’ adaptability, saying, “they’ve always been like, Well, we can find something...they always have an answer or a way to like guide me to go in the right direction.”

Trust

Trusting relationships were at the heart of the mentorship. One mentee explained, “[the mentor] was like very encouraging and showed me how to do things, was very supportive.” The majority of mentor/mentee relationships were described as “open,” “friendly,” and “positive.” Mentees described the mentorship as increasing their confidence in pursuing health research and the relationships formed as making them feel “appreciated.” “[The mentors] definitely have impacted me — just supporting...or they help me believe in myself that I can do it,” said one mentee. Another mentee said, “Sometimes I feel like I’ll be having like a really hard time. We’re like, Oh, kind of get on about myself. And, then like, I’ll talk to like one of the mentors or something... They make me feel appreciated.”

Mentors responded quite similarly to mentees when asked to describe their relationships with mentees. One mentor expressed their hope for the mentee to see them as a “colleague” or a “source of support in the future.” Another mentor described relationships with mentees as, “positive, uplifting, encouraging, trusting.” Similar to the mentees, some mentors described that they were also “growing and learning” from the research mentees and also reported encouraging personal relationships with the students. As one mentor described, “I’m very fond of them (my mentees). And I always will be.” When describing their accomplishments, this mentor noted, “Both of them (my mentees) had a big interest in helping people that... I really value that.”

One mentor described wanting to “be that person that they (mentees) can be vulnerable with, that they (mentees) can come to with questions, that they (mentees) can share their experiences with and share cultural perspectives with too.” One mentee commented, the mentorship “made me feel like I am pretty confident in knowing that this is what I want to do and like this is who I am.” Another mentee said:

I think that was something that was very important. You know, just being able to talk about my culture, you talk about like some things I could do couldn't do within research. So kind of finding a healthy balance helped where I wasn't compromising myself, who I was with the research I was doing. So finding a way that they could also tied it tied it back to home too it was also very important.

One of the mentors requested more opportunities for mentees and mentors to collaborate and get to know each other, saying:

It'd be so nice if there was some sense of a cohort. You know, like we're part of this together, not only could the mentors come together and talk about what they're doing and support each other, but also the, the mentees. So the interns could get to know each other from other areas... to build real friendship, and understanding, and trusting relationships.

Discussion

Mentors and mentees described mentorship in the UNMC-YES internship program as inclusive, aimed at providing AI/AN students with equal access to research education opportunities and resources. Diverse community, career, and academic environments served as the foundation for the mentorship experience. Mentors and mentees developed professional and personal relationships, adopting unique roles and responsibilities as they engaged in research together. Problems arose when black or white thinking was applied to mentorship. Solutions came from mutual recognition of specific values between mentors and mentees. These values form a promising conceptual model of Indigenous health research mentorship.

There is a critical need to increase the representation of AI/AN students pursuing health research professions in areas where significant health disparities exist (AAMC and Association of American Indian Physicians, 2018; National Science Foundation, 2019; WGDBRW & ACD, 2012). Despite this need, there are few studies that have explored both mentee and mentor perspectives of Indigenous health research mentorships. This study was the first to investigate Indigenous and non-Indigenous mentor experiences alongside mentee experiences. It is clear that there is no one-size-fits all mentorship model or any universal strategy designed to support the diverse needs and success of AI/AN research mentees in health sciences. However, the values identified in this study, and acknowledged in the proposed conceptual model, can help guide both mentors and mentees in mentorship practices.

Through collective re-storying, we explained mentor and mentee perspectives of the UNMC-YES mentorship program and the values that guided solutions to mentorship problems. Mentors and mentees worked together with inclusivity to support both Western and Indigenous approaches to research as they conducted cancer research in both public health and biomedical labs. Mentors and mentees mutually shared personal and professional as well as novice and expert perspectives related to Indigenous research and cancer research. Mentors and mentees recognized both individual and collective roles and responsibilities in mentorship. Although some scholars call for a mentee-centered approach when mentoring Indigenous students (Murry et al. 2021), our model that recognizes both mentees and mentors in mutuality is supported by multiple scholars who have found that viewing mentorship as circular rather than hierarchical can foster multi-directional learning that can build on the strengths and

weaknesses of both the mentor and mentee (Ferguson et al., 2021; Halas et al., 2017; Mullen & Cox, 1997). The proposed conceptual model challenges the power hierarchy of a strict chain of command. In the few instances in which mutuality was not realized between mentor and mentee, we noted uncertainties in mentees' and mentors' research goals, mistrust between the mentee and mentor, and negative experiences during participation in the internship.

Disparate understanding of the term "mentor" could also have contributed to uncertainty and lack of mutual understanding. Depending on the size of a faculty member's research group and the many duties assigned to faculty members, in the UNMC-YES program, a faculty member might have little or no time available for directly teaching, helping, or advising an intern, but still have graduate students or postdoctoral associates who are able to assume those functions well. Taking this into account in the mentorship orientations and in the use of the term in evaluations of the program will be advantageous.

Noteworthy is the role that program personnel play in structuring mentorships. In this case, the absence of lab mentor emphasis on Native culture was due to the absence of UNMC-YES program leadership in that regard. Also worth mentioning is the fact that only one of the eight mentors identified as Indigenous. This not only corroborates the need for more AI/AN health researchers but also demonstrates a need to support non-Indigenous mentors with implementing culture-based approaches to research and mentorship. AI/AN faculty find it challenging to provide adequate support for AI/AN students because they face racism, discrimination and the "minority tax," which is an obligation to take full responsibility for diversifying academic medicine

(Rodriguez et al., 2015; Tippeconnic Fox, 2005). There is, thus, a need to recruit and train non-AI/AN faculty as mentors to AI/AN students. Scholarly literature on mentoring Indigenous students recognizes that most mentors are not Indigenous themselves and acknowledges the need for ongoing mentor training that addresses diversity and moves beyond cultural competency toward cultural humility and safety (Walters, Maliszewski Lukszo et al., 2016). Our findings suggest the need to develop a formalized mentoring training that includes both mentors and mentees.

The novelty of the proposed model of Indigenous health research mentorship is the appreciation for the roles of both mentees and mentors and the recognition of the need to support the values of diversity, cultural humility, resilience, and trust in both roles. This aligns with Liaw and colleagues' (2016) definition of culturally effective mentoring relationships, which they explain require a commitment to building mutual trust, maintaining respect and dialogue, recognizing identity and positionality in research, leading and advocating for the community, having knowledge of health systems and services available to the local community, and effectively communicating cultural knowledge. An inclusive and mutual approach to mentorship can facilitate opportunities for culturally effective health research mentoring for AI/ANs.

Mentees described what many refer to as "walking in two worlds," a metaphor that represents the significant and invisible challenges AI/AN students experience when reconciling the often-conflicting values and ethics of Indigenous worldviews with the values of dominant, colonial society (Styres et al., 2010). It is our hope that the proposed model for Indigenous health research mentorship will invite both mentors and mentees to walk in two worlds, together, exploring public health and biomedicine,

Western and Indigenous methods, personal and professional paths, and expert and novice perspectives. The UNMC-YES cancer research internship will incorporate findings of this study into improving program delivery and quality for mentees and mentors alike. These findings can also support and inform the development, evaluation and maintenance of health research mentorship programs for AI/AN students.

Limitations

UNMC-YES program implementation varied greatly across the program sites and across mentorships. Sampling proportional to the representation of mentees and mentors across sites was employed to ensure that these diverse experiences were reflected in study findings. The use of purposive sampling, nonetheless, could present selection bias. Although we tried to control for response bias by ensuring that each mentee was interviewed by someone other than their mentor(s), mentee responses could have been influenced by their relationship to individuals within the research team and/or their relationship to the UNMC-YES program. The majority of UNMC-YES program mentors were biomedical researchers and persons who did not identify as Indigenous. The research team, however, was comprised of more public health researchers and persons who identified as Indigenous. It is important to note the composition of the analysis team as all members of the core research team have studied Indigenous research methods and value Indigenous perspectives and pedagogies. Positionality of the core researchers influenced the research design, the type of data collected and the way that the data were analyzed. Additional studies, including Indigenous scholars and Indigenous methods, should be conducted to

evaluate the proposed conceptual model for effectiveness in successfully retaining and encouraging the matriculation of AI/AN students into health professions research fields.

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Table 1

Organization of story elements in a problem-solution narrative structure

Characters	Setting	Actions	Problems	Solutions
Persons in the story: their role, personality, background, attitude, style and perspectives	Context in the story: history, culture, place, time and purpose	Events in the story that illustrate persons’ thoughts, intentions, feelings and behaviors	Issues in the story or phenomena that negatively affect the persons and need to be addressed	Solutions in the story that support adaptation or transformation that leads to positive

Note: Adapted from Ollerenshaw & Creswell (2002).

Table 2

Re-Storying - Qualitative analysis approach

Steps

1. Conducting interviews, audio recording, and transcribing mentor and mentee interviews.
2. Engaging in an immersion and crystallization organizing style which included reading and rereading and viewing and reviewing the data interspersed with ongoing iterative discussions of findings from multiple perspectives.
3. Deductively coding the transcripts for the elements of plot structure (characters, setting, problem, actions, and resolution).
4. Inductively coding for themes within each element of plot structure and coming to consensus among all members of the analysis team.
5. Organizing plot structure themes into a story that represents the core elements of Indigenous mentorship in health research education.

Figure 1

Conceptual Model for Indigenous Health Research Mentorship



Table 3*Examples of mentor and mentee activities*

Participant	Example quote
Mentor	<ul style="list-style-type: none"> • “[The mentee] was able to witness some of the seminar preparation, and then able to run like DNA gels and kind of analyze those.” • “I think [the mentee] learned ... some new techniques, like the extraction or some genotyping. And also understand some mouse model creation strategies... got to know some like basic cell culture techniques...” • “[The mentee] did a lot of, I think, like western blots and stuff, so [the mentee is] pretty proficient in those.” • “[The mentee] gained that professional attitude towards her colleagues, as well.” • “I really feel like [the mentees] have developed a lot and in some ways I think the students are already pretty clear of what research interests are and have a lot of innate skills that make them really great researchers to begin with.”
Mentee	<ul style="list-style-type: none"> • “[The mentor] did... resumes and stuff and like bios- was helping people work over that.” • “[The mentor] just seemed so passionate about it and like [the mentor] was so excited to share about it and the way [the mentor] explained the information [the mentor] had and would be like and then next week, I'm going to teach you about this, you know, all excited, and it just really made me think, Hmm, [the mentor] can be passionate about this. [The mentor is] so passionate about it. Maybe, maybe I would be passionate about it or enjoy it.” • “[The mentors] always say, just be- just know you can ask questions and they ask sometimes periodically through the Zoom presentation if we have any questions. And even afterwards, so they- they really want you to ask questions. There's no shame in asking them.” • “I learned a lot about cancer and cancer research. I attended some of the lunch seminars that were held at the [institution]...” • “[The mentor] always shared with me anything that [the mentor] gets that's centered around Native Americans. And so [the mentor] recently shared with me a conference for Native American, I think, cancer treatment, a group or initiative or something like that.”

Table 4.

Overarching themes and sub-themes represented as problems and solutions identified by mentors and mentees

Theme/Sub-theme	Definition	<u>Mentor</u>	Examples	<u>Mentee</u>
Inclusivity	The practice of providing equal access to research education and career opportunities and resources for AI/AN students who might otherwise be excluded or marginalized	<p>“It gives them [mentees] like the head start on doing research and getting that experience and learning if research is actually something that they want to pursue, 'cause obviously, it's not for everyone. So they get a really cool opportunity that they get to work with actual scientists and grad students”</p> <p>“It is a good opportunity to get in students that most likely wouldn't have research experience otherwise, especially at the younger levels, so high school level is something that I know I wasn't able to get into, so that's something that's really cool that they had that opportunity to do. And it gives them like the head start on doing research and getting that experience and learning if research is actually something that they want to pursue, 'cause obviously, it's not for everyone. So they get a really cool opportunity that they get to work with actual scientists and grad students and stuff like that”</p> <p>“It's a way for high school student to know, like to shadow like, a post graduate student or post-docs and see how they do research and hopefully they learn something from it or at least get to know how this career path looks like if they wish to pursue that down the road”</p> <p>“I think the program is well set up, in terms of encouraging under-represented, especially Native-Americans in that, it provides stipend. And what I realized is that that's a huge component for underrepresented minority who's not day-to-day exposed to science from early on”</p> <p>“involve opportunities for a wide age range of students ... to really develop an enthusiasm and understanding of</p>	<p>“It's just something that I was interested in some of the impact on my family quite a bit. So yeah, it's just making any small dent in that huge problem. It's great. I would love to learn more about it”</p> <p>“Where I'm from, there's ... no labs, ...there's no research facilities ...So it's it was all new to me... Growing up on the reservation, having a lack of resources to pretty much anything.”</p> <p>“I've always wanted to be a part of research, this was just like such an obvious thing for me to apply for. And I think. And to be honest, because of how competitive I know research is, I didn't think I was going to get into get accepted at first, but the when I received the email from [Mentor] that I had gotten into it was it was like it was such an awesome thing to see and it really made my day that day...I've always wanted to be in research, but I just never got the opportunity...It provided me a way to get into research like a foot in the door, as I was saying. And so ...that's the biggest part for me is that I will always hold that on this program, dear in my heart. Because of that, it really did offer me an opportunity that I had been trying to get to for a while now”</p> <p>“The job that I have right now, I largely got because I already had lab experience and public health experience thanks to being in the YES program, which was great. it brought together like laboratory experience and public health and kind of bundled both of the things that I been doing. So it was like perfect for what I ended up going into. It's a really great career building block for me, and I think having those experiences was probably a large part of the</p>	

		cancer research, of science in general, of approaches in science... focused on the Native-American population and their own world views and their commonalities and their differences among different people who all identify as Native-American”	reason, I got my job immediately out of college. I was the youngest person ever hired in my position and I think it was because of my experiences with YES, that they were willing to hire someone right out of college”
PROBLEM 1: Biomedical vs. Public Health	Mentorship research experiences were, at times, compartmentalized, isolating, myopic and limited by the separation within and between lab-based biomedical sciences and community-based public health.	<p>“The lectures are a lot of times being sent from like the Buffett cancer side of internship, and then all of the opportunities are sent from, like the College of Public Health”</p> <p>“I feel really disconnected from the lab ...the interns working in the labs”</p> <p>“It can be challenging to have curriculum that works across the board”</p> <p>“I feel that [my mentee is] in a little bubble. That [my mentee] is among all these researchers, and there's pre-meds and all these, like, really aggressive students and ...I sometimes feel a little bad, [my mentee is] in a little bubble [themselves].”</p>	<p>“I've met YES interns, maybe twice and we were all together the entire time is there for like taking pictures and then gone. So you ..say, Oh, you guys are Native too? Like, we all get excited and everything. I wish we would have bi weekly or at least weekly meetings with each other would be to like talk and maybe just like compare notes. Know what do you what do you do over there? Oh, that's like you would be really cool to do something like that. Yeah. So create more of a bond between your fellow interns.</p> <p>“It can be improved by maybe having more events where you get to meet more researchers and get a build on relationships with them that way, which we have done in the past. But sometimes our research is different. So then if you're in a big meeting together and sharing it, they just clash. And it's like different. So that's understandable.”</p> <p>“I would just go in and I would be by myself most of the time, and I would just they would tell me, like what to do and I would do it, and then I would just have someone, sign off on my time sheet every week. So there wasn't a whole lot of interaction that I got from that, from being in the lab.”</p> <p>“The graduate students who I worked with were amazing while they were there. But once they left, that was kind of like trying to figure things out on my own, which was which was really difficult...More like hands on demonstrations and stuff would have made it a lot better”</p>
SOLUTION 1: Diversity	Engaging mentors and mentees in research mentorship from multiple perspectives that includes	“We got students who are interested in public health and then have already conducted some biomedical research or have that experience, and then vice versa, there's also been some students who are interested in public health research	“[The mentors] were very influential in me taking this path I'm on right now...the internship...just getting exposed to a lot of the different aspects of health care. That was probably

diverse cultural backgrounds, interdisciplinary fields of research, multiple research methods or techniques and exposure to various research careers.

which are now interested in more getting like, what lab experience or kind of see more of that bench skills, biomedical research experience, which I think it's really awesome for any researcher to have both perspectives and experience, and I'm hoping maybe that's something we can encourage more in a formal way since so many students have already just, kind of, done that on their own, maybe it's something we can encourage students to kind of get experiences in both”

“It is valuable to like, give them a sampling of lots of different types of projects... to rotate through a couple different labs, just to give them samplings of different kinds of research”

“It's really awesome to have – to be surrounded by, by peers, colleagues, students that understand you and are aligned with your ways of being, and knowing and doing”

“I think it's important to expose kids to, especially kids interested in science, to like every aspect of sort of biological research or bio-medicine and biology, including the research side of things”

“We (mentors) tried to give them (mentees) a wide variety of techniques that they (mentees) can learn”

one of the things that got me into the current position I'm in right now”

“Culturally we have a pretty diverse lab. We have one of our lab members is Chinese from Hong Kong and then the other lab members from India. And then my mentor is ... American from here...my research lab is also from India too. So we got quite a quite a mix there. But I think that because of that, it's made me feel more at ease. I guess it's just a bit more welcoming and I I don't want to insinuate anything by saying this, but sometimes it does feel kind of strange to be the only like native in like a homogenous group of people. So yeah, I that's just kind of I feel like that's kind of all. I guess it's normal in a way to feel weird if you're the only one a person of a particular group in a group, that's kind of all the same... I haven't felt out of place or anything. It's just in general, we have a very diverse group of lab members”

“I learned a lot of like lab skills and lab techniques and how to use different instruments, different types of tests. We've also learned a lot about the process of writing like journal articles and helping to see how like that, getting to see how that works on the back end was really cool and very informative. And about different approaches to research when we did community based research, because before that, really all I was familiar with was like bench research, like in a lab. So that was interesting”

“[in public health] there was a lot of emphasis on Native like Native approaches to science and other by using like arts based research methods to incorporate”

“It just showed me a lot of resources moving forward because I think I'm going to apply to graduate school at some point and I intend to pursue a research career, I think get my Ph.D. and then pursue research full time”

“When you do experiments there is a technical aspect and there is like a scientific aspect...you can be really

Western vs. Indigenous Perspectives

Mentors and mentees engaged in research experiences that, at times, operated under the limiting assumption that Western and Indigenous values, worldviews, methods and ethics were incompatible.

imaginative in scientific stuff but when it comes to like technical process, like how you do things exactly in the lab, you need to stick to the protocol”

“For me, not feeling that I have a lot of expertise in that area, I would say that the instruction itself is coming from me did not have that as a big component. But it was a component in our discussions and something that, to whatever extent, they wanted to talk about it with me or that it came up, we would talk about it. For example, [mentee] had had involvement with the high school group focused on Native-American students. So talking about that, and what that meant to her with [mentee], talking about her relationship with her family, and how they valued the Native-American culture”

“I would say a lot of the interns have been interested in learning the history piece. So, having a better understanding of, maybe, specific things that relate to their tribal affiliation, so maybe, like, history from that perspective or maybe even just a history of research, and kind of understanding maybe more of a context of--- in which we conduct research”

“So the instructional format, from what I could do for them as a mentor, did not have a specific focus, I would say. But I think that informal format, and I think there was a general recognition and value among all the people in my laboratory as well, of their background and culture and what they had participated in as members of that culture”

“In the lab... that project wasn't specific to like cancer in indigenous populations. It was just a general cancer project”

“We haven't really touched cultural subjects like organically, just because of the nature of how our lab work is pretty busy. Or we're kind of like working on stuff or when we do talk, it's usually about like the work we're doing or about, like, I guess, other stuff. Like sometimes we'll talk about like tick tock or something like that. But yeah, we haven't really had a, I guess had a chance to really talk about like our cultural backgrounds”

“We're not supposed to do is talk about death, but it's just something that was very. Is considered a very taboo, just seem to say the word. You don't have a word for it. So. Yeah, so I think in a way. I wanted to talk about it, though, is like, you know, with cancer, often is associated with death and everything like people don't make it, but I think getting a [public health] project that was more so focused on, you know, preventative- preventative methods, preventative actions that can be taken towards death was also, you know, it was kind of it was kind of nice.” just focusing on the disease and the ways you can prevent it from happening. That was just the best way is like so that you don't even have to bring up the death”

“We haven't done much... I believe it's open as well. We haven't, so it's more focused on cancer, we haven't really focused on Native Americans, but I do remember when the topic would be brought up it would always be open like there'd be no, well, let's move on real quickly or anything like that. And I'm pretty open”

SOLUTION 2:
Humility

Engaging mentors and mentees in self-reflection and self-critique to learn about and examine one's own history and culture,

“I try to consciously integrate Native American culture perspectives, worldview, protocol, practices, pedagogies research methods, all of that into what we're doing”

“I am a Native American with the eastern band of Cherokee Tribe, and then so my dad's Native American and Puerto Rican and my mom is kind of like Italian and more Caucasian. So I have like a very- I'm like a Heinz fifty seven. So I have kind of like a whole bunch of different

cultural identity and beliefs to establish positionality in research and mentorship.	<p>“Providing them (mentees) with resources that help them learn a little bit more about maybe history, or be supportive in that role...getting them, maybe, books or sharing articles and talking through these things (cultural perspectives related to research)”</p> <p>“Talking to [the mentee] about how [the mentee’s] family works or what [the mentee’s] background is”</p> <p>“I think that for lab science and for mentors an evolving understanding of what we may be able to incorporate, perhaps from an indigenous perspective and learn from the students about any differences in which they may approach the material from their family background, is something that always to have an open mind about”</p>	<p>backgrounds. So I think that gives me kind of a broader understanding of different cultures too, especially in the indigenous side of things, because I know how to approach things have to be from different views- of different backgrounds of people or audiences is the word that I was looking for”</p> <p>“When you first start, you get a few books to read. I think it's like the new thing that we're doing. At first I didn't. But. Like newcomers into the program, you'll get a few books to read about, like Indigenous research and stuff like that. .I do like that whole holistic view of things” and “really appreciating the roots that you come from”</p> <p>“It (integration of culture) helped me feel more connected, like to Native culture and like being involved in the community, which was really big for me and validating”</p> <p>“Oh, so like, you're going to cure cancer? And I'll kind of be like, no, like, it's more like figuring out like the stigma around cancer and like, what causes cancer, like preventing cancer. I feel like that's a lot of what I've done and learned about. And I would say, like specifically in native communities, a lot of times, like a lot of it, is always related to like, how are like Native Americans or like indigenous people viewing cancer? How like, how is the treatment options for them? What are the most common types of cancer specifically in like native communities, which is something I really, really enjoy because I obviously want to specifically work with native communities. I feel like it's setting me up really well for that, right?”</p>	
Mutuality	Solidarity among mentors and mentees who share goals, roles, responsibilities, thoughts, feelings, and actions in the mentorship experience.	<p>“If we are a little bit more consistent in the information you provide to the mentors then that will help the students as well”</p> <p>“There was a lot that I learn from the research interns”</p>	<p>“It was nice to see that there are people that are like that are in oncology and that are Native. And so that's kind of that's kind of been my experience so far. And... I can always reach out to the other YES interns to where I've got to meet briefly. And it was cool to ... meet them and know that there's also other Native Americans in the building”</p>

“I love having the opportunity to pass these things on and teach and learn too. I’ve learned so much from our students. So, I grow from it too as a researcher”

“It gives me a lot of hope..it encourages me in the work that I do ... there's really no reason for me to be doing the work I'm doing if it isn't to support future generations...it makes .. everything that I do relevant”

“I've gotten to know a lot of really special people who, I care about and we've become a force, I'd say, in academia and research, that's promoting indigenous ways of being, and knowing, and doing. And it just makes me feel stronger in, in the work that I do”

“I think it'd be neat if, if not only could the mentors come together and talk about what they're doing and support each other, but also the, the mentees.”

“I would say it's a mutual learning arrangement because I'm kind of working or being taught by grad students, undergrad students and ... they are teaching us about the different types of cancer, maybe a different part of science sometimes. And they are getting experience, you know, presenting their information to a crowd... explaining in a way they can understand, and we are learning that information from them”

“Really get connected, you know, in the indigenous community and spiritually, it's just been just awesome just, you know, really feel what you feel inside, you know, really spiritually. And ... then the way you see the how you connect to other people”

“If I for some reason can't make it to the lab where I'm also definitely willing to do that for them if they ever want me to. And I've actually have done that for the grad student. One time [the mentor] was out of sync, and so I had to kind of do some of her, her work. And so [my mentor] and I was really that really pleased me because that showed that [my mentor] really trusted my ability to do the lab protocol that that was actually pretty, pretty intense. And it kind of took me the rest of the evening. But I figured it out and [the mentor] was always there to ... help me along the way... they treat me like I'm just like any other, like lab member. And so. There's been nothing but mutual respect”

PROBLEM 3:

Personal vs
Professional

Mentors and mentees engaged in research experiences, at times, without recognizing the connections between personal and professional interactions, expectations, and responsibilities.

“I haven't really spoken to her explicitly about what her goal is, in terms of getting this research experience. At some point, I guess, I'll have to have that talk. I think my goal is that if [the mentee] gets good grades, and coming out of four-year college, I mean, university degree, then her future will be opened up with this experience, that [the mentee] can put it on her resume. And then [the mentee will] get to choose, [the mentee will] have choices. I guess that's what I'm going for at this point”

“UNMC has their own set of protocol and rules and everything that you have to follow. Because when I work for UNO it was a lot more independent, I would say. But working under ... UNMC, I think that you have to follow all their rules and protocols, so you have to be, you know, so it's, you know, so many hours not really supposed to work the weekend, just during the week, you know, so many hours that you can do it for, which is just really a lot more tight I would say”

<p>SOLUTION 3: Engaging mentors and mentees in a dynamic process of adapting and transforming the research experience and mentorship process in response to context (i.e., tailoring the experience) to strengthen connections to culture, community, ancestry and land.</p>	<p>“I demonstrate how the experiments are done. Like that's basically my role, it's like a demonstrator. And I do a lot of explaining, like how the experiment is set up, what we are trying to do”</p>	<p>“For quite a bit of time, I first was in a prostate cancer lab and then I did like an immunology lab, and then I decided that I really wanted to do something that aligned with my interests and was more kind of personal- on a personal level. So then I transferred to public health and then that's kind of where I've decided to stay because I really found arts-based research to be more, to align more with my interests of who I am and what I want to research.”</p>
	<p>“I don't know how tailored my project was to [the mentors] actual interests, because he wasn't interested in bioinformatics, and I don't do very much of that”</p>	<p>“Maybe it can be sometimes stressful too, though like if you are doing a lot of things, it can definitely be stressful or. Well, definitely now. Well, maybe in the beginning when I was still kind of working, when I was pregnant... Because it's like, you know, you have to read things. And I think like in the public health department, it's more so because you do a lot of reading and you do a lot of kind of like dissecting and that kind of sense where sometimes your significant other or even your family members don't really understand what you're doing. But they just think they just don't get what you're doing, really. And so I think that that can be emotional too, because it's like, you are super busy, but it may not look like you're super busy, but you're getting interrupted all the time, but you have to read, so it's a different type of work thing, think as well, so it can be both”</p>
	<p>“The things we can show her is very limited. 'Cause like, like [inaudible 21:15] experiment we can do is like overnight experiment. So unless [the mentee] comes like two days in a row or like I have a regular time frame, it's a little bit hard to arrange things for her”</p>	<p>“Definitely the, you know, the mentorship aspect of it. Definitely talking about ways that, to keep me engaged within the program, you know that the weekly check in was definitely very important, kind of reexamining like what projects I could pursue. So that was kind of cool. I was like the second half of the internship. I was like, kind of like. You know, it's kind of like, you know, losing interest in a little bit, and then that's where [the mentor] introduced the project like, you know, like it was a side project at the time, but then it turned into a project with these citizen science ... projects. So being adaptable, adjust to the needs of the students, the needs of the intern”</p>

“It's not just for experiment or techniques, they can also put some personality maybe you need to treat the experiment very carefully. And, sometimes when you face failure, because it is normal way to have a lot of failures before we have a like a successful experiment. So you can look at, learn how to handle, with how failures, how to just to deal with it”

“[Mentor] and [Mentor] definitely have impacted me of just supporting. And they've always been like, Well, we can find something. We always. So they always have an answer or a way to like, guide me to go in the right direction that would enjoy or a project, or they help me believe in myself that I can do it. Or they gives me like the books that I need to read to feel more confident or to get that sense of education”

“I feel like, like, obviously like having like a good mentor, just like in, I guess like a professional aspect. It's good, but I feel like they're also just good mentors. Just like on a personal level, I've never had a bad experience, like not even in the slightest”

“I went to central and then I went to like a dual thing at Central High School. And, you know, so then I just stayed out, you know? I never thought I was going to be at first, but then I always kept my internship. So then I kind of found a way to align everything. So then I stayed, and I'm going to get my bachelor's in media journalism and media communications. So then I'll pursue a master's at UNMC for public health. And then Metro is more of my TV and radio communications where I'm learning like just the different arts, visual arts, like storytelling, which kind of aligns, which does align with indigenous storytelling. And so I kind of want to bring a different- a different kind of form of research, so I'm kind of pioneering my way in the research”

PROBLEM 4:
Expert vs.
Novice

Mentors and mentees have varying experience, expertise and comfort levels related to research, Indigenous methods and mentorship.

“I've never like, had any training in mentorship, so even like, introduction to like mentorship type of thing, ...you just kind of get handed undergrad or like a rotating student and they're like, "Mentor them." And you're like, "I guess I'll learn how to do that"

“High schoolers are like really coming at it from no experience generally. And I've worked with some undergrads, but [the mentee] was the first high-schooler

“I've always been interested in research...I always wanted to be a part of a lab, and ...it's one of those things where it's hard to get your foot in the door at first, but once you're in, you're kind of in. So I've always had an issue with trying to connect with professors or trying to get into any specific lab with professors that I've attended their courses with and sent out a couple cold emails and didn't really get too much of a response, unfortunately. And I think that was probably in part due to the no experience with Lab. And then also, I

that I worked with which was like, "Oh, you have to, you have to really explain everything"

"I need to sometimes explain some pretty complicated concept in their language. Like with the biology, with the chemistry, they know as a high school student"

"It helps me take a step back and really be able to explain things to people that aren't necessarily on the same level, in terms of research experience"

wasn't like top of the class or anything. So I think that had part of the reason why. But I guess to answer the question, I've always wanted to do research, but I just never got presented the opportunity to do it really until the YES program"

"Making one for like an introductory track, like when you're introducing people into public health, maybe have one track introductory. And another track that's like, you know, for people who are in the science, like, you know, if you're a college student, especially with the I was a college student, I was doing this still am. But I think having one for non-science majors like non-STEM majors and one for for STEM majors like, you know, having that bridge, you know, in kind of bridge where they can, you know?"

"But they left the lab in the middle of it and then [my mentor] hired someone new. And then that person quit after a month, and then [my mentor] hired another person, but so by the time that I left apart from like our PI, I was the most senior person in the world, the person who had been there the longest after having only been there for a year. So I felt kind of like all over the place"

"I'm coming from like- like a communications background that maybe they won't accept me as uhm... Into the master's program or getting into that... Maybe I'm doing like so much work in trying to come from so many backgrounds just to get to this place and hoping that there will be like a seat for me there but they're not getting it"

"I haven't had too much experience with actually writing and interpreting the data that we collect and analyzing the data...I have not been given the responsibility of doing that yet, and so I'm not sure that I will because I think a lot of undergrads, they typically do the work that I do or that I explained. And I think it's pretty rare that you have an undergrad in, like the biomedical research, do any kind of publishing or writing"

<p>SOLUTION 4: Trust</p>	<p>Engaging mentors and mentees in open exchanges and experiences involving Indigenous culture, history and a commitment to building a good relationship that is foundational to all actions/activities.</p>	<p>“I feel that, if there is a, like a peer group that we can build on. So with the wide use of Zoom, if there's a peer group, if it's a national or if it's just two sites, like University of Nebraska and University of Arizona, get the YES Mentees together and share their experience. I think that will be positive...if we can build a peer group...that could support each other, I think that would be helpful”</p> <p>“Because I also can learn something new from the like, my trainees maybe they can show me some like a more easy or smarter way to do part of the procedure”</p> <p>“The students who are starting high school, they could really learn a lot from the undergrads who have--- and a lot of cases, undergrads have been participating since high school as well. So, I think it'd be really cool for the students to get to learn from each other in a way”</p> <p>“I love mentoring the students and kind of helping them, helping them grow. And it's always a great opportunity to see them leave the lab and actually want to continue in the lab...Hopefully, they saw me as someone that they could ask research questions to”</p> <p>“I would say a lot of the interns have been interested in learning, the history piece. So, having a better understanding of, maybe, specific things that relate to their tribal affiliation, so maybe, like, history from that perspective or maybe even just a history of research, and kind of understanding maybe more of a context of--- in which we conduct research”</p>	<p>“Being able to meet other students like me was a huge thing for me. So being in the lab with, I mean, even [mentee's name], I know [that mentee] was involved in YES for a very long time. [that mentee] might still be around, but we both went to, you know, we were both in the YES program. And so we just had that connection and it was nice to be able to talk to somebody about that. And I mean, just finding other native people in general, it's kind of hard sometimes. But specifically doing what we're doing”</p> <p>“[The mentors] really trust me to do the right thing. And if I don't know anything, I think they'd know that I would go to them for anything. And so I feel like they definitely trust me, and I think that's for sure reciprocated by me. And I think a huge part of that was being so upfront and communicating very early on in our establishing our relationships. And so I would say we have a great deal of trust in each other”</p> <p>“You have to have like a lot of trust when you're in the labs, for sure”</p> <p>“Getting to know the people inside the (research) community...I get to interact and meet other students that are a part of the program, and I get to interact with people that are in the program too. And it's been really nice...[My mentor] recently shared with me a conference for Native American I think cancer treatment, a group or initiative or something like that. And so [my mentor] shared that with me and I was able to attend that through Zoom. And so that was really cool and interesting, and it was nice to see that there are people that are like that are in oncology and that are Native. And so that's kind of that's kind of been my experience so far. And I would say. The other cool thing is that I can if I if I need to, I can always reach out to the other YES in interns to where I've got to meet briefly. And it was cool ... to meet them and know that there's also other Native Americans in the building, too“</p>
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“I’m kind of like a teenager and I’m forgetful. I have like a lot going on.[the mentor is] really understanding about that. I think it’s just something personally I wish I could fix, but I do feel like there’s like a mutual trust there”

Table 5*Indigenous mentorship values*

Mentorship Value	Definition
Indicators of Inclusivity	
<i>Diversity</i>	Engaging mentors and mentees in research mentorship from multiple perspectives, including diverse cultural backgrounds, interdisciplinary fields of research, multiple research methods or techniques, and exposure to various research careers.
<i>Cultural Humility</i>	Engaging mentors and mentees in self-reflection and self-critique to learn about and examine one's own history and culture, cultural identity, and beliefs to establish positionality in research and mentorship.
Indicators of Mutuality	
<i>Resilience</i>	Engaging mentors and mentees in a dynamic process of adapting and transforming the research experience and mentorship process in response to context (i.e., tailoring the experience) to strengthen connections to culture, community, ancestry, and land.
<i>Trust</i>	Engaging mentors and mentees in open exchanges of experiences and culture with awareness of Indigenous history and a commitment to building a good relationship that is foundational to all actions/activities.