TBM

SYSTEMATIC REVIEWS

Physical activity interventions to promote positive youth development among indigenous youth: a RE-AIM review

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Abstract

Physical activity (PA) programs are a promising strategy to promote positive youth development (PYD). It is not known if published reports provide sufficient information to promote the implementation of effective PYD in indigenous youth. The purpose of this study was to assess the extent to which published literature on PA programs that promote PYD in indigenous youth report on RE-AIM (reach, effectiveness, adoption, implementation, maintenance) indicators. A systematic literature search was conducted to identify articles reporting on PA programs that promote PYD in indigenous youth. The search yielded 8084 articles. A validated 21-item RE-AIM abstraction tool assessing internal and external validity factors was used to extract data from 10 articles meeting eligibility criteria. The most commonly reported dimensions were effectiveness (73 %), adoption (48 %), and maintenance (43 %). Reach (34 %) and implementation (30 %) were less often reported. Published research provides insufficient information to inform real-world implementation of PA programs to promote PYD in indigenous youth.

Keywords

External validity, Aboriginal youth, Knowledge translation, Implementation

INTRODUCTION

Indigenous youth belonging to diverse communities that originate from, and have cultural ties to, particular territories located around the globe that have been adversely affected by colonialism have typically been characterized in terms of maladaptive and risk-taking behaviors [1–3]. Youth programs developed from this deficit-based perspective that views youth as problems that need "fixing" [4] further reinforce colonial relations and marginalization of indigenous youth from mainstream society [4, 5]. Colonialism and the resulting marginalization of indigenous people in the Americas and Australia have had devastating effects for indigenous youth who continue to be at greater risk of poor health status, serious injury, suicide, and developing chronic diseases later in life [3, 6–8]. Increasingly, a strength-based approach called positive youth development (PYD) is being embraced as an alternative viewpoint from which youth programs and life experiences can be shaped to positively influence the spiritual, mental, emotional, and physical aspects of indigenous youth development [9–11]. PYD approaches focus on enhancing life experiences that contribute positively to overall development as well as foster an individual's interests, skills, and abilities [12, 13].

Both traditional and contemporary forms of physical activity and sport have been found to play an integral role in indigenous youth development [9, 14–17] and are a recognized strategy for enhancing PYD [12, 18]. For example, taking part in canoe journeys was found to enhance confidence among indigenous youth in the USA [17], while organized sports in general have been shown to be associated with resiliency and having a positive outlook for youth living on-reserve [16]. Studies involving indigenous youth from Australia and Canada have linked physical activity with confidence, self-esteem, and increased coping skills [9, 14]. Sport-based programs and other organized physical activity opportunities have also been linked to benefits such as community connectedness and community well-being and culture, supporting the role of the community in indigenous youth development [9, 15]. Interventions promoting PYD for indigenous youth are primarily delivered using structured physical activity and educational classes [11, 19–21] or traditional land-based experiences such as canoeing and powwows [17, 22–24] as strategies. Regardless of the strategy used, changes in PYD outcomes such as resiliency, leadership, cultural competence, and general life skills have been demonstrated across diverse indigenous populations [17, 22, 23, 25] in addition to improvements in physical activity, weight, body mass index, and blood pressure [11, 20, 26].

Effective and well-funded physical activity programs that have extensive reach into the youth population can have a strong public health impact [27], and effective programs are often considered for dissemination to similar groups or communities [28]. Given the potential for physical activity and sport to influence positive developmental outcomes in indigenous youth, understanding which types of physical activity programs effectively foster positive developmental outcomes in which youth, under which circumstances, is critical to the sustainability of effective programs to

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support indigenous youth development. However, few physical activity interventions have been designed and reported in such a way to be translated successfully from research into real-world practice [29, 30]. Critical information about the target population, measures of effectiveness, delivery and implementation strategies as well as sustainability, which could facilitate program dissemination and replication to other groups or communities, is often lacking in the published physical activity literature [31–34]. Without sufficient information to adequately gauge the internal and external validity of a program, evidence-informed practice on a broad scale will remain elusive.

The RE-AIM (reach, effectiveness, adoption, implementation, maintenance) framework can be used to strengthen the design, implementation, evaluation, and reporting of physical activity programs by considering both internal and external validity factors [27, 33, 35]. Briefly, RE-AIM assesses reach of the target population and efficacy/effectiveness through program outcomes at the individual level, adoption and implementation of the program by personnel and settings at the organizational level, and maintenance of change at both the individual and organizational levels [35]. The RE-AIM framework has been applied to assess the reporting of internal and external validity factors of physical activity interventions using a variety of strategies [33, 36], in a diversity of settings [34, 37] and in specific populations [32]. A review of the reported internal and external validity of physical activity programs designed to promote PYD in indigenous youth could help facilitate and strengthen the implementation of evidence-based practice that promotes the benefits associated with physical activity found in the published literature [9–11, 14, 17, 22]. The purpose of this study was to explore the degree to which physical activity interventions that promote indigenous youth development report on internal and external validity factors that enable practitioners to utilize research findings.

METHODS

Selection of studies

A two-phase systematic review was initially conducted from July 2012 to January 2013 and updated in July 2015, to identify all eligible peer-reviewed articles ever published that describe physical activity intervention programs promoting PYD in indigenous youth. The process that was undertaken is described in greater detail elsewhere [38]. In phase I (see Table 1), two independent reviewers searched 10 databases: (a) Academic Search Premier, (b) Educations Research Complete, (c) ERIC, (d) MedLine, (e) SportDiscus, (f) ProQuest Dissertations and Thesis, (g) ProQuest Nursing and Allied Health Source, (h) ProQuest Sociology, (i) PsychINFO, and (j) Canadian Research Index. Population search terms included terms used in the USA, "American Indian," "Indian," "Indians of North America," "Native American," "Alaskan Native," and "Pacific Islander;" in Canada, "Aboriginal," "First Nations," "Métis," and "Inuit," and in an international context, "Indigenous." The contexts "sport" OR "recreation" OR "physical activity" OR "exercise" were searched with a combination of the following topic terms, "positive youth development" OR "leadership" OR "athlete development" OR "prosocial" OR "life skills" OR "sport outcomes" OR "psychosocial development" OR "resiliency" OR "empowerment."

Phase II involved searching for the same terms in 25 peer-reviewed indigenous journals that were not indexed in any of the databases explored in phase I. This process was considered integral to the systematic review in order to obtain an indigenous perspective on PYD. The 25 indigenous journals were compiled in a list (see Table 2) based on knowledge of existing journals from indigenous and non-indigenous scholars. Articles meeting the following inclusion criteria were retained for further review: (a) directly and substantially applicable to indigenous people; (b) explores the notion of "positive youth development" and "physical activity," "sport," or "recreation," and (c) uses a quasi-experimental or experimental research design. Descriptive, cross-sectional, review, or meta-analytic studies were excluded.

The initial phase I search yielded 333 articles that were retained for further review. Two researchers independently screened the abstract of each article, of which 16 met the inclusion and exclusion criteria based on abstract review. Inter-rater agreement calculated using Cohen's κ was .81 ($p < .05$), which is considered to be a very high degree of agreement [39]. Disagreements were discussed with an external RE-AIM expert until consensus was reached. The initial phase II search yielded 78 articles that were retained for further review using the same process as outlined for phase I, of which five met the inclusion and exclusion criteria based on abstract review. Inter-rater agreement measured using Cohen's κ was .88 ($p < .05$), which is considered to be a very high degree of agreement [39]. Disagreements were resolved through consultation with an external RE-AIM expert until consensus was reached. The full text of each of the 21 articles retained from the two phases was then assessed by two independent reviewers according to the inclusion and exclusion criteria. As a result, an additional 11 articles were excluded for having no pre/post-test ($n = 4$), having a descriptive research design ($n = 3$), not dealing exclusively with indigenous youth ($n = 2$), or having a qualitative research design ($n = 2$). Six companion articles for the 10 articles retained from the systematic review were added for a sum of 16 articles, representing 10 distinct studies (see Fig. 1).

RE-AIM criteria

Data on internal and external validity from the 16 included articles were extracted using a validated 21-item RE-AIM tool [32, 40–42]. Two trained raters extracted data using the 21 RE-AIM items to

Table 1 | Phase I and phase II databases and search terms

Phase	Content	Database(s)	Key terms
I	Indexed peer-reviewed journals	1. Academic Search Premier; 2. Education Research Complete; 3. ERIC; 4. MedLine; 5. SportDiscus; 6. ProQuest Dissertations and Thesis; 7. ProQuest Nursing & Allied Health Source; 8. ProQuest Sociology; 9. PsychINFO; 10. Canadian Research Index.	("Aboriginal" OR "First Nations" OR "Métis" OR "Inuit" OR "American Indian" OR "Indian" (omitting Indian from India), OR "Native American" OR "Indigenous" OR "Indians of North America" OR "Pacific Islander") AND ("sport" OR "recreation" OR "physical activity" OR "exercise") AND ("positive youth development" OR "leadership" OR "athlete development" OR "prosocial" OR "life skills (development)" OR "sport outcomes" OR "psychosocial development" OR "resiliency" OR "empowerment")
II	Non-indexed peer-reviewed indigenous journals	See Table 2	

determine if the study reported on the reach (5 items), efficacy/effectiveness (4 items), adoption (6 items), implementation (3 items), and maintenance (3 items) dimensions of the RE-AIM framework. Reach items included the method to identify the target population, inclusion and exclusion criteria, participation rate, and characteristics of participants and non-participants. Efficacy/effectiveness items included the primary outcome measure employed, the use of intent-to-treat versus present at follow-up data analysis, a measure of quality of life, and attrition at program completion. Adoption included reporting on a description of the intervention location, a description of staff who delivered the intervention, the method to identify the delivery agent, a description of the level of expertise of the delivery agent, inclusion and exclusion criteria for the setting, and an indication of the rate comparing participating settings with non-participating settings. Number and duration of intervention contacts, the extent that the original intervention protocol was delivered as intended, and cost were used to assess implementation. Maintenance items included the

Table 2 | Non-Indexed Indigenous Journals searched during Phase II

Journal Name	Inaugural Publication Year
AlterNative: An International Journal of Indigenous Scholarship	2005
Australian Indigenous Law Review	1996
American Indian Culture and Research Journal	1974
BC Studies: The British Columbian Quarterly	1969
Cultural Survival Quarterly	1972
Decolonization: Indigeneity, Education and Society	2012
First Peoples Child & Family Review	2004
International Journal of Circumpolar Health	1972
Journal of Aboriginal Health	2004
Journal of Ethnopharmacology	1979
Indigenous Policy Journal	1989
Indigenous Law Journal	2002
International Journal of Critical Indigenous Studies	2008
International Indigenous Policy Journal	2010
Journal of Indigenous Research	2011
MAI Review	2006
Native Social Work Journal	1997
Native South	2008
Pimatisiwin: A Journal of Aboriginal and Indigenous Community Health	2003
Plains Anthropologist	1955
Settler Colonial Studies	2011
Tribal Law Journal	1998
Te Kaharoa	2008
UCLA's Indigenous Peoples Journal of Law, Culture & Resistance	2004
Wicazo Sa Review	1985

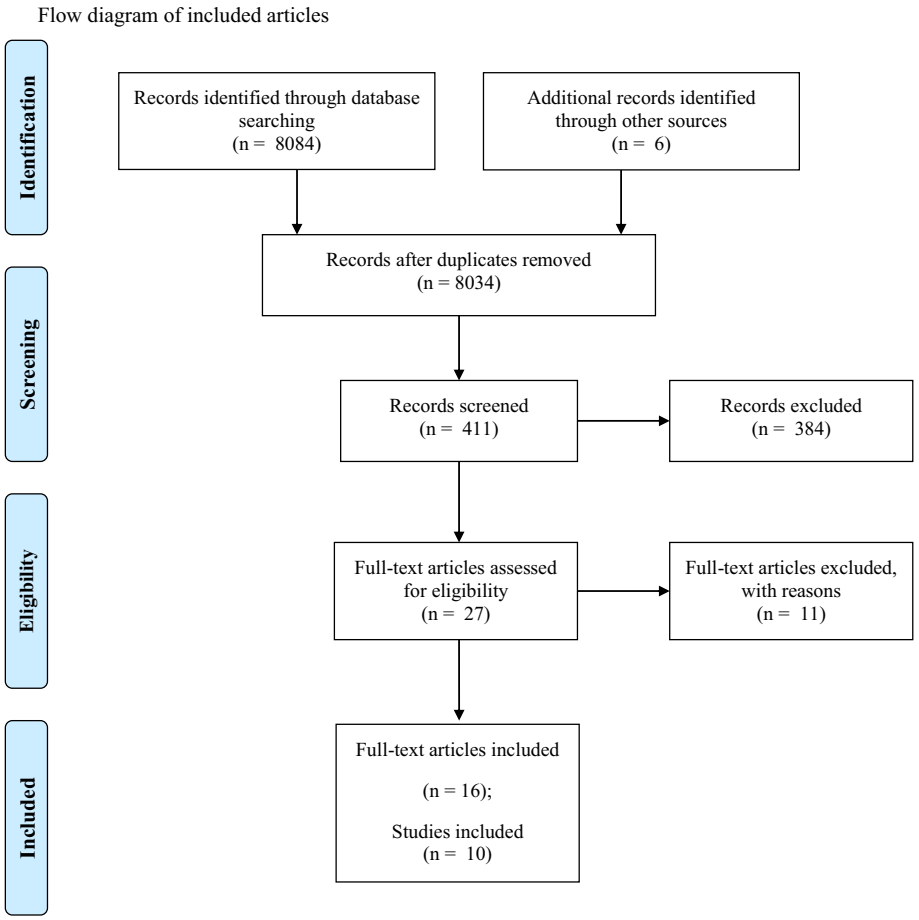

Fig. 1 | Flow diagram of included articles

assessment of individual behavior, as well as an indication of whether or not the intervention program was still in place or had been institutionalized. RE-AIM items were coded as being either *present*=1 or *absent*=0 based on established operational definitions.

Inter-rater reliability

Articles were coded by two RE-AIM trained raters. The average inter-rater agreement achieved, calculated using Cohen's κ, was .60 ($p < .05$), indicating moderate agreement [39]. In cases where there was not initial agreement in the coding, a discussion was held with an external RE-AIM expert until consensus was reached.

Data analysis

Frequencies and percentages for each of the 21 RE-AIM items were calculated. The average reporting of RE-AIM dimensions across studies was determined using the percentages found for each of the RE-AIM indicators. RE-AIM reporting quality measured the degree to which RE-AIM items were reported using the total frequency of the 21 RE-AIM items within each study, where 0–7 = low, 8–14 = moderate, and 15–21 = high quality.

RESULTS

While the 10 studies all aimed to enhance various dimensions of PYD, interventions primarily did so via a main goal of reducing risky behaviors ($n = 6$) [17, 19, 22, 23, 25, 26], preventing the onset of chronic diseases ($n = 3$) [11, 20, 21], or promoting cultural connectedness ($n = 1$) [24]. Most of the studies were quasi-experimental ($n = 8$) [11, 17, 19, 21–23, 25, 26], but randomized controlled trial designs ($n = 2$) [20, 24] were also utilized. Studies were conducted in the USA ($n = 6$) [11, 17, 19, 22, 23, 26], Canada ($n = 2$) [21, 25], and Australia ($n = 2$) [20, 24]. Studies reported an average of 9.70 (±3.24) out of 21 RE-AIM items, ranging from 5 to 14 reported items (Table 3). The majority of studies (70 %) had moderate RE-AIM reporting quality, with the remainder of studies (30 %) considered to be of low reporting quality. Reporting proportions for all RE-AIM dimensions and corresponding items are included in Table 4.

Reach

On average, the proportion of reach items reported across studies was 34 %. The method to identify the target population, a factor related to internal validity, was reported most often (50 %) within the reach

Table 3 | Validated RE-AIM ($n = 21$) indicators reported by each study

Primary author/year	Reach ($n = 5$)	Efficacy/effectiveness ($n = 4$)	Adoption ($n = 6$)	Implementation ($n = 3$)	Maintenance ($n = 3$)	Total ($n = 21$)
Boyd-Ball 2003	3	3	3	1	1	11
Canuto et al. 2011	2	4	3	2	1	12
Dell et al. 2005	1	2	2	0	3	8
Donovan et al. 2015	3	2	3	1	1	10
Hawkins et al. 2012	0	3	0	1	3	7
Kiran et al. 2010	0	3	2	1	0	6
Penn et al. 2008	0	1	2	0	2	5
Sharma 2010	4	3	4	2	1	14
Teufel et al. 1998	3	4	5	0	1	13
Weaver et al. 2010	1	4	5	1	0	11

dimension. Inclusion and exclusion criteria, also related to internal validity, were reported as often (40 %) as the external validity item, participation rate (40 %). Characteristics of both participants and non-participants, a key external validity factor, was not reported for any study.

Efficacy/effectiveness

The average proportion of efficacy/effectiveness items (73 %) reported across studies was highest among the RE-AIM dimensions. A large proportion of studies reported on items associated with internal validity. Among these items, primary outcome results were reported in all (100 %) studies, followed closely by percent attrition (90 %) and analytical technique employed (present at follow-up/intent-to-treat analysis; 70 %). Quality of life and unintended negative outcomes, both external validity items, were reported in 30 % of studies.

Adoption

Across studies, the proportion of adoption items reported on was 48 % on average. The level of expertise of the delivery agent, a description of the staff who delivered the intervention, and a description of the intervention location was reported most often (60 %) in the adoption dimension. Setting and delivery agent participation rate (40 %), method to identify the target delivery agent (40 %), and inclusion/exclusion criteria for settings (30 %) were mentioned in less than half of the studies.

Implementation

The average reported proportion of implementation items was lowest (30 %) across all studies. One item, intervention duration and number of contacts with participants, was reported in 70 % of studies. These details are associated with establishing internal validity for a study. Another internal validity factor, the extent to which the protocol was delivered as intended, was only discussed in 20 % of studies. Not a single study reported on cost-related outcomes.

Maintenance

Average reporting of maintenance items was 43 %. Participation maintenance in the form of individual outcome assessment beyond 6 months was reported in 40 % of studies. Setting maintenance, as measured through information on continued delivery, was mentioned in half (50 %) of the studies. Information on the degree to which the program was institutionalized was included in 40 % of studies.

DISCUSSION

Using the RE-AIM framework, this review examined the extent to which internal and external validity factors are reported for physical activity interventions that enhance indigenous youth development. The

Table 4 | Proportion of reported items according to RE-AIM dimension

RE-AIM indicator	Reporting proportion
Reach	
Method to identify target population	50 %
Inclusion criteria	40 %
Exclusion criteria	40 %
Participation rate	40 %
Characteristics of participants and non-participants	0 %
Total reach indicators	34 %
Efficacy/effectiveness	
Primary outcome results	100 %
Present at follow-up/intent to treat	70 %
Percent attrition	90 %
Quality of life/measure of unintended outcomes	30 %
Total efficacy/effectiveness indicators	73 %
Adoption	
Description of intervention location	60 %
Description of staff who delivered intervention	60 %
Method to identify target delivery agent	40 %
Level of Expertise of delivery agent	60 %
Inclusion/exclusion criteria of settings/interventionists	30 %
Setting or delivery agent participation rate	40 %
Total adoption indicators	48 %
Implementation	
Intervention number of contacts/duration	70 %
Extent protocol delivered as intended	20 %
Measure of cost	0 %
Total implementation indicators	30 %
Maintenance	
Individual outcomes assessment	40 %
Information on continued delivery	50 %
Information on the degree of institutionalization	40 %
Total maintenance indicators	43 %

proportion of RE-AIM items reported across studies was highest for efficacy/effectiveness, adoption, and maintenance while reach and implementation were seldom reported. A gap in the reporting of these RE-AIM dimensions makes it difficult for practitioners to determine the potential of an intervention for population-level dissemination (reach). It also makes it difficult to ensure intervention fidelity (implementation) [27]. While reporting for adoption and maintenance was still inadequate, the current review differs from other physical activity RE-AIM reviews in that these two dimensions were not reported least often [28, 32, 33]. These findings suggest that there is insufficient information to successfully translate effective physical activity interventions that enhance PYD into practice.

Within each of the RE-AIM dimensions, items related to internal validity were reported more often across studies included in the present review than those related to external validity even though the overwhelming majority of studies had quasi-experimental designs and took place in natural settings. This suggests that even studies designed to demonstrate effectiveness and thus illustrate potential for widespread dissemination prioritize the reporting of items associated with internal validity. This is consistent with previous findings [31, 43] reporting that there is an emphasis on efficacy and internal validity factors in the health promotion literature rather than on effectiveness and external validity.

Among individual-level RE-AIM dimensions, the proportion of items reported for reach in the present review was significantly lower than that of other RE-AIM evaluations, which show that the majority of studies have reported on method to identify the target population, inclusion criteria, and participation rate [28, 32, 34, 44, 45]. Similar to previous RE-AIM evaluations of physical activity interventions, participant and non-participant characteristics, or representativeness of participants, was least likely to be reported within the reach dimension [28, 32–34, 43, 45]. In some cases, including in the present review, not a single study reported on non-participant characteristics [33]. Without information about non-participant characteristics that make up a portion of the target population, translation to new populations of indigenous youth will remain elusive for practitioners. Among efficacy/effectiveness items, primary outcomes and percent attrition were almost always reported in both the present and past RE-AIM reviews [19,

28, 32, 45]. While present at follow-up/intent-to-treat analysis reporting ranged from 16 to 100 % across RE-AIM reviews [32, 33, 44, 45], quality of life and unintended negative consequences were rarely mentioned [32, 33, 44]. Given that quality of life is an important public health indicator [27, 32], its absence from the studies in the present review represents a limitation to the advancement of evidence-based public health practice. Given that indigenous youth generally report their health as worse than other youth on self-rated health measures [8], quality of life indicators in indigenous youth are critical for the translation of successful PYD initiatives.

Within the adoption dimension, the level of expertise of the delivery agent, description of intervention location, and description of staff who delivered the intervention were mentioned by the majority of studies included in the present RE-AIM review. While not reported to the same extent, Galavíz and her colleagues [32] also identified the same three items as most often reported in their review of physical activity interventions among Latin American populations. Setting and delivery agent participation rate, inclusion and exclusion criteria for settings and interventionists, as well as the method to identify the target delivery agent were included in less than half of the studies. While a RE-AIM review investigating breast cancer and physical activity interventions found similar results [45], another RE-AIM review on the topic of theory-based physical activity interventions found that participation rates and inclusion and exclusion criteria were reported in significantly lower proportions [33]. Program settings can vary by resources, expertise, and commitment [27]. As a result, reporting items from the adoption dimension can help in understanding whether a physical activity program is feasible in a particular setting and can be adapted to new settings. Consequently, physical activity programs with potential for adoption in new settings should be prioritized for funding to benefit indigenous youth from different territories.

While the reporting of implementation items varied considerably across studies in the present review, the number of contacts and duration of each intervention were discussed in most studies. By contrast, the extent to which the protocol was delivered as planned was rarely reported and a measure of cost was not included in any study included in this review. While other RE-AIM reviews have also found that a measure of cost is rarely, if ever, reported [31, 32], a RE-AIM review by McGoey and colleagues [31] reported that 8 % of physical activity interventions for school-aged children reported a measure of cost. Information about fidelity and cost is important for program modification [45]. Program modification is an essential component of successful physical activity programs for indigenous youth [22] that can be supported through funding that seeks to maximize participation from marginalized populations through adaptation of effective interventions. Among the maintenance items reported in this RE-AIM review, information about continued delivery was reported slightly more than both individual level outcomes at 6 months and institutionalization across studies. Maintenance, often reported more often for individual outcomes in other reviews [33, 46], illustrates that there is a dearth of information available to understand physical activity intervention sustainability for indigenous youth development, making it difficult to predict long-term viability of physical activity programs that enhance indigenous youth development. Sustainability could be supported through funding earmarked for follow-up evaluations and the institutionalization of physical activity programs in community organizations.

Based on the findings of this review, researchers should consider reporting on factors that support external validity and facilitate evidence-based practice. When considering reach, studies should not only report on the demographic information of participants, but also non-participants. Kiran and Knights [24] provided a detailed description of the 167 participants, including indigenous identity (21.6 % of students) and gender (54.2 % male). To enhance generalizability, reporting on a comparison with non-participants in terms of demographics like gender, age, and indigenous identity and behaviors such as physical activity would aid in understanding any differences between the study sample and population at large that would support translation to practice. Reporting on reach and specifically determining who did not participate can help researchers identify indigenous cultures and groups in the catchment area that may have inadvertently been excluded from the study sample. Furthermore, future physical activity interventions should consider the value of quality of life and unintended consequence indicators in determining health status for practitioners and its impact on public health when measuring efficacy/effectiveness [32, 47]. For example, in a study describing the Zuni diabetes prevention program [11], researchers noted that teenagers were using the wellness center to avoid school. Although this was certainly not intended, when unintended negative consequences are reported, practitioners can make informed decisions that weigh the benefits against the risks of adopting the intervention to ensure feasibility on a broad scale. A critical examination of any risk associated with participation is important when working with indigenous youth who suffer from poor self-reported health and higher rates of suicide [7, 8].

At the settings level, information describing the skills and individuals required to deliver a physical activity program and information about the way in which settings are chosen for inclusion in the study is needed. In the *Healthy Living in Two Worlds Project* [26], program coordinators were described by their decades of social worker experience and indigenous background and each component of the intervention setting–a large university with a gym, pool, outdoor space, and kitchen–was explained. These details, related to external validity, provide practitioners with the necessary information to enhance the adaptability

of similar interventions to new settings, especially when cost and resources are limited [27]. Furthermore, programming like the *Health Living in Two Worlds Project* [26] that is delivered by indigenous community members for indigenous youth tends to be more effective than programs delivered by non-indigenous people [22].

Related to internal validity, any adaptations to the protocol as well as the extent to which the protocol was delivered should be reported along with a measure of implementation costs. For example, Canuto [20] describes the Aboriginal and Torres Strait Islander Women's Fitness Program as two classes of 45–60 min per week for 12 weeks that follow a strict program manual. While Canuto [20] thoroughly discusses the implementation protocol, measures of cost are missing. Reporting on indicators of fidelity strengthens confidence that the effects of an intervention are due to the intervention implemented [31], while cost is a practical consideration in determining feasibility [27, 43, 45, 48]. Finally, reporting on individual outcomes and organization-level maintenance of the program after the original intervention is completed denotes a program with potential for sustainability, in both long-term effectiveness and viability in the realm of public health. The study of canoe journeys by Hawkins and LaMarr [17] provides an excellent reporting example that includes a follow-up of outcomes 6 months after the intervention as well as information about the institutionalization of the program by eight indigenous nations across Canada and the USA.

Limitations of this review include our focus on reported RE-AIM dimensions in published literature and the breadth of physical activity intervention literature for indigenous youth development. By focusing on RE-AIM items reported in articles, data related to other key aspects of the RE-AIM framework that were collected, but not published, would not have been included in the review. Authors were not contacted to follow up on RE-AIM items that were absent from the available articles. As a relatively new area of research, there is scant literature for physical activity interventions that enhance indigenous youth development. Thus, it is possible that authors have focused primarily on establishing internal validity in an attempt to establish a cause and effect relationship between physical activity intervention strategies and positive youth development for indigenous youth. This may also help explain why even quasi-experimental studies taking place in natural settings prioritize the reporting of factors related to internal validity. Both of these limitations have been partially addressed by seeking out all companion articles for studies that were included as part of the systematic review.

Despite the inclusion of only 10 studies, the protocol included searches in both indexed peer-reviewed journals and non-indexed indigenous peer-reviewed journals that are typically excluded from systematic reviews. This study provides valuable insight and recommendations into key factors that are typically missing from intervention research, such as participant and non-participant characteristics and implementation cost, which are critical for ensuring effective translation of research to practice. Implementing these recommendations will reinforce external validity, and the generalizability, feasibility, adaptability, and sustainability of successful physical activity programs that enhance indigenous youth development through spiritual, mental, emotional, and physical well-being.

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