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Promoting physical activity among Native American youth: A systematic review of the methodology and current evidence of physical activity interventions and community-wide initiatives

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Abstract

Promoting physical activity using environmental, policy, and systems approaches could potentially address persistent health disparities faced by American Indian and Alaska Native children and adolescents. To address research gaps and help inform tribally-led community changes that promote physical activity, this review examined the methodology and current evidence of physical activity interventions and community-wide initiatives among Native youth. A keyword guided search was conducted in multiple databases to identify peer-reviewed research articles that reported on physical activity among Native youth. Ultimately, 20 unique interventions (described in 76 articles) and 13 unique community-wide initiatives (described in 16 articles) met the study criteria. Four interventions noted positive changes in knowledge and attitude relating to physical activity but none of the interventions examined reported statistically significant improvements on weight-related outcomes. Only six interventions reported implementing environmental, policy, and system approaches relating to promoting physical activity and generally only shared anecdotal information about the approaches tried. Using community-based participatory research or tribally-driven research models strengthened the tribal-research partnerships and improved the cultural and contextual sensitivity of the intervention or community-wide initiative. Few interventions or community-wide initiatives examined multi-level, multi-sector interventions to promote physical activity among Native youth, families and communities. More research is needed to measure and monitor physical activity within this understudied, high risk

group. Future research could also focus on the unique authority and opportunity of tribal leaders and other key stakeholders to use environmental, policy, and systems approaches to raise a healthier generation of Native youth.

Keywords: American Indians, Alaskan Natives, active living, physical activity, exercise, obesity

Introduction

The rapid rise in the multigenerational occurrence of chronic disease among American Indians and Alaska Natives has grave implications for the vitality and sustainability of our nation's Indigenous people.^{1,2} One of the first nationally representative studies to estimate the prevalence of obesity among American Indian/Native Alaskan preschoolers estimated 31.2%, which was notably higher than the following four racial/ethnic groups: Asian (12.8%), non-Hispanic white (15.9%), non-Hispanic black (20.8%), and Hispanic (22.0%).³ To understand what may be contributing to these differences, investigators recommended future studies examine the role of community context, particularly as it relates to possible differences in eating and physical activity behaviors. Nevertheless, research on correlates, determinants or interventions specific to physical activity among American Indian and Alaska Native children and adolescents is limited.⁴⁻⁶ A systematic review of articles reporting on physical activity levels in Native American populations in Canada and the United States (US) published between 1960 to 2011 found that 26.5% (based on self-report) to 45.7% (based on pedometry and accelerometry) of children met physical activity recommendations put forth by Canada and the World Health Organization, among others.⁶

Exploring environmental, policy, and systems approaches to promote physical activity and obesity prevention among tribal communities may be particularly powerful since research has indicated health disparities may be partially explained by low-income, racial/ethnic minority and rural neighborhood environments with less access to public parks, open space, and private recreation facilities.⁷⁻¹⁰ Limited research, however, has examined the associations between the built environment and chronic diseases that focused exclusively on American Indian and Alaska Native communities.^{11,12} Even less direct observational research has been conducted to explore the features of the built environment that influence physical activity among tribal communities.^{4,13-16} Likewise, few studies have explored the role of tribal government in promoting or inhibiting physical activity through its courses of action, funding priorities, regulatory measures, laws and policies, and tribal resolutions (a common term used to describe an official expression of the opinion or will of a tribal government and may have the effect of law within the tribe's jurisdiction).^{17,18}

To address research gaps and help inform tribally-led community changes that promote physical activity, this review examined the methodology and current evidence of physical activity interventions and community-wide initiatives among American Indian and Alaska Native children and adolescents (Native youth). For our purposes, an intervention consisted of field trials or hypothesis-driven studies conducted by researchers often examining physical activity related outcomes at the individual level. A community-wide initiative generally consisted of projects or programs undertaken that were not necessarily using rigorous research designs and tended to focus more on environmental, policy, and system approaches at the community level.

Methods

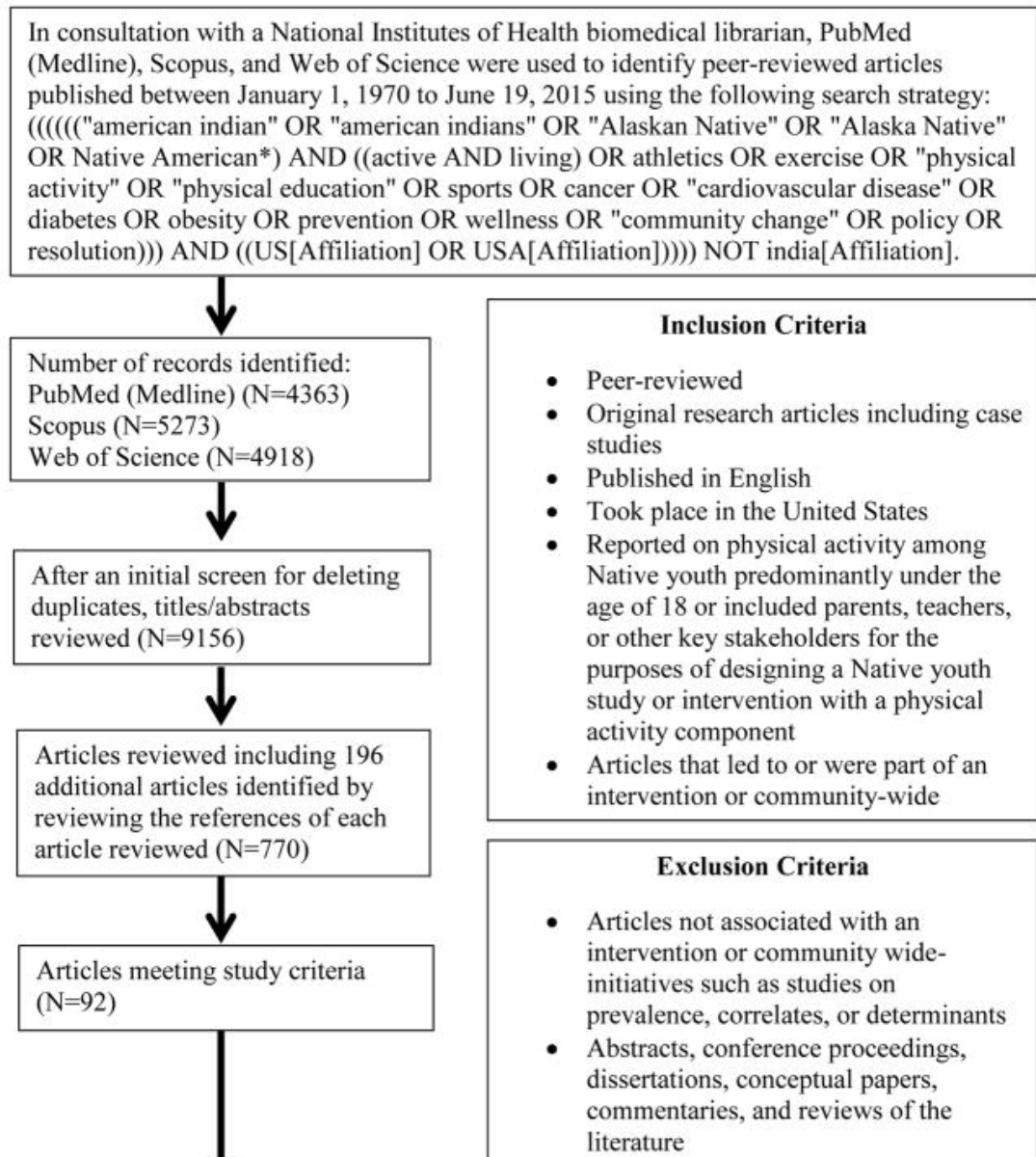
In consultation with a National Institutes of Health biomedical librarian, PubMed (Medline), Scopus, and Web of Science were used to identify peer-reviewed articles published between January 1, 1970 to June 19, 2015. In all three databases, the following search strategy was used: ((((((“american indian” OR “american indians” OR “Alaskan Native” OR “Alaska Native” OR Native American*) AND ((active AND living) OR athletics OR exercise OR “physical activity” OR “physical education” OR

sports OR cancer OR “cardiovascular disease” OR diabetes OR obesity OR prevention OR wellness OR “community change” OR policy OR resolution))) AND ((US[Affiliation] OR USA[Affiliation]))) NOT india[Affiliation]. The references of each article were reviewed to identify any additional articles. Peer-reviewed original research articles including case studies published in English that took place in the US were considered if they reported on physical activity among Native youth predominantly under the age of 18. Articles were also considered if they included parents, teachers, or other key stakeholders for the purpose of designing a Native youth study or intervention with a physical activity component. Articles that led to or were part of an intervention or community-wide initiative were included. Emphasis was placed on interventions and initiatives using or providing insights on tribally-led environmental, policy, and system approaches to fostering active living; therefore, as one example, a national campaign tailored to American Indian children and parents, among other ethnic minority groups, was excluded (e.g., the VERB™ campaign¹⁹). Articles not associated with an intervention or community-wide initiative such as studies on prevalence, correlates, or determinants were excluded. In addition, abstracts, conference proceedings, dissertations, conceptual papers, commentaries, and reviews of the literature were excluded.

When possible, the following information was extracted from each article: year of publication, year of data collection, sample age, sample size used for final analyses, study setting, study design, measures and methods, data sources, psychometric properties, intervention strategies, outcomes, covariates, results, funding source, author identified strengths and limitations, and author identified lessons learned particular to conducting research and promoting physical activity among American Indians and Alaska Natives. Lead authors were contacted when necessary to obtain missing information. Inter-rater reliability was conducted with high agreement across all information extracted with minor reconciliations (SF’s codes were compared with RC’s codes for 74 articles and SF’s codes were compared with ER’s codes on 34 different, additional articles).

Results

770 articles were identified from the search strategy that reported on American Indian and/or Alaska Native health. Ultimately, 92 articles met the aforementioned study criteria. The following results summarize the methodology and current evidence of physical activity interventions (n=20 unique interventions; 76 articles) and then community-wide initiatives (n=13 unique initiatives; 16 articles) among Native youth (See [Figure 1](#) along with [Tables 1](#) and [2](#)).



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[Figure 1](#)

Overview of systematic search process

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Table 1

By targeted setting, interventions reporting on physical activity among Native youth (n=20 unique interventions; 76 articles)

Intervention Target Age Group Geographic Setting Sample Size	Brief Description
Childcare-based	
<p><u>The Child Health Initiative for Lifelong Eating and Exercise (CHILE)</u>^{30,45,86,87}</p> <p>Preschool (Head Start)</p> <p>Southwest (6 rural Pueblos, New Mexico) 1879</p>	<p>Used a socio-ecological approach to design an intervention including classroom curriculum, teacher and food service training, family engagement, grocery store participation, and health care provider support. Reported on lessons learned and concluded Head Start could play an important role in improving physical activity among preschool children.</p>
Church-based	
<p><u>Native Proverbs 31 Health Project</u>³⁹</p> <p>Multiple Age Ranges (Adult Women and Girls > 12 years old)</p> <p>Southeast (Robeson County, North Carolina, homeland of the Lumbee Tribe of North Carolina)</p> <p>4 Lumbee churches (64 women and 11 girls in 2 primary intervention churches; 82 women and 8 girls in 2 delayed intervention churches)</p>	<p>Conducted formative research to develop weekly classes during a 4-month period in 4 churches (2 primary churches and 2 delayed intervention churches) that were led by community lay health educators. Reported churches were receptive to the program including hosting a walking club.</p>
Family-based	

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Table 2

Community-wide initiatives reporting on physical activity among Native youth (n=13 unique initiatives; 16 articles)

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Community-Wide Initiatives Geographic Setting	Brief Description
<u>Chokka-Chaffa' Kilimpi', Chikashshiyaakni' Kilimpi</u> ⁵⁸ Chickasaw Nation, south central Oklahoma	Conducted qualitative study to understand the meaning of health and well-being for Chickasaw families. Reported how traditional and contemporary contexts influenced participants' responses.
<u>Communities Putting Prevention to Work</u> ⁵⁰ Multiple study regions three tribes	Provided training support through a workshop for analyzing, writing, and publishing Communities Putting Prevention to Work initiative findings. Reported participants viewed the workshop positively and one tribe has submitted a manuscript for publication.
<u>Community Based Participatory Research Program Evaluation and Development Project</u> ⁵⁹ Rural tribal reservation in Washington	Created a community advisory board and developed an exercise survey to assess physical activity patterns, preferences, and determinants. Reported youth distinguished between sports and exercise with each possessing different determinants. Youth identified common motivators including friends, coach, and school. Barriers discussed included lack of programs and school or work. None of the youth reported meeting the recommended 60 minutes of strenuous exercise daily.
<u>Community Coalitions</u> ⁵⁴ Eastern and three	Described how community coalitions were formed, implemented, and maintained to teach culturally appropriate fitness activities to groups of community members. Reported how successful institutionalization of community events by tribal

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Interventions

For the 20 interventions identified (See [Table 1](#)), the following summarizes the study populations, theoretical frameworks, research design and methods, formative research and process evaluation, targeted settings and intervention strategies, and outcomes.

Study Populations Almost half of the intervention trials identified (n=9; 45%) focused on elementary school-aged children.²⁰⁻²⁸ More recent interventions targeted early infancy (e.g., Prevention of Toddlers and Teeth Health Study²⁹) and the preschool-aged period (e.g., CHILE³⁰ and Healthy Children, Strong Families³¹). All of the interventions were based in rural tribal communities except Healthy Living in Two Worlds²⁶, which was based in an urban setting. One-third (30%) of the interventions were based in the southwest region of the US.^{21,23,24,28,30,32} Eight interventions (40%) worked with more than one tribal community (e.g., Pathways³³ worked with seven American Indian tribes residing in Arizona, New Mexico and South Dakota).^{23,24,27,29-31,33,34} Only four interventions had a sample size or recruitment goal greater than 500 participants.^{22,25,29,30}

Theoretical Frameworks Nine interventions (45%) noted being informed by a specific theoretical framework.^{20,22,23,26,27,30,31,35,36} Social learning theory^{22,26,35}, social cognitive theory^{20,36}, and grounded theory^{27,30} were mentioned most frequently. Others cited health promotion theory^{23,37} and theory of planned behavior³¹.

Research Design and Methods Half of the interventions (n=10; 50%) explicitly noted using a participatory research approach such as a tribal-research partnership or community-based participatory research.^{22,25,27-31,35,38,39} As one example, Adams, et al.³¹ explained how their team used community-based participatory research, along with their history of university-tribal partnerships to jointly design Healthy Children, Strong Families.

Regarding study design, about one-third of the interventions (n=7; 35%) used a randomized controlled trial.^{20,22,24,29-31,35} The remaining two-thirds of the interventions were non-randomized trials (n=5; 25%)^{25,28,32,38,40} or pilot/feasibility studies (n=8; 40%)^{21,23,26,27,34,36,39,41}. Three of the non-randomized trials discussed why using a randomized controlled trial would not be appropriate within their community contexts.^{28,32,38} Three self-described pilot studies used randomization.^{23,27,36} Additionally, Bright Start²⁰, Pathways²², and the Zuni Diabetes Prevention Program³² mentioned conducting pilot and feasibility phases before implementing the interventions. Only four studies (20%) included a non-Native comparison sample.^{23,30,32,40}

Formative Research and Process Evaluation Formative assessments were described in almost half of the interventions (n=9; 45%).^{20,25,31,39,42-46} Most of the formative assessments used a mixed methods approach including qualitative methods such as key informant interviews and focus groups. Pathways also conducted direct observations⁴² while the Youth Wellness Program⁴³ used a school self-assessment and a locally generated environmental inventory. Other interventions gathered formative research through youth health assessments, youth surveys or parent surveys (e.g., Healthy Children, Strong Families³¹ and Zuni Diabetes Prevention Program⁴⁴). Similarly, process evaluation or measures were discussed by less than half of the interventions (n=9; 45%).^{20,26,27,29-31,34,39,47} Whether or not an intervention formally conducted formative assessments or a process evaluation, all but one intervention⁴⁰ discussed their aim to develop a culturally appropriate intervention. Many of the physical activity cultural adoptions made emphasized cultural values to be fit both physically and spiritually and incorporated culturally relevant activities such as fishing, hiking, as well as traditional Native dancing and games. For instance, Brown et al.⁴⁶ used community feedback to adapt the Diabetes Prevention Program and to develop and pilot Journey to Native Youth Health, which included traditional activities such as berry picking, nature walks, gardening, horseback riding and dancing, along with seasonal activities such as hunting, hiking, camping, sledding, skiing, and winter hockey.

Targeted Settings and Intervention Strategies The targeted settings of the interventions were as follows: school-based (n=8; 40%), family-based (n=6; 30%), childcare-based (n=1; 5%), church-based (n=1; 5%), summer day camp (n=1; 5%), supervised classes (n=2; 10%), and workshop (n=1; 5%). In addition to the variation in targeted settings, the interventions used several types of strategies to promote physical activity among Native youth, usually incorporating more than one approach. All of the interventions used an educational or knowledge-based approach.^{20-32,34-36,38-41} Seventeen interventions (85%) included a train-the-trainer aspect as well that focused on training teachers, peer-educators, or other stakeholders how to deliver educational messages to the targeted audience.^{20,22,24-32,34-36,38,39,41} Almost two-thirds of the interventions (n=12; 60%) integrated a family- or household-based activity such as home visits, parent/caregiver lessons, and motivational interviewing for the parent/caregiver.^{20-22,26,27,29-31,34-36,38} Just over half of the interventions (n= 13; 65%) enhanced opportunities to be physically active through environmental, policy, or system approaches such as increasing recess time, adding in class “action breaks”, or improving activity spaces or equipment.²⁰⁻

[23,25,26,28,30–32,35,39,40](#) One school-based intervention offered fitness opportunities for the school's faculty.²⁵ Some of the interventions included multi-sector strategies that involved more than one setting (i.e., school, church and worksites)^{25,29,30,34} and/or integrated media-based approaches^{25,29,32,34}. Regarding levels of and length of intervention studies, wide variation was found. As one example, one intervention was as short as a half-day⁴¹ workshop while another intervention provided more than three years of targeted intervention exposure²². However, the interventions were not always explicit about the levels of or length of the intervention. Put another way, interventions reviewed varied on discussing intervention dose or clarifying the length of their intervention versus providing the dates of their entire study period including design and manuscript development, the length of the follow-up period – if any, or the time devoted to the partnership process.

Outcomes This section summarizes the physical activity relevant outcomes reported by the 20 interventions by individual, family/household, and environmental, policy, and systems approaches.

At the individual level, four interventions (20%) noted positive changes in knowledge and attitude relating to physical activity.^{22–24,41} Ten interventions (50%) discussed collecting physical activity behavior related data^{22,24,26–28,31,35,36,39,40}; granted only four used accelerometers^{22,27,31,36} and only three reported post-intervention findings^{22,26,27}. In Pathways²², based on accelerometry data, intervention schools were more active than control schools at three of the four sites examined, although the overall difference was not statistically significant. In Journey to Native Youth Health²⁷, both the Journey Diabetes Prevention Program (DPP) and health-oriented comparison condition group performed worse on accelerometer measures at the end of the program compared to baseline. The change in average daily minutes of moderate to vigorous activity for the Journey DPP group were small and not statistically significant while the comparison group had more substantial declines in daily moderate to vigorous activity. Finally, in Healthy Living in Two Worlds²⁶, at post-test, youth reported exercising, on average, six of the past seven days. This finding was higher than the five days reported at pre-test. Participants in Healthy Living in Two Worlds also reported engaging in physical activity that burned between 400 and 499 calories per hour at post-test, which was 100 calories per hour higher than pre-test.

More than half of the interventions (n=14; 70%) mentioned calculating body mass index (BMI), predominantly using measured height and weight.^{20–22,24,27–31,34,36,39–41} Five interventions (25%) also collected body composition data such as percent body fat.^{20,22,24,40,41} Four interventions (20%) measured fasting blood glucose^{28,32,40,41} and only one of these three interventions did not measure plasma insulin levels²⁸. One study measured blood pressure²⁴ and another measured plasma cholesterol⁴⁰. Nevertheless, only eight of these interventions (40%) ultimately reported on the weight (e.g., BMI or percent body fat) or health-related (e.g., blood glucose) data gathered as outcome measures post-intervention^{20,27,28,32–34,36,40} and none reported statistically significant improvements on weight-related outcomes.

At the family/household level, less than half of the interventions (n=8; 40%) examined parental level measures.^{20,29–31,33–36} Most of these interventions focused on a parent or primary care giver's involvement in intervention study's family-oriented events or child feeding practices (e.g., examined how a parent determines the foods and portion sizes their child(ren) are offered). Both Bright Start²⁰ and Pathways⁴⁸ reported low parental involvement in the intervention family events and indicated efforts to engage parents needed to be strengthened. Three interventions collected information about parent/caregiver height and weight but none published specific post-intervention findings on this data^{20,31,35}.

Less than half of the interventions (n=9; 45%) examined environmental, policy, and systems approaches to promoting physical activity.^{20,21,25,28-30,33,34,39} Five interventions (25%) examined school-specific environmental or policy approaches that promote physical activity.^{20,21,25,28,33} CHILE focused on changes within childcare centers but also explored healthy eating intervention strategies targeting the local grocery stores.³⁰ Two evaluated community-wide intervention completion plans primarily intended to help support breastfeeding initiation and duration.^{29,34} Only six interventions (30%) reported actually implementing environmental, policy, and system approaches relating to promoting physical activity.^{20,22,25,31,35,39} As one example, in Healthy Children, Strong Families, the Community Advisory Board component of the intervention was credited with decreasing environmental barriers to being physical activity such as instituting dog control regulations, building an environmentally friendly playground, and providing access to recreational facilities and community gardening.³¹ Cherokee Choices briefly noted “system changes in the school have generated increased physical activity among students and staff” and credited the intervention with increased faculty and student interest in activity related events and celebrations.²⁵ While not much was mentioned about the sustained change of the Pathways physical activity intervention, standardization of the training was deemed to be critical to increasing the amounts of activity in students.²² Bright Start reported a trend, although not statistically significant, for increased duration in combined time in recess and physical education classes associated with the intervention.²⁰ The study investigators discussed how such a trend indicates schools were changing their scheduling in response to the intervention. Moreover, the study investigators of Healthy Hearts Across Generations discussed how environmental interventions were being discussed with the community for future planning efforts with the hope that their intervention results would point to which strategies would be most effective and relevant for their families.³⁵

Community-Wide Initiatives

For the 13 community-wide initiatives identified (See [Table 2](#)), the following summarizes the study populations, theoretical frameworks, research design and methods, and intervention strategies.

Study Populations The targeted geographical regions of these community-wide initiatives varied. Specifically, initiatives examined multiple study regions⁴⁹⁻⁵¹ or a tribal community or communities in Alaska⁵², California^{53,54}, New Mexico^{13,55}, North Carolina¹⁷, Oklahoma⁵⁶⁻⁵⁸, or Washington⁵⁹.

Theoretical Frameworks All of the initiatives mentioned being informed by theory or explicitly noted a theoretical framework guiding their study design, data analysis or interpretation processes. Wide variation was found in the types of theory mentioned and the extent to which theory was discussed. Social cognitive theory¹⁷ and grounded theory^{13,57} were mentioned, along with concepts or conceptual frameworks that emphasized biculturalism⁵⁸, cultural humility⁵⁰ and using a holistic approach⁵¹.

Research Design and Methods All but one⁵⁷ of the initiatives used some form of tribal participatory or partnership building approach to develop, implement, evaluate, or disseminate their initiative. Similarly, all of the community-wide initiatives were predominantly in the formative stages of partnership development. These manuscripts also provided preliminary insights on the initiative’s development, dissemination, and institutionalization processes and outcomes. Seven initiatives (54%) gathered qualitative data to garner insights using various qualitative and/or quantitative data collection strategies.^{13,17,53,56-59} Three initiatives (23%) used some form of community assessment^{17,53,55}; however, two of these initiatives focused predominantly on evaluating the food environment versus the one that evaluated environmental and policy factors influencing physical activity⁵³. Various culturally competent approaches were discussed including using digital storytelling⁵³, a modified Talking

Circle¹⁷, and a workshop series integrating Indigenous evaluation methods⁵⁰. Only one initiative had some form of non-Native comparison group⁴⁹ but more than a third (n=5; 38%) included more than one tribe^{17,49-51,54}.

Strategies Used to Promote Physical Activity While extensive detail and discussion were not provided on the strategies used within the targeted tribal communities to promote physical activity, six initiatives (46%) provided insights on promising areas such as improving environmental access to recreational areas and facilities and instituting school and worksite activity policies.^{13,17,49,53-55} For example, Davis et al.⁵⁵ discussed how recommendations developed through their health impact assessment are being integrated into a public lands National Environmental Policy Act process for planning access to a new segment of the Continental Divide National Scenic Trail. Another initiative reported on the successful development of cultural fitness events for tribal communities designed by community coalitions.⁵⁴ The Healthy, Native North Carolinians initiative was awarded a grant that supported tribally-led community changes to foster active living and healthy eating.¹⁷ Similarly, a tribal council and health clinic of a California tribal community used insights from their participatory research project to write a grant that would support the construction of a walking and bike path featuring culturally appropriate art and educational exhibits.⁵³

Discussion

The aim of this review was to examine the methodology and current evidence of physical activity interventions and community-wide initiatives among Native youth. The following summarizes our findings from the 20 unique interventions and 13 unique community-wide initiatives examined for this review, identifies research gaps and opportunities, and provides recommendations for advancing tribally-led community changes that promote physical activity.

Study Populations

The majority of the interventions and community-wide initiatives occurred on Federal Indian reservations in rural areas. Small sample sizes were a challenge for most of the analyses and few had non-Native comparative samples. Since an effective intervention or community-wide initiative in one tribal community may not be effective in another tribal community, more research is needed to explore similarities and differences across tribal communities (e.g., by size, region, and urbanization).^{60,61} For example, several interventions such as Healthy Children, Strong Families³¹ or Pathways³³, as well as community-wide initiatives such as Healthy, Native North Carolinians¹⁷ showed promise in collaborative, cross-tribal approaches. Equally as important is future work that explores similarities and differences between tribal communities and other ethnic minority, low-income, or rural communities.⁶²⁻⁶⁵ As one example, comprehensive research briefs examining physical activity among Native youth could be compared and contrasted with syntheses generated through *Salud America!* (<https://salud-america.org>) that focuses on reducing Latino childhood obesity or the African American Collaborative Obesity Research Network (www.aacorn.org) that focuses on weight-related issues in African American communities.

Theoretical Frameworks

Interventions and community-wide initiatives guided by social learning theory^{22,26,35}, social cognitive theory^{17,20,36}, or grounded theory^{13,27,30,57} generally discussed the value these theories had in shaping their study design, data analysis or interpretation processes. Concepts or conceptual frameworks emphasizing cultural traditions and a holistic approach were also discussed as valuable.^{50,51,58} Still, little is known about the theoretical underpinnings of increasing physical activity among Native youth in a specific tribe and generally among American Indian and Alaska Native communities. This is

problematic because it limits developing interventions using socio-ecological models that target intersections between individual behavior changes and environmental, policy, and systems approaches. More longitudinal data gathered during longer invention periods or longer follow-up periods could help validate and extend theoretical findings among Native youth. In addition, future studies could explore further how best to construct theoretical and conceptual frameworks for guiding obesity prevention among Native youth that integrates what is known about promoting both active living and healthy eating.

Research Designs and Methods

Similar to prior findings^{66,67}, community-based participatory research or tribally-driven research models were often utilized by reviewed studies and were generally described as effective at building trusting tribal-research partnerships. Another important approach identified was conducting formative research using mixed methods over multiple stages, which was generally recognized as a means of strengthening tribal-research partnerships, improving the design of more culturally and contextually sensitive methods and intervention strategies, and fostering a sense of community ownership for the intervention or community-wide initiative.⁶⁸

Not surprising given findings from interventions including physical activity components focused on American Indian adults^{69,70}, cultural adoptions made by the interventions and community-wide initiatives reviewed enhanced acceptability. These modifications generally included: emphasizing the close-knit nature of tribal communities (e.g., used alternative study designs to randomized controlled trials), integrating long-held Indigenous knowledge and value systems (e.g., recognized a holistic sense of body, mind, and spirit, along with relationships between human beings and their environments), and incorporating cultural traditions, norms, and sense of pride (e.g., encouraged Native dance, traditional games, hunting, and storytelling by community elders). Future research could test further the role of traditional and contemporary held beliefs and practices among Native youth, especially as more community- and youth-oriented work focuses on asset-based approaches, social media grows as a powerful medium to engage youth and relevant stakeholders across Indian Country, and as storytelling increasingly becomes digital.

Targeted Settings and Intervention Strategies

Based on our findings, interventions and community-wide initiatives aiming to increase physical activity among Native youth appear to be a culturally and contextually feasible approach to address their disproportionate risk of developing type 2 diabetes, cardiovascular disease, and obesity. Nevertheless, more research among Native youth is needed to identify specific contributors of physical activity-based strategies to health promotion and disease prevention including depression⁷¹, substance abuse^{72,73}, and suicide prevention⁷⁴. In addition, further work is needed to advance our understanding of the role of environmental, policy, and systems approaches in promoting physical activity among Native youth, families, and communities including the potential of multi-level and multi-sector approaches.⁷⁵ Specifically, build on Pathways³³, Bright Start²⁰, and the Youth Wellness Program²⁸ and evaluate further how environmental, policy, and systems approaches within and surrounding school settings can be maximized to increase physical activity among Native youth before, during, and after school, as well as on and off the school campus. Another research opportunity is building on findings from CHILE³⁰ and Healthy Children, Strong Families³¹ to understand how to improve physical activity among children ages 0 to 5 years-old in the household, childcare setting, healthcare system, and other relevant settings. This includes exploring further lessons learned from Healthy Children, Strong Families on instituting dog control regulations³¹ since the average annual dog bite hospitalization rates have been shown to be higher among American Indian and Alaska Native children compared with the general US child population and may discourage outdoor play among Native

youth.⁷⁶ Aside from schools and childcare centers, more work is needed to understand how best to leverage intersections between community approaches and clinical services; as one example, further developing and disseminating best practices through the Indian Health Service (IHS) Special Diabetes Program for Indians and the IHS Health Promotion/Disease Prevention program.⁷⁷ For some tribal communities, collaborations with churches may also be promising.³⁹

To successfully identify potential environmental, policy, and systems approaches and gain the full participation of Native youth, families, and communities, future research could explore youth-oriented formative research formats^{46,59}, community coalitions with youth representatives^{18,54}, and capacity building workshops and technical assistance targeting key sectors^{17,50}. Also helpful will be researchers and practitioners who focus on identifying, developing, implementing, evaluating, disseminating, and sustaining tribally-led environmental, policy, and systems approaches that recognize tribal leaders' unique authority and opportunity to raise a healthier generation of American Indian and Alaska Native children. Recent initiatives encourage tribal leader action on promoting physical activity in addition to providing specialized funding and resources to support tribal leaders in making these types of changes such as the Healthy Native North Carolinians Network

(<http://americanindianhealthyteating.unc.edu/healthy-native-north-carolinians-2/>), The Notah Begay III Foundation Native Strong Program (<http://www.nb3foundation.org/our-work/programs/>), and *Let's Move!* in Indian Country (<http://lmic.ihs.gov/>). Dissemination research specific to tribal communities will be a critical component to understanding how to spread, apply, and tailor what works.⁷⁸

Outcomes

The interventions and community-wide initiatives examined for this review were predominantly in the formative stages, relied on self-reported physical activity data, and often only shared anecdotal information about the environmental, policy, and systems approaches tried. To advance our understanding of physical activity among Native youth in general and specifically on the role of environmental, policy, and systems approaches, more research is needed to measure and monitor physical activity within this understudied, high risk group. This work would include improving how to measure and monitor physical activity within this population, since only Pathways extensively examined the psychometric properties (e.g., validity and reliability) of their evaluation instruments.^{22,33,79-84} Moreover, further work is needed to understand the prevalence, correlates, and determinants of physical activity among Native youth. As one example, national surveillance systems could be enriched with American Indian and Alaska Native children and adolescents under the age of 18 years. Care must be taken to ensure surveillance systems accurately account for Native youth who identify as mixed race.

Taking a life-course approach and exploring further how economic conditions interact with genetic and evolutionary biology could potentially provide meaningful insights for designing long-term interventions.^{1,85} Another research opportunity is examining the effects of physical activity interventions on other outcomes such as depression, self-esteem, identify, cultural and traditional connectedness, substance use, and suicidal ideation. In addition, more rigorous research could expand our understanding of the effects of physical activity among Native youth on motor skill development, academic achievement, leadership development, and civic engagement.

Funding

Specialized funding from government and non-government sources plays a critical role in supporting culturally appropriate research and evaluation of physical activity interventions and community-wide initiatives targeting Native youth. The National Institutes of Health (NIH) was the primary support for 15 interventions (75%).^{20,22-24,26-32,35,36,38,39} Three of the remaining interventions acknowledged

the Centers for Disease Control and Prevention (CDC)²⁵, the Health Resources and Services Administration (HRSA)⁴⁰, and the American Medical Association⁴¹. About half of the community-wide initiatives were supported by the CDC (n=6; 46%)^{13,49-51,55,56}; other funding sources acknowledged included the Indian Health Service (IHS)⁵⁹, the NIH^{51,52}, the US Department of Agriculture (USDA)⁵⁷, state governmental agencies^{53,54}, and foundations^{17,53,55}. Future funding initiatives could focus on developing the next generation of American Indian and Alaska Native researchers and practitioners, ensuring strong skills in conducting community-based participatory research or tribally-driven research models. Another potential funding area that could be stimulated and strengthened is multi-level, multi-sector interventions to promote physical activity among Native youth. A call for data on the cost-effectiveness of implementing and sustaining interventions and community-wide initiatives targeting physical activity among Native youth will be instrumental in encouraging tribal leaders to explore these types of strategies and in advancing our understanding of how to bring effective approaches to scale in Indian Country. Similarly, more work with tribal leaders will help advance our understanding of how to encourage them to use environmental, policy, and systems approaches to promote physical activity and address any specific data needs they have to make informed decisions on these matters.

Conclusions

Few interventions noted positive changes in knowledge and attitude relating to physical activity and none reported statistically significant improvements on weight-related outcomes. Some interventions and community-wide initiatives discussed implementing environmental, policy, and system approaches relating to promoting physical activity but generally only shared anecdotal information about the approaches tried. Using community-based participatory research or tribally-driven research models could strengthen tribal-research partnerships and improve the cultural and contextual sensitivity of the intervention or community-wide initiative. More research is needed to better understand what to focus on to promote physical activity among Native youth. Future research could also focus on the unique authority and opportunity of tribal leaders and other key stakeholders to use environmental, policy, and systems approaches to raise a healthier generation of American Indian and Alaska Native children.

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Table 3

Study demographics and methods used for the 20 interventions with physical activity components among Native youth

	n (% of total)	Citation(s)
Target Age Group		
Early Infancy (0–2 years)	3 (15)	29,34,36
Preschool-Aged (2–5 years)	3 (15)	30,31,38
Elementary School-Aged	9 (45)	20–28
High School-Aged	2 (10)	32,41
Multiple Age Ranges	3 (15)	35,39,40
Geographic Setting (specific States examined)		
Midwest (NE, SD, WI)	4 (20)	20,31,40,41
Northeast (NY)	2 (10)	26,36
Northern Plains (MT)	1 (5)	27
Pacific Northwest (ID, OR, WA)	4 (20)	29,34,35,38
Southeast (NC)	2 (10)	25,39
Southwest (AZ, NM)	6 (30)	21,23,24,28,30,32
Multiple Study Regions	1 (5)	22
More than One Tribal Community	8 (40)	23,24,27,29–31,33,34
Rural Setting	19 (95)	20–25,27–32,34–36,38–41
Urban Setting	1 (5)	26
Sample Size		
<100	8 (40)	26–28,32,36,39–41
>100 but ≤500	6 (30)	20,21,23,31,34,35
>500	4 (20)	22,25,29,30
Not Reported	2 (10)	24,38

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Table 4

Targeted settings and intervention strategies for the 20 interventions with physical activity components among Native youth

	n (% of total)	Citation(s)
Targeted Setting		
Childcare-based	1 (5)	30
Church-based	1 (5)	39
Family-based	6 (30)	29,31,34–36,38
School-based	8 (40)	20–25,28,32
Summer Day Camp	1 (5)	26
Supervised Classes	2 (10)	27,40
Workshop	1 (5)	41
Intervention Strategies		
Educational (e.g., knowledge-based activity)	20 (100)	20–32,34–36,38–41
Enhanced Opportunities to Be Active	13 (65)	20–23,25,26,28,30–32,35,39,40
Family- or Household-Component	12 (60)	20–22,26,27,29–31,34–36,38
Integrated Other Sectors	4 (20)	25,29,30,34
Media-based	4 (20)	25,29,32,34
Training-the-Trainer (e.g., peer educators or staff)	17 (85)	20,22,24–32,34–36,38,39,41
Length of Intervention, Partnership or Project		
Less than Six Months	7 (35)	23,26,32,36,39–41
One to Two Years	8 (40)	20,21,27–29,31,34,35
Greater than Two Years	5 (25)	22,24,25,30,38
Outcome Data Interventions Planned to or Reported		

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¹Includes outcomes the intervention planned to collect or gathered (e.g., BMI); however, not all of these interventions ultimately reported on the results of these data.

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Footnotes

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