

A TRANSDISCIPLINARY APPROACH IS ESSENTIAL TO COMMUNITY-BASED RESEARCH WITH AMERICAN INDIAN POPULATIONS

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Abstract: Social determinants of health and their effects on health outcomes create a complex system, with interaction between social, economic, physical, and biological factors necessitating research take a holistic approach. Transdisciplinary research, one of the three core values of the Collaborative Research Center for American Indian Health, seeks to go beyond methods of knowledge production occurring solely within disciplinary boundaries, because real-world societal problems do not adhere to such restrictions. Community involvement is an essential component for successful research partnerships with American Indian and Alaska Native (AI/AN) communities. We posit that transdisciplinary approaches, which considers community-level expertise as an equitable component on the research team, show great potential for advancing research in AI/AN communities.

Roughly 5.2 million people in the United States identify as American Indian and Alaska Native (AI/AN) alone or in combination with another race, making up 1.7% of the total population (U.S. Census Bureau, 2010). It is well documented that AI/AN populations experience significant health disparities (Indian Health Service, 2015; 2018), and the importance of recognizing social determinants of health and their effects on health outcomes are receiving increased attention in medical and health professional circles (Dankwa-Mullan et al., 2010; Secretary's Advisory Committee, 2010). This complex system, with its interaction between social, economic, physical, and biological factors, makes a multi-pronged approach to addressing certain health disparities more likely to be successful (Emmons, Viswanath, & Colditz, 2008; Ruffin, 2010). Research is needed to identify and understand how best to address the complex issues caused by social determinants of health.

A prior history of “bad research” has rightly led to suspicion and negative perceptions of researchers in many AI/AN communities (Davis & Reid, 1999; Hodge, Weinmann, &

Roubideaux, 2000). Research conducted without relevance to local concerns provides no new, useable information or tangible benefits to the tribe and only manages to further the researcher's career (Deloria, 1991; Wax, 1991). Furthermore, non-Native researchers often lack sufficient understanding of the historical context of AI/AN communities, and they frequently do not fully recognize the cultural uniqueness of each tribe (Davis & Reid, 1999). Outside researchers' lack of interaction with the communities they study gave rise to the term "helicopter researchers," which describes investigators who "fly in" to gather data and then "fly out" to write up their findings, with no attempt to connect with the community or provide them with relevant results (Hodge et al., 2000). To help improve research practices and relationships, scholars have heralded the benefits of community-based participatory research (CBPR), which ideally prioritizes community perspectives and knowledge and, therefore, promotes greater impact, relevance, and sustainability (Burhansstipanov, Christopher, & Schumacher, 2005; Caldwell et al., 2005). For researchers who work with AI/AN populations, including community perspectives and knowledge in research projects in all phases of the research process supports tribal sovereignty and allows for the inclusion of certain contextual factors that might affect the project but are not necessarily or readily apparent to an outsider (Burhansstipanov et al., 2005).

However, in order to conduct research that truly benefits AI/AN communities, we posit that an even more equitable research partnership is necessary. This requires a shift in our understanding of CBPR, which has a variety of interpretations that leave room for researchers to include community members in varying degrees, depending upon individual research agendas. Like many proponents of CBPR, we argue that community members should be involved in *all* stages of the research process, from conceptualization to publication, a notion that is not without its critics. This approach has been called "fanciful if not naïve" by some (Weiner & McDonald, 2013, p. 5), and perhaps this has its place. But as researchers who work with AI/AN communities, we have found that CBPR that adopts an inclusive, transdisciplinary framework is the best way to conduct research with Native populations. When addressing a truly complex problem, such as health disparities in AI/AN communities, moving to a transdisciplinary approach and employing a team from a variety of disciplinary backgrounds is necessary. In fact, a transdisciplinary approach that recognizes the interconnectedness of many of these determinants aligns well with AI/AN holistic worldviews, and the inclusion of community experts within the team is crucial to successful projects. Going a step further, we posit that transdisciplinary research with AI/AN communities dissolves the boundaries that separate

investigators from community members by re-conceptualizing what we mean by “expertise.” In other words, transdisciplinary research should, according to its traditional definition, draw upon several academic disciplines, but it should also incorporate on equal footing the community “discipline” of tribal knowledge. Maintaining that community expertise is comparable to the knowledge acquired through advanced training in an academic discipline is an important step forward in the field and truly upholds tribal sovereignty, something that the Collaborative Research Center for American Indian Health (CRCAIH) aims to do.

COLLABORATIVE RESEARCH CENTER FOR AMERICAN INDIAN HEALTH

Creation and Aims

CRCAIH was established in 2012 with a \$13.5 million dollar grant from the National Institute for Minority Health and Health Disparities (NIMHD) as one of the Transdisciplinary Collaborative Centers (TCCs) for health disparities research. In describing the initial funding opportunity, NIMHD emphasized that improving minority health would require transdisciplinary frameworks that cut across organizational silos, fostering strong collaborations and integrative approaches with many disciplines (U.S. Department of Health and Human Services, 2012; see Kenyon et al., 2019, in this special issue). As such, CRCAIH—a multi-faceted endeavor comprised of three divisions (Administration, Community Engagement & Innovation, and Research) and three technical cores (Culture, Science, & Bioethics; Regulatory Knowledge; and Methodology)—was built on the core values of tribal sovereignty, sustainability, and transdisciplinary research and strives to bring together tribal communities and researchers from multiple disciplines in South Dakota, North Dakota, and Minnesota. Since 2012, CRCAIH has supported three large research projects and 15 pilot grants in AI social determinants of health. In addition to supporting these transdisciplinary research projects, the other primary aim of CRCAIH was to engage in formal partnerships with seven tribes in the region in order to assist them in building their own research infrastructures (Elliott et al., 2016; see Buffalo et al., 2019, in this special issue).

Key to implementing a transdisciplinary approach, CRCAIH staff come from a variety of disciplinary backgrounds. Experts in clinical psychology, epidemiology, family studies and human development, sociology, law, nutrition, public health, nursing, medicine, and maternal child health have served as directors of the cores and divisions and as the principal investigators

(PIs). Other staff come from a range of educational backgrounds, including economics, data science, biostatistics, early childhood development, human resources, business administration, nursing, health sciences, and psychology. Having staff from a wide skill set has allowed CRCAIH to offer capacity-building assistance to tribal partners in multiple areas.

Additionally, each research project and pilot grant employed team members with backgrounds relevant to their particular areas of focus, including tribal community partners, although not all research sites were located within reservation boundaries. The type and number of tribal community partners involved depended upon the study. For example, some pilot grants worked directly with tribal organizations' existing staff, while others hired local tribal community members to assist with recruitment and intervention delivery. AI/AN staff from various tribal affiliations were represented in all components of CRCAIH as evaluators, core directors, research specialists, community liaisons, and pilot grant investigators. Notably, half of CRCAIH pilot grant awardee PIs and Co-PIs were AI/AN. Invaluable expertise was brought to the project by staff who possessed knowledge of AI/AN history, values, and culture and utilized that lens when working in areas such as research ethics. One example of this was the development of a Cultural Narrative to accompany the lengthy final report of data collected during a tribal partner's Comprehensive Community Assessment (see Buffalo et al., 2019, in this special issue). The entire process was rooted in Dakota cultural values, and the resulting Cultural Narrative was key to disseminating findings in a useful and culturally sensitive way to the community (Around Him & Pickner, 2016).

In funding CRCAIH, the National Institutes of Health (NIH) understood that for tribal communities to be truly equal research partners and fully engage in research projects, there needs to be a substantial investment in tribal infrastructure. This investment is essential to upholding tribal sovereignty and thereby improving tribal-academic research partnerships. A number of power differentials stemming from the lingering effects of colonialism as well as absent (or inadequate) resources continue to impede tribes' ability to conduct and regulate research (Emmons et al., 2008; Manson, Garrouette, Goins, & Henderson, 2004). Tribal stewardship and regulation of research leads to meaningful and useful research results and ensures that the research conducted will benefit the tribe and proceed in a positive way (Oetzel et al., 2015). By electing to limit the number of fully partnering tribes, CRCAIH made funding available for each tribal partner to support one full-time equivalent employee. This strategic allocation meant tribal

partners would have staff dedicated wholly to research infrastructure building and could capitalize on the dedicated CRCAIH core/division support over the grant period.

Honoring Tribal Sovereignty

The uniqueness of each community meant a “one-size-fits-all” approach to research capacity building would neither honor tribal sovereignty nor meet the communities’ needs effectively. The tribal partners were at various stages of developing their own research infrastructure when their CRCAIH partnerships began, with each having different needs and priorities they wished to address. The purpose of CRCAIH in providing capacity-building assistance was not to dictate what the tribal partners should do, but to provide tools, technical assistance, and financial support to help them enact their own vision for research and research regulation in their community. This aspect of CRCAIH has been particularly beneficial in working with AI/AN populations. As one pilot grant awardee expressed,

I see data sovereignty as a part of public health, which is one of the inherent authorities of a sovereign government. We do not have that yet. We do not have public health infrastructure or the ability to analyze our own data. In order to exert our sovereignty in public health, we need our own capacity. ... CRCAIH has fostered a climate for tribes doing their own investigation ... [and] has done a lot to promote the different core capacities for actively participating in data and translating what is done to how it can benefit the tribe itself (A. Simonson, personal communication, March 26, 2019).

Indeed, this quote highlights the importance of the capacity-building work CRCAIH has performed using a transdisciplinary approach.

Uniqueness of the Transdisciplinary Collaborative Center (TCC)

Like CRCAIH researchers, the other seasoned TCC investigators were already entrenched in research with their community-based partners (most often African American communities in the southern United States). They employed unique ways of investing in community members, including community-member research training and crowd-sourcing of pilot research projects. CRCAIH is different in that community partners are *tribal nations*, which

comes with a variety of complex factors that differ when compared to working with other minority and/or vulnerable populations. Federally recognized tribes are sovereign nations, and, as such, have the power to enact and enforce laws regulating research taking place on their lands (Harding et al., 2012). Exercising this authority becomes difficult without the appropriate financial resources and human capital. CRCAIH's support of regional tribes, particularly in helping to build and enhance their research infrastructure, supports tribal sovereignty and future tribal engagement in transdisciplinary research. As detailed above, the fact that CRCAIH was established as a capacity-building mechanism, with core and division support for tribal research infrastructure, was a drastically different use of resources.

Conceptualizing the Manuscript

As CRCAIH continued its work building tribal research infrastructure and supporting research projects, a theme that often arose was how the notion of transdisciplinary research was the next big step in advancing the field of AI/AN research. The way in which researchers view the connectedness of factors that impact social determinants of health is a product of their disciplinary perspective. In contrast, one of the core principles that CRCAIH was founded on, *transdisciplinary research*, goes beyond typical academic sector methods of knowledge production that occur within disciplinary restrictions, because real-world societal issues do not adhere to such rigid boundaries (Pohl, 2011). Transdisciplinary research in health disparities that extends beyond the traditional academic-scientific realm to involve a broader network of disciplines allows new perspectives to shine through, which in turn might reframe a project's focus (Abrams, 2006). It follows that having additional perspectives can provide a more nuanced and representative picture. This multifaceted lens has the ability to improve project design, community participation, as well as scientific rigor.

To be sure, the development of CRCAIH provided fertile ground for discussion. These ideas took shape in lively conversations between CRCAIH administration and NIH project officers and scientists about building transdisciplinary teams and the unique aspects of CRCAIH. These initial discussions were the seed for many of the ideas in the present manuscript.

Relationship of Transdisciplinary Research to Community-based Participatory Research

Depending upon the criteria used, the similarities between transdisciplinary research and CBPR tend to blur their boundaries. Pinning down concrete definitions that can be widely agreed upon is often difficult, if not impossible. We posit that ideally performed CBPR would meet the tenets of transdisciplinary research. In fact, some scholars have gone so far as to suggest that CBPR “requires a shift away from disciplinary to transdisciplinary research methods” (de la Torre, 2013, p. 4). As Leavy (2011) suggests, “In its best form CBR is necessarily a transdisciplinary modality of research” (p. 83). Yet most community-based research (CBR) does not reach the level of transdisciplinary for a variety of reasons. The level of synergies, collaboration, and integration that modalities reach in real world application tend to fall somewhere along a spectrum, with few achieving the highest levels. The difficulty of reaching this level, however, should not prevent the attempt. When working with AI/AN communities, transdisciplinary research is necessary, not just preferable.

Community-based Participatory Research

CBPR and related approaches (community-engaged research, action research, participatory action research, tribal participatory research) have grown in popularity in recent years, particularly in research that addresses health disparities in minority populations (Israel et al., 2010; Muhammad et al., 2015; Wallerstein & Duran, 2006). An oft-cited definition from the W. K. Kellogg Foundation Community Health Scholars Program (2001) describes CBPR as:

a collaborative approach to research that equitably involves all partners in the research process and recognizes the unique strengths that each brings. CBPR begins with a research topic of importance to the community and has the aim of combining knowledge with action and achieving social change to improve health outcomes and eliminate health disparities. (p. 2)

In her 1998 Review of Community-based Research, Israel and colleagues set forth eight key principles of CBPR, which was later expanded to nine (see Table 1; Israel et al., 2008). Numerous scholars have added to Israel’s recommendations, especially when working with AI/AN communities, since there are other contextual factors to consider when working with tribes (e.g. Caldwell et al., 2005; Fisher & Ball, 2003; LaVeaux & Christopher, 2009; see Table 1).

Table 1
Principles of community-based participatory research, tribal participatory research, and transdisciplinary approaches

CBPR ^a	Tribal Participatory Research ^b	Transdisciplinary ^c
Community is unit of identity	Historical experience with research...work to overcome negative image of research	Focus on real-world problems
Builds on strengths and resources within the community	Recognize tribal sovereignty	Transcending and integrating disciplinary paradigms
Facilitates collaborative partnerships in all phases	Differential tribal & community membership	Participatory research
Integrates knowledge & action for mutual benefit of all partners	Understand tribal diversity and its implications	Search for unity of knowledge beyond disciplines
Promotes co-learning and empowers to address social inequities	Plan for extended timelines	
Involves cyclical and iterative process	Recognize key gatekeepers	
Addresses health from positive and ecological perspectives	Prepare for leadership turnover	
Disseminates findings and knowledge gained to all partners	Interpret data within the cultural context	
Long-term process & commitment to sustainability	Utilize Indigenous ways of knowing	

Note: ^a Israel, B. A., Schulz, A. J., Parker, E. A., Becker, A. B., Allen, A. J., III, & Guzman, J. R. (2008). Critical issues in developing and following CBPR principles.

^b LaVeaux, D., & Christopher, S. (2009). Contextualizing CBPR: Key principles of CBPR meet the indigenous research context.

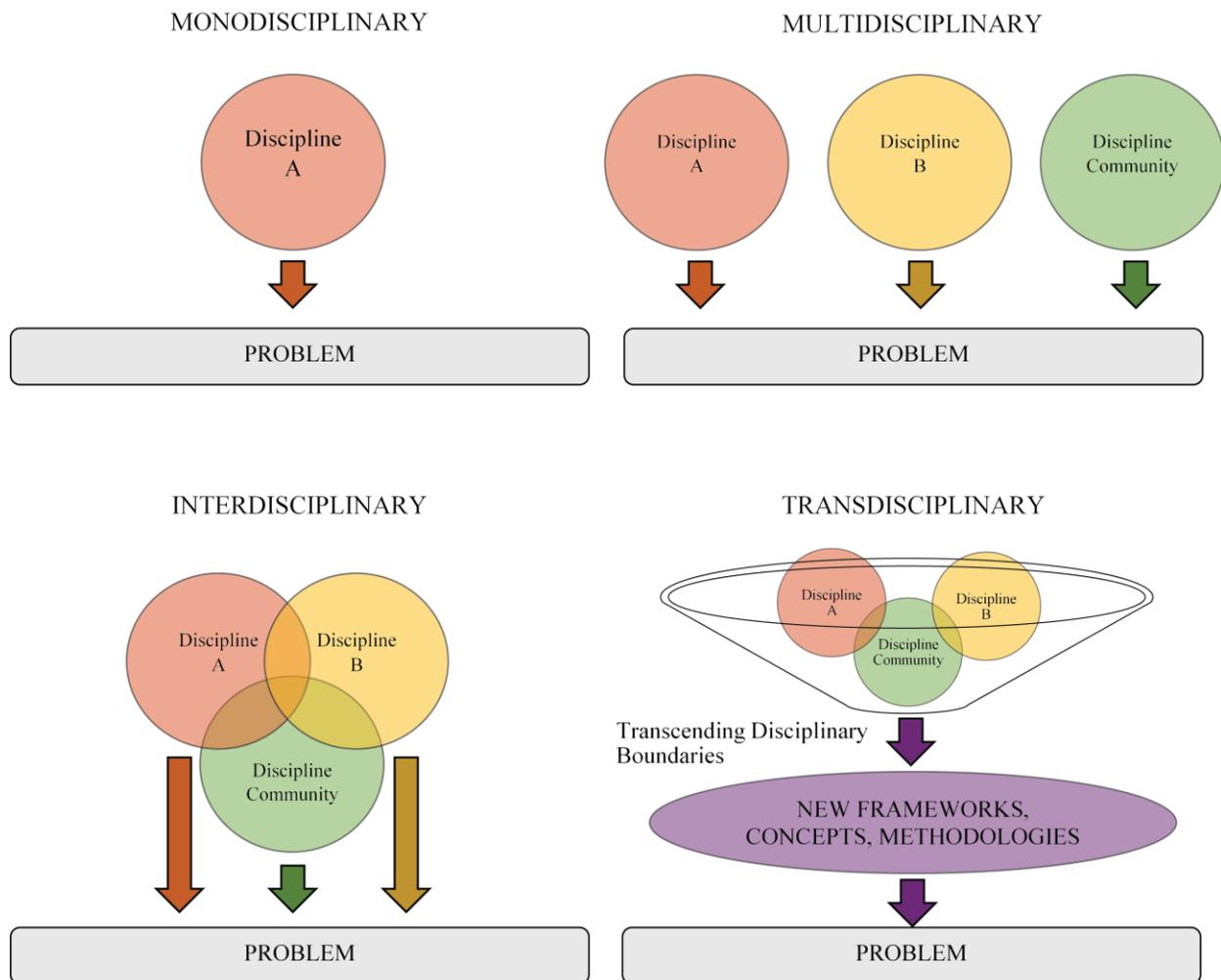
^c Hadorn, G. H., Biber-Klemm, S., Grossenbacher-Mansuy, W., Hoffmann-Riem, H., Joye, D., Pohl, C., . . . Zemp, E. (2008). The emergence of transdisciplinarity as a form of research.

Transdisciplinary Research

Much like the plethora of terms somewhat analogous to the CBPR approach, transdisciplinary research has often been used interchangeably with interdisciplinary, cross-disciplinary, and multidisciplinary research (see Figure 1). Although the literature lacks a widely agreed upon definition of transdisciplinary research, attempts have been made to outline distinguishing features (Choi & Pak, 2006; Thompson, Owen, Lindsay, Leonard, & Cronin, 2017). Rosenfield (1992) described the nuanced differences of each type of research in an effort to provide distinction. Multidisciplinary is where researchers work in parallel or sequentially from their disciplinary-specific base to address a common problem. Interdisciplinary is defined as when

researchers work jointly but still from a disciplinary-specific basis to address a common problem. Finally, *transdisciplinary* differs in that researchers work jointly using shared conceptual framework that draws together disciplinary-specific theories, concepts, and approaches to address a common problem. Aboelela et al. (2007) concluded that there exists a “continuum of collaboration” along which research approaches fall, with transdisciplinary research requiring the highest degree of synthesis.

Figure 1.



In seeking distinguishing characteristics of transdisciplinary research, Hadorn et al. (2008) laid out four criteria (see Table 1), two of which are distinct from CBPR: transcending and integrating of disciplinary paradigms, and the search for unity of knowledge beyond disciplines. Other researchers have identified three characteristics that differentiate transdisciplinary research from other similar modalities: problem focus, evolving methodology, and collaboration (Wickson,

Carew, & Russell, 2006). We feel the characterization of transdisciplinary research that includes three features—a) participatory research, b) focus on real-world, socially relevant issues, and c) transcending and integrating disciplinary paradigms (Hadorn et al., 2008; Wickson et al., 2006)—is a good fit for research with AI/AN communities and will be explored in subsequent sections.

Participatory Research

The disciplinary areas that come together to conduct research can be both within and outside of academia, encompassing researchers from various fields of study, practitioners, and other stakeholders (Leavy, 2011; Mobjörk, 2010). In this respect, transdisciplinary research has similarities to CBPR. In fact, some would contend that the success of transdisciplinary research in addressing health disparities is dependent on “the extent that TDR [transdisciplinary research] teams embrace a broad participatory community-based philosophy” (Abrams, 2006, p. 527). However, there is often an element of insider versus outsider status inherent to CBPR, which can make building trust in partnerships with outside organizations challenging. Having a local face of research in a community is a major step towards building trust in the research process. We suggest that for optimal research outcomes with AI/AN populations, the community must be included on the research team in a meaningful way.

Significantly, this is not only crucial to the autonomy of the tribe, but it can also make the research project more relevant and rigorous. Non-Native CRCAIH pilot grant awardees have reiterated how necessary tribal partnerships were for the work they did with tribal communities. For example, a non-Native pilot grant PI stated:

Having that tribal expertise is critical. The project would not have been able to happen without the partnership ... for a whole host of reasons. [We had tribal members] looking over the materials, the wording we used, the graphics we used, paying attention to those things I would not have paid attention to as closely. (A. Simonson, personal communication, March 26, 2019)

This transdisciplinary approach ultimately left the tribal community with a positive feeling about the project. “For so much of history it’s been this top down approach, and we know that that’s not an approach that works, especially with Native communities,” noted the Native pilot grant co-PI. “To give them that autonomy, in a way that works for them, rather than saying, ‘here’s the

intervention,” was critical to establishing and maintaining a good relationship between outside researchers and tribal community partners, she pointed out. In fact, even though the intervention was ultimately not statistically significant, the tribe remembers the project fondly:

Every time I go back to council, they always say, ‘that We Rise project was so cool!’ They loved that we got into more of a soft social science, as opposed to the quantitative methods, [and] they really enjoyed seeing the effort that went into helping these young moms. That was something the tribal council was really appreciative of. (A. Simonson, personal communication, March 26, 2019; see McCormack, O’Leary, Moran, & Hockett, 2019 and O’Leary et al., 2019, in this special issue)

A principle of participatory research holds that not only should knowledge/findings be shared with all partners in an understandable manner, but that all partners also be involved in the dissemination process, including coauthoring publications and co-presenting at conferences (Israel et al., 2008). An example of this participatory process can be seen in transdisciplinary projects where community experts direct dissemination, such as a 2015 CRCAIH pilot grant project that involved a pregnancy health survey for new parents in a tribal community. The principal investigators were committed to sharing the results with the community in ways that were meaningful, culturally-responsive, and utilized a strengths-based approach. They enlisted the help of the Research Ethics And Dissemination (READ) core of Sanford Research to develop infographics that would facilitate dissemination of survey findings. READ staff worked collaboratively with the SWO First 1000 Days Initiative Interagency Forum, a community group comprised of representatives from a range of community programs, services, and businesses dedicated to creating collective impact to promote healthy families and children on the reservation (SWO First 1000 Day Initiative Interagency Forum, n.d.). Much care was taken to make these infographics reflective of and meaningful to the community, from photographs depicting AI/AN families to using words in the community’s traditional language. Creation of each infographic was an iterative process, with multiple rounds of back and forth between READ and the Interagency Forum. The researchers and community wanted results presented in a strengths-based manner, highlighting positive survey results and acknowledging areas where there was room for

improvement. In the end, the CRCAIH stakeholders felt that CRCAIH's approach was less about publishing and more about serving the community. For example, one pilot grant PI stated:

Sometimes it seems like the purpose of research is to write an article ... so that other people that are studying in the field can stay current. But with the projects that I've been involved in with CRCAIH, [the question has] been: how can this apply to the programming that we are providing for the people we serve, ... [and] how can we disseminate the results, not for the professionals, but for the people in the community? (A. Simonson, personal communication, March 26, 2019)

Research Topics Focus on Real-World, Socially Relevant Issues

The second aspect of transdisciplinary research is that it aims to address broad, complex societal problems (Hirsch Hadorn, Bradley, Pohl, Rist, & Wiesmann, 2006). It acknowledges that real world issues are often multi-dimensional and cannot be successfully or adequately addressed by a single discipline. This focus on real world problems lends itself to framing the issue as it is experienced by those impacted (Carew & Wickson, 2010). The results of this research are then practical outcomes that can be implemented to bring about change (Wickson et al., 2006). Transdisciplinary research differs from traditional positivist approaches to scientific knowledge in that "transdisciplinary contexts embrace a constructivist view of scientific knowledge, in which its value is tied to its societal relevance" (Thompson et al., 2017, p. 31). There is growing support for the idea that research must be socially relevant, issue-driven, and focused on contemporary problems, particularly for AI/AN populations (Deloria, 1991).

We argue that this focus on real-world problems is mandatory for research with tribes because of the aforementioned health disparities. Furthermore, research with AI/AN communities should focus on bringing about positive change. Tribes have long been the subjects of research where benefits to the tribes were not prioritized by the investigators (Deloria, 1991). Employing a modality of research that focuses on real-world problems serves the immediate needs of the community, which is paramount for research with tribal communities (Fisher & Ball, 2003). Herein lies another benefit of greater involvement of community members, not just in the data collection process, but also in the identification of what needs to be researched and how to go about that research. Involving community members who know specifically what issues a particular

tribe is facing certainly increases the relevance of the project and the likelihood that the outcomes will be of practical use.

CRCAIH's approach to building tribal research infrastructure supports the problem-focus aspect of transdisciplinary research in a variety of ways. Most tribal partners work to create and maintain a research inventory of projects conducted on their lands. Having access to a catalog detailing what types of research has been conducted allows for identification of research data that is available as well as potential research gaps. These gaps could assist tribes in developing a research agenda, another area of interest for CRCAIH tribal partners. A research agenda helps guide the direction of future research pursuits towards addressing issues most needed in the community.

Transcending and Integrating Disciplinary Paradigms

The third critical principle of transdisciplinary research is apparent in the term itself, transcending beyond disciplines, but is also more difficult to conceptualize. Ciesielski, Aldrich, Marsit, Hiatt, and Williams (2017) stated, "A key to getting better answers is asking better questions, and transdisciplinary perspectives can generate hypotheses that unidisciplinary perspectives might otherwise miss" (p. 125). Transcending disciplinary bounds is more than seeking feedback from collaborators outside one's home discipline. All collaborators are critical members of a team whose discipline-specific knowledge contributes to the development of innovative practices, approaches, and theories that go beyond each contributor's discipline. As one non-Native CRCAIH pilot grant awardee described working with tribal partners, "We all had different roles on the project, but none was more or less valued than the others. If I didn't have the tribal member's help, I wouldn't have had that expertise at the community level: communication, recruitment, nuances that non-Natives just miss" (A. Simonson, personal communication, March 25, 2019). Ultimately, the ability of researchers to respect and value the methods and knowledge systems of other groups, thus embracing a disciplinary humility, promotes this shift from cross/multi/inter-disciplinary to a transdisciplinary level. The difference reveals itself in the creation of something new versus incorporating one set of ideas into another discipline's framework.

This idea of researchers coming together to create new frameworks for addressing problems, in its exemplary version, is an ideal fit for AI/AN communities. This can present difficulty because Western academic disciplines are grounded in inherent cultural worldviews that idealize

methodologies, which preclude other knowledge systems (Smith, 1999). Many academics and community members have emphasized the need for moving beyond typical Western approaches. Indeed, scholars have stressed the importance of indigenous ways of knowing and traditional indigenous approaches in doing research with AI/AN populations (Caldwell et al., 2005).

Traditional Ecological Knowledge

One way in which scholars have utilized indigenous approaches is through traditional ecological knowledge (TEK). TEK has been described as a “cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment” (Berkes, Colding, & Folke, 2000, p. 1252). TEK has in recent years been used by academic and research communities as a way to incorporate the knowledge and voices of the populations they study into the research process itself. This practice has been both lauded and criticized. The message behind much of the literature on TEK is one of fair warning: uncritical applications of TEK by non-Native researchers harms Native populations and further alienates research communities from the populations they seek to study (Christie, 2006). This is not to say that it is impossible to include TEK in Western research methodologies, but the practice requires the space to be carefully and critically included. Scholars would caution against merely interpreting indigenous knowledge using Western research frameworks (Cochran et al., 2008). Successful applications of TEK and Western science take into consideration that TEK cannot be disconnected from its original context (Finn, Herne, & Castille, 2017).

The holistic approach of TEK continues to garner interest from federal and academic circles, particularly in complex issues relating to health and environment. Finn et al. explain, “Because TEK represents an understanding of the interconnectedness of environmental factors and human health, it has striking similarities to the concepts of the exposome and social determinants of health” (2017, p. 085006-3). However, there are some who suggest there are limitations on who can fully utilize TEK, which is one of the benefits of transdisciplinary approaches (Christie, 2006). Transdisciplinary research illustrates how a team comprised solely of non-Native researchers can pursue research with AI/AN communities in culturally relevant and effective ways. Frameworks and methodologies that are responsive and reflective of the community the researchers are working with will be more successful (Israel, Schulz, Parker, & Becker, 1998), and using methods inclusive of indigenous ways of knowing promote more appropriate and effective research (LaVeaux &

Christopher, 2009). In this way, transdisciplinary research with AI/AN populations can foster collaboration across academic fields and community knowledge without the misstep of attempting to graft TEK onto Western research methods.

The Community Discipline

We posit that when the *community itself* is viewed as analogous to an academic discipline, the experts in that discipline are the community members, thus creating an integral space for Native voices on the research team. Indeed, some scholars would agree that when engaging in transdisciplinary research in a community setting, the community is essentially one of the contributing disciplines (Emmons et al., 2008). Western science holds assumptions that can directly conflict with the notion that the community-level expertise should be seen as a discipline because it conceives of “researchers” as academics with advanced scientific degrees earned at traditional colleges. However, this convention leaves out a whole host of knowledge that is just as insightful, valuable, and vital to the success of a research project in a community. For transdisciplinary research, one must broaden the definition of disciplinary knowledge to *expertise in a specific area, whether by study, experience, or other, that can be used in addressing a problem*. A discipline provides a framework for learning and understanding. It provides the structure through which to view the workings of the world and ways to address problems. The problem-focus of transdisciplinary research calls for research team members who are qualified to tackle the issue by their proximity to the problem at hand (Carew & Wickson, 2010). Expertise in an academic discipline is acquired through years of study in formal education systems. Expertise in the “community” discipline also takes several years and cannot be taught or learned from books. That type of knowledge comes from personal and lifelong association, being a part of the community, interacting with its members, knowing the history of the people, their values, their culture; it is emic (or insider) knowledge. Expanding the limited definition of researcher opens up new modes of knowledge production capable of producing more relevant frameworks and solutions, a worthy goal for anyone who seeks to truly make a difference in the world by confronting disparities and exposing inequalities.

Elevating the community to the level of a discipline enables its contributions to do more than simply inform the research process and help non-Native investigators avoid cultural *faux pas*. Legitimizing community knowledge as an expertise at a disciplinary level goes further than assembling a community advisory board to check a box. Transdisciplinary approaches incorporate community expertise in ways that aren’t simply paying lip service to community involvement.

Community members are key expert contributors, not merely an optional addendum to the research process. When the community is part of a team that develops new frameworks rather than a group charged with inserting cultural elements into Western science, there is greater potential for innovative and impactful results. Transdisciplinary research approaches with the community as a discipline compels research to keep focus on community benefit.

The critical role of the community-based research team member is exemplified in a research project focused on teen pregnancy prevention. Not only was it imperative to have a local champion, as is recommended by CBPR principles, the community-based team member's role and expertise transformed the project and changed the approach, which is arguably what raises the collaboration to the level of a transdisciplinary partnership. As an enrolled tribal member, life-long resident of the area, mother of four, high school coach, and with an outgoing personality, she was highly integrated into the community, and no one would question her Native identity as a tribal member. She brought a lifetime of wisdom, where her input and perspective as a member of this tribal community truly rose to the level of its own discipline. As a person who was not raised with many "traditional" Dakota cultural activities, her experience of being a Dakota woman was normative for the area. Her insight was invaluable to understanding the diversity of thoughts and readiness when developing content for youth to reflect on traditional AI values where there are families with a range of comfort levels with and knowledge of traditional teachings. For example, knowing the diversity of beliefs and knowledge within her tribe, she advocated the medicine wheel used in the curriculum to be framed as one example of how a medicine wheel could look and be utilized, and that the program's teachings do not intend to conflict with students' families' beliefs.

Her suggested approach highlighted the sensitivity that the recent reclamation of traditions needs to be respectful of the majority of AI families who are still dealing with the repercussions of forced assimilation policies. She advocated the team's main goal be that people with a variety of backgrounds of cultural knowledge could teach the curriculum and that the main mission was to teach the foundational cultural concepts and have the youth reflect on their beliefs and values and how it applied to their own behaviors. Therefore, the resulting curriculum included detailed background on the cultural concepts as well as suggested readings and videos for facilitators. Her perspective transformed the project for the better, as the team created a culturally-infused teen pregnancy prevention curriculum.

Flexibility of Approach

Although examples and approaches can be found in the literature, there is a lack of agreed-upon concrete framework and methodologies for implementing a transdisciplinary project and resulting outcomes (Mobjörk, 2010; Thompson et al., 2017). The positive aspect of this lack of structure according to Thompson et al. (2017) is that it “leaves space for transdisciplinary approaches to be shaped by the evolving network of participating scientists and stakeholders, according to their perspectives of the approach and what it embodies” (p. 31). For transdisciplinary research with AI/AN populations, this represents an opportunity for investigators to customize their approach to transdisciplinary research to grow and shape the methods that make sense for each community. It would be impossible to prescribe what transdisciplinary research would look like in all AI/AN communities because each unique community helps shape how the transdisciplinary approach takes form. The process can play out in a variety of ways, each organically manifesting during the course of the collaborative partnerships.

BARRIERS/CONSIDERATIONS

Achieving a level of integration for research to be considered transdisciplinary is difficult in any project, but conducting transdisciplinary research with AI/AN communities involves unique barriers and challenges that must be addressed. Building up tribal research infrastructure can help address some of those limitations.

Power Differentials

One caution for team formation is to be cognizant of power differentials and inequities due to structural/institutional resources, the impact of colonialism, and perceived levels of expertise (Muhammad et al., 2015; Wallerstein & Duran, 2006). For optimal results reflective of the true spirit of transdisciplinarity, care must be taken to prevent the dominant thought from superseding other perspectives. Successful transdisciplinary endeavors necessitate equity in the distribution of resources, which includes things like information, funding, and decision-making power (Emmons et al., 2008; Stokols, Misra, Moser, Hall, & Taylor, 2008), and thus reinforces the need for a robust tribal research infrastructure. Power differentials limit the success and sustainability of a project (Stokols et al., 2008), so taking steps to reduce those by enhancing/building community capacity for research is beneficial. One way in which CRCAIH addressed this potential barrier was through

annual Executive Steering Committee meetings where all members working on CRCAIH were brought together with an equal place at the table for sharing updates and strategic planning.

One thing that can negatively impact the success of the transdisciplinary project is the perception and/or creation of status differences in team formation (Stokols et al., 2008). Structures that consider academic researchers to be the experts and community stakeholders to be those who simply provide feedback privileges the voice of the researcher and does a disservice to the process. This is where recognizing community knowledge and tradition as expertise and the pursuit of thoughtful collaboration among all disciplines is truly beneficial to breaking down hierarchies and advancing research approaches toward true transdisciplinary work.

Differences in Organizational Cultures

Another barrier to transdisciplinary research involves differing organizational cultures, diverse worldviews, and educational backgrounds (Stokols et al., 2008). In the academic sector, the notion of “publish or perish” pressures researchers, often driving activities with a goal of generating publishable results that fit within the theoretical framework of their discipline as fast as possible (Stokols, 2006; Wax, 1991). In tribal communities dealing with health disparities, the more pressing needs of providing services and delivering interventions with immediate results take precedence. Communities desire research that will address concerns in a timely manner (Emmons et al., 2008), so with these urgent needs, waiting for the results of a 10-year longitudinal study is not practical. Another consideration for the academic sector is that research results need to be generalizable. Recent research directions with tribal communities stress the uniqueness of each tribe, the implication of which is research results may not be generalizable beyond that particular community.

With transdisciplinary team projects where all players are equal partners in the process, tension can arise around who drives the project and to what extent. Tribes are sovereign nations with the right to regulate research happening within their boundaries, which they are increasingly doing (Harding et al., 2012). Outside researchers need to ensure they are recognizing tribal sovereignty while collaborating on transdisciplinary projects. Additionally, researchers must also be aware of inherent power dynamics within each unique community. Communication becomes crucial as researchers navigate conflicts in respectful ways and make efforts to learn from alternative perspectives.

Even when team members are on the same page regarding project goals, differing organizational structure and cultures impact the execution of tasks designed to help achieve those

goals. One element of working with tribes is to be prepared for extended timelines (LaVeaux & Christopher, 2009). This can be due to things like changes in tribal council membership, office closures due to inclement weather or a death in the community, institutional processes that require multiple levels of approval, or lack of clarity on approval processes. In smaller offices, competing institutional demands means that staff might be pulled away from a larger goal to focus on addressing an urgent issue. When this happens frequently, the constant effort to “put out fires” can force other big picture projects to the back burner and impede progress towards long-term goals.

Institutional Resources and Technology

Some tribes are quite rural, spanning thousands of acres, and located far away from large urban centers, which is particularly true for the Northern Plains tribes. Limited ability to travel for face-to-face meetings with the rest of the transdisciplinary team necessitates dependence on other methods of communication. CRCAIH was able to utilize site visits, teleconferences, and online meetings (Skype, GoToMeeting) to maintain open and bidirectional communication with tribal partners while working to build research capacity. However, internet and phone service can be patchy in some areas of large reservations. CRCAIH has tried to overcome these barriers through flexibility and not being afraid to change directions and try new methods of connecting. For example, in-person tribal partner retreats became more common in the final years of the original grant.

Era of Budget Constraints

Tribes have faced various unmet infrastructure needs, from physical infrastructure for housing, health care, and education, to technology, employment, and workforce development (National Congress of American Indians, 2017). Tribal governments must prioritize where to invest their limited funds, and, unfortunately, research infrastructure is not always high on the list. Since the initial CRCAIH grant award in 2012, NIH has elected to discontinue the funding mechanism that supported building these Transdisciplinary Collaborative Centers. Subsequently, CRCAIH and partners continue to explore alternative funding options. Getting the tribal research office visibility in the community and with leadership will help to cement the value of continuing to invest in research infrastructure even without the support of federal grants. This infrastructure building is critical if community partners are able to come to the table as equals in research projects.

DISCUSSION

As previously stated, there has been a lack of agreement surrounding how one measures the success of a transdisciplinary project (Stokols, 2006). This isn't surprising considering the variety of unique factors that influence the trajectory of each collaborative partnership and the principle goals of sectors involved in the project. There is not a generalizable exemplar of what "good" transdisciplinary research with tribes looks like due to circumstances and contextual factors unique to each tribal community. One key component of good transdisciplinary research with tribes, however, is the *integral involvement* of the community. Because each community is distinctive in how the problem manifests and the strengths existing within the community, the approaches selected for addressing the issue cannot be summed up in a one-size-fits-all method. The community involvement for transdisciplinary research, as with CBPR approaches, is critical in determining the process and outcomes.

Having representation from various academic disciplines and community stakeholders as members of the research team does not necessarily imply the research conducted is transdisciplinary. Investigators must challenge themselves to critically analyze their approaches and whether community experts are being treated as equitable contributors and orchestrators of the research process throughout. As investigators reflect on current practices, they may discover that hosting a few focus groups and community advisory board meetings does not sufficiently bring in valuable community perspective to a level enabling research to go beyond their own disciplinary frameworks in doing problem-centered research. By involving community stakeholders as equals in all aspects of the research process – design, implementation, evaluation, and dissemination – with the goal to co-create new theoretical frameworks for addressing health disparities, we can move towards the transdisciplinary research ideal.

Researchers and funders should challenge themselves to broaden narrow Western-academic-centric definitions of what research is, what constitutes a discipline, and what credentials make for expertise. Doing so expands the knowledge base and tools for addressing issues in complex real-world scenarios. Some scholars have recommended that funders promote transdisciplinary research by financing only those projects that clearly engage community partners and prioritize the importance of culture when assessing needs and developing programs that mollify disparities (Finn et al., 2017, p. 085006-7). This makes for better research and gets closer to achieving the ultimate goal of improving health outcomes and reducing disparities. Couple CBPR with transdisciplinary research and you have a catalyst for real change. Imagine taking the

wisdom of the community itself, the traditional ecological knowledge, and promoting its integration with multiple other disciplines to develop new theoretical frameworks and concepts for addressing health disparities.

FUTURE DIRECTIONS

This manuscript posits that transdisciplinary approaches are necessary to working with AI/AN communities and has distinct benefits to utilize alongside CBPR approaches. The concept of a transdisciplinary approach is essential to attaining the ideal of a truly equal partnership in working in academic-community research. Even community-directed research may fall short if the community partner's knowledge is only applied or invited in certain aspects of a project. Implementing transdisciplinary principles provides a way to create these meaningful partnerships, which is particularly essential in conducting tribally-based research. This takes a considerable investment of time and resources to build the foundation of trust and understanding to move forward as an equitable, high-functioning team.

Since CRCAIH was funded, it can provide a model of how some transdisciplinary aspects were achieved. This transdisciplinary research lens and approach can help move the needle and drive the field of AI/AN health research forward through co-creation of new culturally-based approaches. Since transcending and integrating disciplinary paradigms is one of the major goals of transdisciplinary research, searching for a unity of knowledge and creating something bigger than simply mixing disciplines is a goal that necessitates a perspective that distinguishes community members' perspectives as a discipline.

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