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Original Research

Best Practices for the Prevention and Management of Diabetes and Obesity-Related Chronic Disease among Indigenous Peoples in Canada: A Review



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ABSTRACT

Objectives: To carry out a systematic review of interventions that have aimed at improving screening, treatment, prevention and management of type 2 diabetes and obesity-related chronic disease in Indigenous communities in Canada from 2008 to 2014, with the aim of identifying current best practices.

Methods: A comprehensive literature review was carried out through an electronic database search using Medline, EMBASE, PubMed and Google scholar.

Results: We identified 17 publications, comprising 13 evaluated interventions. Of them, 7 were school-based programs focused on children, 5 focused on adults, and 1 included both adults and children. Most interventions aimed at encouraging behaviour change, especially dietary change, but did little to address the underlying context of systemic marginalization and colonialism experienced in many Indigenous communities. Interventions focused on improving fitness were more effective than those aimed at dietary change. Overall, we found a range of successes among these interventions. Those that met with limited success reported that complex social issues and poverty presented challenges to effective intervention work in these communities. Participatory action research methods and community ownership of the intervention were found to be essential for project success.

Conclusions: Diabetes-focused intervention research in Indigenous communities appears to be a low priority for Canadian funders and policymakers. More intervention research is urgently needed in these communities. To be effective, this work must take an approach that is historically deep and sufficiently broad as to enable the ideologic, policy and institutional changes necessary in order to achieve true equity. This will involve addressing colonialism, racism and social exclusion as broader determinants of health.

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R É S U M É

Objectifs : Mener une revue systématique de la littérature à propos d'interventions qui ont visés à améliorer le dépistage, le traitement, la prévention et la gestion du diabète de type 2 et les maladies chroniques liées à l'obésité dans les communautés des Premières Nations au Canada entre 2008 et 2014, dans le but d'identifier les meilleures pratiques actuelles.

Méthodes : Un examen complet de la littérature a été réalisé en utilisant des bases de données électronique - Medline, Embase, PubMed et Google scholar.

Résultats : Nous avons identifié 17 publications, comprenant 13 interventions évaluées. Parmi eux, 7 visaient des programmes d'école axés sur les enfants, 5 étaient concentrés sur les adultes, et 1 comprenait les adultes et les enfants. La plupart des interventions visaient à encourager le changement de comportement, en particulier le changement de régime alimentaire, mais peu portaient attention au contexte

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sous-jacent de la marginalisation systémique et le colonialisme connu dans de nombreuses communautés autochtones. Les interventions axées sur l'amélioration d'état physique étaient plus efficaces que celles qui visaient des changements d'alimentation. Dans l'ensemble, nous avons trouvé une gamme de succès parmi ces interventions. Celles avec un succès limité, rapportaient des obstacles complexes au niveau social et de pauvreté qui ont présenté des défis pour travailler avec les communautés et mettre en place une intervention de façon efficace. Les méthodes de recherche participative et la possession communautaire de l'intervention ont été jugées essentielles pour la réussite du projet.

Conclusions : La recherche interventionnelle axée sur le diabète dans les communautés autochtones semble être une faible priorité pour les bailleurs de fonds et les décideurs politiques canadiens. Il y a un besoin urgent pour plus d'études avec intervention dans ces communautés. Pour être efficace, ce travail doit prendre une approche qui est historiquement profonde et suffisamment large pour permettre l'idéologie, la politique et les changements institutionnels nécessaires afin de parvenir à une véritable équité. Il faudra pour cela aborder le colonialisme, le racisme et l'exclusion sociale comme déterminants de la santé.

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Introduction

Diabetes and obesity-related chronic disease have reached epidemic proportions among Indigenous peoples in Canada (1–3). The Public Health Agency of Canada has recently reported a diabetes prevalence rate of 17.2% among on-reserve First Nations people, 10.3% among off-reserve First Nations and 7.3% among Métis (1). The disparity between these figures and the prevalence rate of 5% among non-Indigenous Canadians illustrates the particular threat that obesity-related morbidities pose for Indigenous peoples in Canada.

Genetic vulnerability plays a role in the development of diabetes, but the rates of diabetes and related chronic diseases among Indigenous peoples are widely considered to be due primarily to nonmedical factors. These nonmedical factors include sedentization and dietary change (1,4,5), high cost and limited availability of healthful foods in many remote communities (6,7) as well as sociostructural barriers, such as high rates of poverty, poor infrastructure and limited opportunities for employment in many Indigenous communities (8). Furthermore, although the presence of walking trails and access to exercise equipment has been found to promote increased physical activity in Indigenous communities (9), many nonurban communities lack both safe and all-weather places for walking, as well as facilities for specialized physical activity such as sports (10,11). Moreover, many Indigenous peoples face additional challenges in accessing appropriate healthcare, as many reside in rural and remote regions that lack comprehensive primary care and are often at great distances from specialized care (12). Stressful working conditions and isolation impede the retention of health-care personnel in remote areas (13,14).

As with other health disparities between Indigenous and non-Indigenous peoples in Canada, the burden of diabetes and chronic disease are linked to the socioeconomic marginalization of Indigenous communities. Contemporary health disparities are part of the history of colonization that includes loss of land and livelihood, diminished community self-determination and policies that have undermined social and economic development such as the Residential School system (15,16). Any effort to address the health disparities between Indigenous peoples and other Canadians must therefore attend to the relationship between colonization, inequality and health. Moreover, such efforts must also attend to the loss of cultural continuity and identity due to active suppression of Indigenous culture and knowledge (15), including Indigenous concepts of health and wellness as well as severe social and economic disadvantage (15–17). Many interventions aimed at Indigenous communities have met limited success in part because they have failed to account for local conceptualizations of wellness (18,19).

Aims and objectives

The objective of this study was to report the results of a systematic review of interventions that have focused on improving the

screening, treatment, prevention and management of type 2 diabetes and obesity-related chronic disease in Indigenous communities in Canada between 2008 and 2014, with the aim of identifying current best practices. The review was carried out as a preliminary component of a study funded by the Canadian Institutes of Health Research to inform the design and the delivery and testing of a multisite intervention to be implemented in multiple Indigenous communities across Canada. The objective of the intervention is to develop an effective diabetes-care model that integrates with and extends existing diabetes prevention and treatment efforts in these communities by supporting their own efforts toward improvement in the delivery of care and in community programming.

This review was deemed necessary because of previous calls for evidence-based programs aimed at reducing type 2 diabetes in Indigenous communities (18–21) and the paucity of formally evaluated, effective interventions that have aimed at improving screening, treatment, prevention and management of type 2 diabetes and obesity-related chronic disease in these communities, both in Canada and internationally. Indeed, a 2013 global systematic review of all randomized controlled trials (RCTs) carried out in Indigenous communities between 2000 and 2010 found only 22 studies that met their inclusion criteria, 6 of which were conducted in Canada (20). These low numbers represent a modest increase from the 13 studies that Morris (1999) found in his systematic review of RCT studies of Indigenous peoples between 1999 and the early 1970s, none of which were conducted in Canada (22).

Canadian studies have also been included in a multicountry systematic review of type 2 diabetes interventions in Indigenous populations (19) and in a systematic review of physical-activity interventions focused on Indigenous communities in the United States and Canada (23). McNamara and colleagues (19) identified only 5 Canadian studies in their 20-year (1988–2008) review and report substantial limitations to the rigour of nearly all of the studies included in their review. Indeed, the limited quantity of useful material led the authors to conclude that “we have found an urgent need to increase the amount of high-quality intervention research in this field, which is currently at low levels” (10 [pg. 7]). Furthermore, in their systematic review of physical-activity interventions, which spanned 1986 to 2006, Teufel-Shone and coauthors (23) identified very few Canadian studies and found that the majority of relevant interventions published during that period were implemented in the American Southwest. Finally, the authors of a 2010 multicountry review of successful cardiovascular health programs in Indigenous communities note that in the Canadian context they were “unable to find any cardiovascular treatment programs focused exclusively on the First Nations populations” (24 [pg. 354]). Given the very limited available material with which to establish best practices for diabetes and obesity-related chronic disease in Indigenous communities in Canada prior to 2008, we focused our search on identifying recent Canadian material.

Methods

We carried out a comprehensive literature review of online databases to identify relevant Canadian intervention studies published between January 1, 2008, and December 31, 2014. We did not include studies that were published prior to 2008 because they have already been identified by McNamara and colleagues (19).

The literature review was carried out by KR using Medline, EMBASE, PubMed and Google scholar. RCTs were sought initially because they are widely considered to be the gold standard for evaluating the efficacy and effectiveness of health interventions (25). However, the extremely low volume of articles necessitated a broadened review that included all studies with quantitative evaluative components, irrespective of the design. To be included in our review, interventions had to fulfill the following criteria: 1) have a baseline for comparison; 2) have incorporated an intervention aimed at reducing the incidence of diabetes, reducing rates of obesity and/or body mass index (BMI), improving blood sugar or blood pressure, or increasing physical activity or knowledge about fitness and/or healthful eating habits, or some combination of these; and 3) have evaluated the efficacy of that intervention. It was not necessary for there to be a control group, although particular effort was made to identify all controlled trials that fulfilled our selection criteria. Search terms were combined using *and*, and they included *First Nations, Aboriginal, Indigenous, intervention, evaluation, prevention, Métis, Inuit, Inuvialuit, diabetes, hypertension, high blood pressure, chronic disease, chronic condition, obesity, diet, fitness, physical activity, best practice* and *randomized controlled trial*. Initial citations were selected by title and abstract and were then reviewed by KR to ensure that they met our inclusion criteria.

After identifying suitable studies, we systematically extracted data. These data included the goal of the study, the location of the intervention, information about the research participants, the duration of the intervention, the measured outcomes, the results of the evaluation and the limitations of the study (see Appendix 1).

The literature we identified through our review was supplemented by a scoping review of wider literature relevant to best practices for diabetes and obesity-related chronic diseases among Indigenous people. These included qualitative, quantitative and mixed-methods research, and our search focused on but also extended beyond Canada. In particular, we reviewed literature concerning intervention studies on which recent Canadian interventions have been modelled, notably Pima Pride (26) Kahnawake Schools Diabetes Prevention Project (27–30), Sandy Lake Schools Diabetes Prevention Program (31,32), Healthy Buddies (33), Pathways (34) and Apache Healthy Stores (35–36). We also carried out scoping reviews of relevant interventions carried out in Indigenous communities in contexts similar to those of Canada. Following earlier systematic reviews (19,22), we determined *similar context* to mean Native American, Native Hawaiian and American Samoan, Australian Aborigine and Torres Strait Islander, and Maori. Finally, although no exclusively qualitative studies met our inclusion criteria, we reviewed a large body of qualitative literature discussing best practices for health-care provision, treatment and prevention in Indigenous communities in Canada. Several of the interventions included in our study involved interview components or ethnographic research as a component of the preliminary development of the intervention. This wider review was carried out in order to gain a more fulsome understanding of the body of knowledge upon which the reviewed interventions were designed and to better contextualize the limitations of and challenges incumbent on the reviewed interventions.

Results

We found very few recent evaluative studies of Canadian diabetes and chronic disease interventions. Our search produced a total

of 17 publications that fit our inclusion criteria. These comprised 13 unique evaluated interventions; 4 interventions were discussed in multiple publications.

Participant population

Of the 13 interventions that met our review criteria, 7 were school-based programs that focused on children (37–45). Some of these studies had components aimed at the wider community (for instance, community walking trails, newsletters sent home to caregivers), but all 7 focused exclusively on children when measuring the success of their interventions. Another study included both children and adults (46) (Oster et al, 2010), and the remaining 5 interventions (47–53) targeted adults exclusively.

Of the studies, 2 (47–48) included both urban and rural communities, whereas the remaining interventions focused on rural and remote communities in all provinces and territories except the Yukon, New Brunswick, Prince Edward Island, Newfoundland and Labrador, Quebec and Nova Scotia. Three interventions (45–47) included First Nations participants both on and off reserve. Of the 13 interventions, 7 were implemented exclusively on reserve; 2 interventions (43,49,50) were implemented in remote or semiremote regions, but it is unclear whether the First Nations participants resided on reserve, off reserve or some combination of both. Mead, Sharma and colleagues (51,52) conducted the only intervention focused on Inuit communities.

Outcome measures

All studies but 1 used BMI and waist circumference as outcome measures. Of these 12 studies, only 5 studies (37,38,42,46,48) reported reduced waist circumference, and only 4 (37,38,42,46) reported lowered BMIs. Five studies also measured blood pressure pre- and postintervention. Foulds and colleagues (48), whose intervention was a walking and running fitness program, reported significant improvements for participants who had high blood pressure at baseline. Ronsely et al (42) recorded a modest 3% drop in blood pressure postintervention, alongside a 15% increase in high blood pressure in their control group. Tobe et al (53) and Oster et al (46) reported improvements in blood pressure. Toth (45) reported no improvement in blood pressure. Three studies (46–48) measured cholesterol. Oster found improved cholesterol postintervention, while Foulds (48) reported improved cholesterol only among female participants. Only Dredger et al (47) measured blood glucose levels and reported significant reductions postintervention.

Seven studies measured change in knowledge about healthful eating and/or active lifestyles (37–41,51,52), and all of them reported increased knowledge about healthful behaviours postintervention. However, authors concede that increased knowledge alone is of little use, especially if the target populations are children (who may have little control over the food they eat), or if healthful foods and safe areas for exercise are difficult to access. Moreover, moving knowledge into action may be a challenge for participants confronted on a daily basis with poverty (54). The limited impact of this increased knowledge is evident in that although 6 interventions reported increased knowledge of healthful behaviours, only 3 (41,49,50) reported an actual increase in healthful behaviours. An example of such behaviour includes participants actively buying and cooking more foods that are low in fat and sugar.

Of the 6 interventions that measured change in knowledge of healthy eating and lifestyle, 4 also measured self-efficacy (55). In the context of these intervention studies, self-efficacy means participants' confidence in their ability to actually use their increased knowledge to live a healthier lifestyle in the future. Of the 4 interventions that measured self-efficacy, 1 found no change (39), and 3 (49–51) found increased self-efficacy but also found that increased

knowledge and self-efficacy did not lead to healthier behaviour. The 1 exception is Eskicioglu et al (37), who report that increased self-efficacy was the best predictor of reduced waist circumference postintervention.

The weakest area of outcome concerns increasing physical activity and fitness. Eleven studies (37,38,41–45,48,49,51,52) included physical activity components, yet only 3 studies (43,45,48) reported increases in either physical activity or fitness (measured as VO_{2max}), while 2 studies reported decreases in physical activity following the intervention (45,49). Moreover, although Toth (45) found an increase in physical activity postintervention, the author acknowledges that a new physical activity program was launched in the local school concurrent with her intervention, and that the improvements in fitness were likely the result of this new curriculum rather than the intervention. Her results are also somewhat contradictory in that she found increased fitness but decreased physical activity. It appears that prioritizing fitness and physical activity in the intervention was important for success; of the 2 interventions that made improvements in activity and fitness, 1 study (48) focused on them exclusively, and the others (43,44) placed heavy emphasis on them in their school-based program.

Seven interventions drew on participatory-action research methods, meaning that the interventions themselves were designed, implemented and evaluated as coconstructed projects between researchers and the community partners (56). Moreover, all interventions that met with even moderate success employed community-engagement strategies (57). Most authors reported that long-term engagement and established relationships with communities were essential for the success of their interventions.

Only 4 studies included a control group (37,38,42,53). Most of the interventions lasted less than 1 year, and in 1 case, evaluation of the intervention began only 1 week after implementation (40). Four studies were limited by small sample size (39,40,45,47).

Discussion

Given the widespread acknowledgment of the health disparities between Indigenous people and the wider Canadian populace, it is both surprising and disappointing that we found only 13 studied interventions that met our inclusion criteria. However, this small number is larger than the number found in previous reviews—which spanned much longer time periods—indicating a likely rise in the number of intervention studies conducted in Indigenous communities. The existence of 13 interventions indicates, nevertheless, a very small number of interventions, suggesting that Indigenous health is a low priority in the context of current research and policy.

In terms of improved outcomes, the interventions in our review that met with the most success were those that collaborated closely with local communities at all stages of the research process and drew on local human resources as key actors in their interventions. For example, Foulds and coauthors (48) trained and then employed members of local First Nations communities as fitness trainers, while Ronsley et al (42) and Eskicioglu et al (37,38) attribute much of their program's success to expressed desire for a diabetes-focused intervention on the part of the communities they worked with and to a mentorship/buddy system among local children and youth.

The number of interventions targeting school children is of interest. It may occur because children are seen as valuable foci for intervention research because their participation in a study is more easily achieved in a school-based intervention. The success of several studies included in our review (42–44), notably the effective Healthy Buddies First Nations and the Aboriginal Youth Mentorship Program, add further evidence to indicate the potential of child-focused school-based interventions. Importantly, the most effective school-based interventions (37,38,42) involved peer-mentoring, a strat-

egy not reflected in earlier school-based interventions. The success of the interventions that used peer mentorship as a pedagogic strategy suggests that this may be a best practice for future intervention research focusing on Indigenous children.

A number of studies had control arms that received the intervention at staggered times, but the search identified only 1 randomized controlled trial (DREAM3) (53). Ronsley et al (42) state that an RCT would not have been acceptable to the community because of the longstanding relationship that had been established between the researchers and the community. However, although an RCT was evidently unacceptable in the case of Ronsley et al, RCTs may be appropriate in some contexts. As Saini and Quinn (20) note in a systematic review of RCTs in Indigenous contexts, “not including these communities in effectiveness-based interventions to assess health outcomes limits the transferability of knowledge gained from these studies and further marginalizes Aboriginal communities from the knowledge regarding the benefits and limitations of health-based interventions” (pg. 7). Indeed, the authors of several interventions included in our review indicated that they hoped to implement modified versions of their interventions as RCTs in the future. Furthermore, BRAID (Believing we can Reduce Aboriginal Incidence of Diabetes)-Kids (45) was originally designed as an RCT, but this never materialized. Nevertheless, Toth reports that the community members were open to the idea of an RCT because they understood that an RCT would offer the best means of identifying whether the outcomes measured were indeed results of the intervention. Rather, the failure to develop an RCT, and the overall limited success of the intervention in its final form, was attributed to barriers such as high turnover of necessary staff in local schools and other crises in the community. As Toth found with BRAID-Kids, conventional research methodologies such as RCTs may be ill-equipped to cope with the larger context of marginalization and oppression that Indigenous communities continue to confront. Although excluding Indigenous communities from effectiveness-based interventions serves to perpetuate their marginalization, addressing the larger forces of oppression is a prior imperative.

Interventions, such as BRAID-Kids, indicate that evaluative health interventions, including RCTs, encounter particular problems in many Indigenous communities. As Toth notes, multiple complex social problems and more immediate needs in many Indigenous communities mean limited local energies can be devoted to interventions, so spending these energies in evaluation may detract from the success of the programs. Moreover, Ronsley et al (42) note that they were able to implement their intervention only due to a longstanding relationship with the 3 intervention communities and that it would not have been possible to appoint 1 of these communities as a control group because they all wanted to benefit from the intervention. This is a difficult balance because evaluation is generally perceived as a way to increase the chances of scale-up and sustained resource inputs from political decision makers. Mead et al (51) struggled with high staff turnover in the remote northern communities in which they implemented Healthy Foods North and with logistic barriers to stocking the local store with healthful food. Staff turnover was also a challenge for Naylor et al (44), whereas storage of dairy products at remote schools consisting entirely of portables was a challenge for Gates (39) and her colleagues.

With the exception of Oster et al, (46), all the interventions we identified made explicit reference to the historical and social context of discrimination and colonization that implicate Indigenous health-care, and they used participatory research methodologies as part of their study designs. These included Indigenous communities as key players at all stages of the interventions, from design to evaluation. In some cases (e.g. Ronsley et al [42]), the community had themselves requested the involvement of researchers in response to a perceived local need. The studies reviewed suggest that community-based participatory research is a necessary compo-

ment for effective interventions and that this is now standard practice for intervention studies of diabetes among Indigenous peoples. Nevertheless, in focusing on evaluated interventions, our inclusion criteria may have failed to capture some important non-evaluated interventions. Our findings indicate that more interventions focused on achieving dietary changes as opposed to physical activity and fitness. The majority of the interventions have focused on improving diet through greater knowledge about healthful eating and, to a lesser extent, by augmenting the availability of healthful foods. However, the few studies that improved physical activity and fitness were among those with the most significant improvements in health postintervention (42–44,48). Moreover, the only intervention (48) that focused exclusively on physical activity and fitness found significant improvements in overall health for nearly all of their measured indicators, especially among participants who were in the poorest health at baseline. Although this represents only 1 intervention, the encouraging results of this physical activity-focused intervention may indicate that physical activity is a fruitful focus for future disease-focused interventions.

The interventions reviewed suffer from a number of limitations, the most significant of which is the absence of a control group in all but 4 of the studies. Moreover, although school-based initiatives aimed at peer mentoring met with some success, focusing on changing children's eating habits does little to address the underlying issues of food access and availability in Indigenous communities, thus reflecting a very superficial and depoliticized approach to ensuring that nutritious foods are available to Indigenous children. Some of the interventions in our study were very fairly short term—in one case only 1 week long—and 4 studies were limited by small sample size. Longer-term interventions with larger cohorts of participants would better inform best practices for future interventions targeting diabetes and chronic disease among Indigenous peoples in Canada.

Overall, the vast majority of intervention research we examined looked to change personal lifestyle choices, such as enhancing nutrition knowledge in order to enable healthful eating choices. This should continue, but we feel it was out of proportion to the need for improvements in healthcare delivery and the socially constructed determinants of health. For health research to make long-term and significant inroads into Indigenous health inequality, social inequality must also improve. This will entail accepting that colonialism, racism and social exclusion are themselves fundamental, ongoing social determinants of health. As Czyzewski (58) states:

Colonialism is the guiding force that manipulated the historic, political, social, and economic contexts shaping Indigenous/state/non-Indigenous relations and account for the public erasure of political and economic marginalization, and racism today. These combined components shape the health of Indigenous peoples. At the intermediate level, this occurs via the funding and organization of the health care, education, and labour systems; as well as the extent to which Indigenous peoples can operate their environmental stewardship and maintain cultural continuity. Along with these intermediate determinants, proximal determinants are also subsumed under this larger structural reality: that the root of these determinants is colonial relations; relations that have produced and reproduce unfavourable conditions and environments (p. 4).

Thus, Indigenous health research that fails to recognize and address how these root causes shape Indigenous health will fail to achieve Indigenous health equity and may also reproduce health inequity for Indigenous peoples. Indeed, health institutions, programs or services that fail to promote Indigenous health equity may serve to perpetuate ongoing disparities between the well-being of Indigenous peoples and other Canadians, rendering them tools of oppression rather than wellness.

Conclusion

More diabetes intervention research in Indigenous communities is strongly recommended. We believe that the lack of research into diabetes and obesity-related chronic disease in Indigenous communities in Canada is wholly insufficient and fails to reflect the need for reducing the gross inequality that exists between Indigenous and non-Indigenous Canadians. In particular, off-reserve First Nations, Métis and Inuit communities have been overlooked in the diabetes and obesity-focused interventions we examined. Although the successes in the research that worked with children should continue, further research to improve outcomes for adults is also needed.

We also recommend the continuation of intervention research that works with communities as equal partners who are able to take ownership by engaging in and undertaking research on their own terms. For example, we identified peer mentorship as 1 possible expression of enhanced control and ownership of health at the community level. Indigenous control and ownership must remain a priority to advance intervention research and working with communities to harness their strengths may offer additional support to overcome the challenges alluded to previously.

The interventions included in our review focused on behavioural and lifestyle modifications. These interventions are thus insufficiently attentive to the relationship between social inequality, ongoing colonialism, social determinants of health and poor health delivery in many Indigenous communities. These areas must also be addressed in the interest of effectively addressing Indigenous health inequality. Therefore, we recommend that intervention research take an approach that is historically deep and sufficiently broad to enable the ideologic, policy and institutional changes necessary to achieve true equity.

Limitations

The small number of studies in our review implies that our findings and recommendations are intended to be exploratory. Given the need to improve the rates and impact of diabetes in Indigenous communities, we hope our discussion and recommendations promote conversation and engagement among health researchers and communities about how to expand and improve diabetes and chronic-disease research. Despite our use of multiple search engines, it is possible that our search terms failed to capture all studies that would have fulfilled our selection criteria. Moreover, some intervention studies may not have been published, and many community-level activities and interventions may be effective yet are never documented online. Researchers are less likely to publish studies with poor outcomes, which may suggest that interventions have achieved less than the moderate success indicated (35). Finally, although we have aimed to carry out this study in a manner that acknowledges and attends to the historical and contemporary context of marginalization, racism and colonialism faced by Indigenous communities, the colonial heritage of health research and practice in Canada may be impossible to entirely supersede within the confines of contemporary intervention research. We recognize that our efforts in this regard are likely incomplete.

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Table 1
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Author Contributions

KR collected the data, contributed to data analysis, drafted portions of the text, revised it critically for intellectual content and gave

final approval of the version to be published; BT, MZ, BL, DEB and SH contributed to data analysis, drafted portions of the text, revised it critically for intellectual content and gave final approval of the version to be published.

Appendix: 1

Summary of interventions

Title	Study type	Location	Duration	Participants	Intervention	Outcome	Limitations
Dreger LC, Mackenzie C, McLeod B. Feasibility of a mindfulness-based intervention for Aboriginal adults with type 2 diabetes. <i>Mindfulness</i> 2013;4:264-80	Quasi-experimental pre/post intervention	Manitoba (urban and rural sites)	3 separate 8-week sessions	18+, self-identified as Aboriginal, type 2 diabetes, no substance abuse, suicidal ideation or active psychosis	2 two-hour-long weekly mindfulness meditation sessions, instruction to practice mindfulness at home for 20–30 min/day, 5 days/week	Significant improvement in blood sugar regulation Significant improvement in emotional well-being Participants liked program	Small sample size, low numbers of male participants Medications were not monitored; some participants may have been taking medications that influenced the results No control group
Eskicioglu P, Halas J, Sénéchal M, Wood L, McKay E, Villeneuve S, Shen GX, Dean H, McGavock JM. Peer Mentoring for type 2 diabetes prevention in First Nations children. <i>Pediatrics</i> 2014;133:e1624-31 Eskicioglu P, Halas J, Villeneuve S, Monias C, McKay E, Wood L, McGavock J. The Aboriginal Youth Mentorship Program (AYMP): A peer-led healthy living after-school program for achieving healthy weights in First Nations children living in a northern remote setting. <i>Abstracts/Can J Diabetes</i> 2013;73:S217-89	Pre/post evaluation with control arm	Remote: northern Manitoba	5-month intervention, offered twice	237 grade 4 students	Weekly 90-minute peer-led after-school program for grade 4 students, led by volunteer peer-mentors grades 7–12 Included healthful snack, physical activity, and an educational game	Significant decrease in WC and zBMI in intervention arm Significant improvement in knowledge of healthful eating and self-esteem in intervention arm	Risk of selection bias due to self-selection to the intervention Study arms differed in age at baseline Ratio of female-to-male participants in intervention arm was 3:1, while the ratio was 1:1 in the control arm Risk of carry-over of students who received the intervention into the control arm in year 2
Foulds HJA, Bredin SSD, Warburton DER. The effectiveness of community-based physical activity interventions with Aboriginal peoples. <i>Preve Med</i> 2011;53:411-6	Non-randomized pre/post evaluation	21 Indigenous communities in British Columbia (urban, rural, on and off-reserve)	13 week session, offered annually 2007–2010	5925 people age 18–75, at risk for cardiovascular disease. 273 pre and post-screening sessions	Weekly group training plus 2 weekly personal-training sessions, in preparation for the 10 km Vancouver Sun Run Participants trained to walk, walk and run, or run Trainers were Indigenous	Significant improvements in WC, significant improvements in cholesterol in females, improved physical activity scores	Self-selected participants, no control group
Gates M, Hanning RM, Gates A, Isogai A, Tsuji LJS, Metatawabin JA. Pilot comprehensive school nutrition program improves knowledge and intentions for intake of milk and milk alternatives among youth in a remote First Nation. <i>J Nutr Educ Behav</i> 2013;45:455-9	Pilot pre/post evaluation	Fly-in remote reserve on James Bay	5 weeks	Kindergart-en to grade 12 school children	School-based program focused on milk and milk alternatives, taught by visiting university students; each class received one 30-minute class on nutrition Healthful breakfasts and snacks were provided	Significant improvement in knowledge about milk and milk alternatives, and intentions to consume in the future	Short duration, difficult to establish cause and effect without control group.
Gates M, Hanning RM, Gates A, McCarthy DD, Tsuhi LJS. Assessing the Impact of pilot school snack programs on milk and alternatives intake in northern Ontario, Canada. <i>J School Health</i> 2013;83:69–76	Pilot pre/post evaluation	2 remote, isolated communities on James Bay, Ontario	1 school year	Schoolchildren grades 6–8	A daily school snack program was initiated in 1 community In the other, milk and alternatives were added to an existing school snack program Snacks consisted of one fruit or vegetable item and 1 milk or milk alternative item The research team facilitated the program for 1 week, and collected data both at baseline and after 1 week The program was then handed over to a local volunteer Research team returned to collect data after 1 year	Community 1: short-term increase in consumption of milk and alternatives, no long-term Community 2: Significant improvement in consumption in short and long term.	Data collected after 1 week, with follow-up after 1 year. Small sample size, no control group.

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Appendix (continued)

Title	Study type	Location	Duration	Participants	Intervention	Outcome	Limitations
Ho LA, Gittelsohn J, Rimal R, Treuth MA, Sharma S, Rosecrans A, Harris SB. An integrated multi-institutional diabetes prevention program improves knowledge and healthy food acquisition in Northwestern Ontario First Nations. <i>Health Educ Behav</i> 2008;35:561-73	Quasi-experimental pretest/post-test evaluation	4 communities (2 remote, 2 semiremote) in Northwestern Ontario 2 sites received the intervention in the first year, and the other 2 in the second year	9 months	Randomly selected adults	Multi-institutional program with school, store and community components	Greater acquisition of healthful food following intervention Greater knowledge of healthful lifestyles following interventions	Relatively short time period for such extensive intervention Components not well integrated Communities were not randomly assigned, no control group
Mead EL, Gittelsohn J, Roache C, Corriveau A, Sharma S. A community-based, environmental chronic disease prevention intervention to improve healthy eating, psychosocial factors and the behaviors in Indigenous populations in the Canadian arctic. <i>Health Educ Behav</i> 2012;40:592–602	Quasi-experimental pre/post-evaluation	3 Inuit and 3 Inuvialuit intervention communities in Nunavut and the Northwest Territories, all above the Arctic circle. One additional Inuit and 1 additional Inuvialuit community received a delayed intervention, and served as a comparison Communities ranged from 800 to 3500 residents.	12 months	246 (intervention communities) and 133 (comparison communities) randomly-selected adults who were not breastfeeding and were long-term residents of these communities	7 phases (tea/coffee/healthful breakfast; healthy snacks; healthy home eating/traditional foods; healthy beverages; healthier cooking/meal planning; consuming sufficient vitamins and minerals) Stocked local store with healthier items, offering tastings and cooking demonstrations, and point-of-purchase advertising of healthy foods Worked with local community to identify local ways of being active Radio and television media, community-wide activities in red centres, schools, and so forth Activities included taste tests, community feasts, walking clubs, pedometer challenges and cooking classes	Intervention communities showed significant improvements in food-related self-efficacy and intentions but not with healthy food acquisition frequency. Greatest improvements were seen in overweight and obese participants, and participants of with high socioeconomic status	No follow-up after the intervention ended, therefore unable to determine whether the intervention had any lasting effect Low numbers of male participants.
Kakekagumick KA, Naqshbandi Hayward M, Harris S, Saksvig B, Gittelsohn J, Manokeesic G, Goodman S, Hanley AJ. Sandy Lake Health and Diabetes Project: A community-based intervention targeting type 2 diabetes and its risk factors in a First Nations community. <i>Front Endocrinol</i> 2013;4:1–9	Review of interventions over 22 years, including 2 pre/post-test evaluations	Sandy Lake First Nation (remote, fly-in community in Sub-Arctic Ontario)	22 years (many different phases): Phase 1 (Formative research studies): 1991–1996 Phase 2 (Community baseline survey, Northern Store Program): 1993–1995 Phase 3 (Home visit program, launch of radio show and school curriculum): 1996–1997 Phase 4 (School program evaluation 1): 1998–1999 Phase 5: (School program evaluation 2) 2005–2006 Community walking trail	Children in grade 3 and 4 were evaluated at the end of the school year in 3 consecutive years.	Component of the Sandy Lake Health and Diabetes Project (SLHDP). Intervention included a radio show, a Northern Store program, a home visit program, a diabetes radio show, a community walking trail, promotional activities such as distribution of pamphlets, and a school-based diabetes curriculum All program components aimed to encourage physical activity and healthy lifestyle promotion The program explicitly aims to encourage culturally appropriate activities and lifestyles	Improvement in self-efficacy and health knowledge, increase in milk consumption and decrease in sugar consumption	Limitations of the various stages of the intervention are unclear.

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Appendix (continued)

Title	Study type	Location	Duration	Participants	Intervention	Outcome	Limitations
Oster RT, Shade S, Strong D, Toth EL. Improvements in indicators of diabetes-related health among First Nations individuals enrolled in a community-driven diabetes complications mobile screening program in Alberta, Canada. <i>Revue Canadienne de Santé Publique</i> 2010;101:410–4	Pre/post screening of diabetes-related health indicators	43 on-reserve communities in Alberta	Biannual visits between 2001 and 2007	People aged 9 to 84 who were diagnosed with diabetes and who either self-enrolled in response to advertising, or were enrolled by community health workers. This comprised 64% percent of eligible Indigenous people in Alberta	2 mobile clinics staffed by healthcare personnel who were either First Nations or had Aboriginal-specific training visited local communities Local community health personnel facilitated in each community	Significant improvements in BMI, blood pressure, total cholesterol and A1C levels	With no control group, it is impossible to know whether the improvements are due to the intervention Participants self-selected Information on medications that could have impacted the findings were not reliably collected
Ronsley R, Lee AS, Kuzeljjevic B, Panagiotopoulos C. Healthy Buddies reduced body mass index score and waist circumference in Aboriginal children living in remote coast communities. <i>J School Health</i> 2013;83:605–13	Pilot pre- and postanalysis with control group	Three remote communities in coastal northern British Columbia	10 months	Students in grades K-12 at two schools, third school dropped out (naturalistic control group)	School-based program based on a BC Ministry of Education program, adapted for FN communities. Includes 3 components (physical activity, healthful eating, healthy body image) Comprises 21 lessons and 6 fitness loops Peer mentoring is central to the program	Significant decrease in zBMI, WC in intervention groups BP increased in control group but not in intervention group Linear model analysis showed significant interaction between zBMI, weight, nutritious beverage knowledge, healthy living, and self-esteem	Limited data on individual schools' adherence to the program, not an RCT
Tobe S, Vincent L, Wentworth J, Hildebrandt D, Kiss A, Perkins N, Hartman S, Ironstand L, Hoppe J, Hunter K, Pylypchuk G. Blood Pressure 2 years after a chronic disease management intervention study. <i>Int J Circumpolar Health</i> 2010;69:50–60	Prospective single-arm observational study of an RCT	All over Alberta	2 years	96 on-reserve adults (18+) with Indian status, all of whom had completed DREAM3, an RCT study of blood pressure control	Blood pressure measurements every 6 months over 2 years	Blood pressure control was maintained 2 years after the completion of DREAM3	Not all participants completed all measurements.
Tomlin D, Naylor PJ, McKay H, Zorzi A, Mitchell M, Panagiotopoulos C. The impact of Action Schools! BC on the health of Aboriginal children and youth living in rural and remote communities in British Columbia. <i>Int J Circumpolar Health</i> 2012;71:179–99	Pre-experimental pre/post design	Three remote communities in coastal northern British Columbia	7 months	All school children grades 4–12	School-based program including classroom-based healthy eating education and physical activity (150 mins per week, plus 15 extra minutes per day in-class) Includes family and community elements	WC increase, increase in variety of vegetables consumed, substantial increase in aerobic fitness Teacher evaluations of program indicate that it is feasible and appropriate for First Nations schools	Short duration, no control group.
Naylor PJ, Scott J, Drummond J, Bridgewater L, McKay HA, Panagiotopoulos C. Implementing a whole school physical activity and healthy eating model in rural and remote First Nations schools: A process evaluation of Action Schools! BC. <i>Rural Remote Health</i> 2010;10:2:1296	Pilot pre-postanalysis	1 FN community in northern Alberta	1 year	School-children	School-based diabetes and obesity prevention curriculum, tradition-based "Cree Pride" intervention for families	Fitness improved, physical activity decreased Males less active than females	Improvements in fitness drawn from 25 children, very low sample size, high turn-over of staff in the school and high number of community deaths due to addictions diverted focus from the intervention No control group

References

- Public Health Agency of Canada. Diabetes in Canada: Fact and figures from a public health perspective. Ottawa; 2011.
- Young TK, Reading J, Elias B, O'Neil JD. Type 2 diabetes mellitus in Canada's first nations: Status of an epidemic in progress. *CMAJ* 2000;163:561–6.
- Liu J, Young TK, Zinman B, et al. Lifestyle variables, non-traditional cardiovascular risk factors, and the metabolic syndrome in an Aboriginal Canadian population. *Obesity* 2006;14:500–8.
- Sharma S, Gittelsohn J, Rosol R, Beck L. Addressing the public health burden caused by the nutrition transition through the healthy foods north nutrition and lifestyle intervention program. *J Hum Nutr Diet* 2010;23(Suppl. 1):120–7.
- Kuhnlein HV, Receveur O, Soueida R, Egeland GM. Arctic indigenous peoples experience the nutrition transition with changing dietary patterns and obesity. *J Nutr* 2004;134:1447–53.
- Willows ND, Hanley AJ, Delormier T. A socioecological framework to understand weight-related issues in Aboriginal children in Canada. *Appl Physiol Nutr Metab* 2012;37:1–13.
- Egeland GM, Pacey A, Cao Z, Sobol I. Food insecurity among Inuit preschoolers: Nunavut Inuit child health survey, 2007–2008. *CMAJ* 2010;182:243–8.
- Reading CL, Wien F. Health inequalities and social determinants of Aboriginal peoples' health. Prince George, BC: National Collaborating Centre for Aboriginal Health; 2009.
- Wendel-Vos W, Droomers M, Kremers S, et al. Potential environmental determinants of physical activity in adults: A systematic review. *Obesity Rev* 2007;8:425–40.
- Joseph P, Davis AD, Miller R, et al. Contextual determinants of health behaviours in an aboriginal community in Canada: Pilot project. *BMC Pub Health* 2012;12:952–60.
- Anand SS, Davis AD, Ahmed R, et al. A family-based intervention to promote healthy lifestyles in an aboriginal community in Canada. *Can J Pub Health* 2007;8:447–52.
- Shubair MM, Tobin PK. Type 2 diabetes in the first nations population: A case example of clinical practice guidelines. *Rural Remote Health* 2010;1505.
- Andrews ME, Stewart NJ, Pitblado JR, et al. Registered nurses working alone in rural and remote Canada. *Can J Nurs Res* 2005;37:14–33.
- Kulig JC, Stewart NJ, Morgan D, et al. Aboriginal nurses' insights from a national study. *Can Nurse* 2006;102:16–20.
- Vancouver Coastal Health, 2008–2011 Aboriginal Health and Wellness Plan. 2008.
- Blackstock C. First Nations children count: Enveloping quantitative research in an Indigenous envelope. *First Peoples Child Fam Rev* 2009;4:135–43.
- Chino M, DeBruyen L. Building true capacity: Indigenous models for indigenous communities. *Am J Pub Health* 2006;96:596–9.
- Smylie J, Kaplan-Myrth N, McShane K, Metis Nation of Ontario-Ottawa Council, Pikwakanagan First Nation, Tungasuvvingat Inuit Family Resource Centre. Indigenous knowledge translation: Baseline findings in a qualitative study of pathways of health knowledge in three Indigenous communities in Canada. *Health Promot Prac* 2009;10:436–46.
- McNamara BJ, Sanson-Fisher R, D'Este C, Eades S. Type 2 diabetes in Indigenous populations: Quality of intervention research over 20 years. *Prev Med* 2011;52:3–9.
- Saini M, Quinn A. A systematic review of randomized controlled trials of health related issues within an Aboriginal context. Prince George: National Collaborating Centre for Aboriginal Health, 2013.
- Edwards K, Patchell B. State of the science: A cultural view of Native Americans and diabetes prevention. *J Cult Divers* 2009;16:32–5.
- Morris PS. Randomized control trials addressing Australian Aboriginal health needs: A systematic review of the literature. *J Pediatr Health Care* 1999;35:130–5.
- Teufel-Shone NI, Fitzgerald C, Teufel-Shone L, Gamber M. Systematic review of physical activity interventions implemented with American Indian and Alaska Native populations in the United States and Canada. *Am J Health Promot* 2009;26:S8–32.
- Huffman MD, Galloway JM. Cardiovascular health in Indigenous communities: Successful programs. *Heart Lung Circ* 2010;19:351–60.
- Evans D. Hierarchy of evidence: A framework for ranking evidence evaluating healthcare interventions. *J Clin Nurs* 2003;12:77–84.
- Narayan KM, Hoskin M, Kozak D, et al. Randomized clinical trial of lifestyle interventions in Pima Indians: A pilot study. *Diabetic Med* 1998;15:660–72.
- Macaulay AC, Cargo M, Bisset S, et al. Community empowerment of the primary prevention of type 2 diabetes: Kanien'kehka:ka (Mohawk) ways for the Kahnawake schools diabetes prevention project. In: Ferreira ML, Lang GC, editors. Indigenous peoples and diabetes: Community empowerment and wellness. Durham: Carolina Academic Press, 2006. pg. 407–58.
- Paradis G, Levesque L, Macaulay AC, et al. Impact of a diabetes prevention program on body size, physical activity, and diet among Kanien'kehka:ka (Mohawk) children 6 to 11 years old: 8-year results of the Kahnawake schools diabetes prevention project. *Pediatrics* 2005;111:333–9.
- Macaulay AC, Paradis H, Potvin L, et al. The Kahnawake schools diabetes prevention project: Intervention, evaluation, and baseline results of a diabetes primary prevention program with a Native community in Canada. *Prev Med* 1997;26:779–90.
- Potvin K, Cargo M, McComber AM, et al. Implementing participatory intervention and research in communities: Lessons from the Kahnawake schools diabetes prevention project in Canada. *Soc Sci Med* 2003;56:1295–305.
- Saksvig BI, Gittelsohn J, Harris SB, et al. A pilot school-based healthy eating and physical activity intervention improves diet, food knowledge, and self-efficacy for Native Canadian children. *J Nutr* 2005;135:2392–8.
- Hanley AJG, Harris SB, Gittelsohn J, et al. The Sandy Lake Health and Diabetes Project: Design, methods and lessons learned. *Chron Dis Canada* 1995;16:149–56.
- Stock S, Miranda C, Evans S, et al. Healthy buddies: A novel, peer-led health promotion program for the prevention of obesity and eating disorders in children in elementary school. *Pediatrics* 2007;120:e1059–68.
- Davis SM, Going SB, Helitzer DL, et al. Pathways: A culturally appropriate obesity-prevention program for American Indian schoolchildren. *Am J Clin Nutr* 1999;69:796S–802S.
- Curran D, Gittelsohn J, Anliker J, et al. Process evaluation of a store-based environmental obesity intervention on two American Indian Reservations. *Health Educ Res* 2005;20:719–29.
- Gittelsohn J, Anliker J, Ethelbach B, et al. A food store intervention to reduce obesity in two American Indian communities: Impact on food choices and psychosocial indicators. *FASEB J* 2005;19(Suppl):AS94.11.
- Eskicioglu P, Halas J, Sénéchal M, et al. Peer mentoring for type 2 diabetes prevention in First Nations children. *Pediatrics* 2014;133:e1624–31.
- Eskicioglu P, Halas J, Villeneuve S, et al. The Aboriginal Youth Mentorship Program (AYMP): A peer-led healthy living after-school program for achieving healthy weights in First Nations children living in a northern remote setting. *Can J Diabetes* 2013;73:S217–89.
- Gates M, Hanning RM, Gates A, et al. A pilot comprehensive school nutrition program improves knowledge and intentions for intake of milk and milk alternatives among youth in a remote first nation. *J Nutr Educ Behav* 2013;45:455–9.
- Gates M, Hanning RM, Gates A, et al. Assessing the impact of pilot school snack programs on milk and alternatives intake in Northern Ontario, Canada. *J School Health* 2013;83:69–76.
- Kakekagumick KA, Naqshbandi Hayward M, Harris SB, et al. Sandy lake health and diabetes project: A community-based intervention targeting type 2 diabetes and its risk factors in a First Nations community. *Front Neuroendocrinol* 2013;4:1–9.
- Ronsley R, Lee AS, Kuzeljevic B, Panagiotopoulos C. Healthy buddies reduced body mass index score and waist circumference in aboriginal children living in remote coast communities. *J School Health* 2013;83:605–13.
- Tomlin D, Naylor PJ, McKay H, et al. The impact of action schools! BC on the health of Aboriginal children and youth living in rural and remote communities in British Columbia. *Int J Circumpolar Health* 2012;71:179–99.
- Naylor PJ, Scott J, Drummond J, Panagiotopoulos C. Implementing a whole-school physical activity and healthy eating model in rural and remote first nations schools: A process evaluation of action schools! BC. *Rural Remote Health* 2010;10:1296.
- Toth E. Early trend towards improving fitness amongst children: A final project report to the Alberta Centre for Child, Family, and Community Research, 2012.
- Oster RT, Shade S, Strong D, Toth EL. Improvements in indicators of diabetes-related health among first nations individuals enrolled in a community-driven diabetes complications mobile screening program in Alberta, Canada. *Rev Can Santé Pub* 2010;101:410–14.
- Dreger LC, Mackenzie C, McLeod B. Feasibility of a mindfulness-based intervention for Aboriginal adults with type 2 diabetes. *Mindfulness* 2013;4:264–80.
- Foulds HJA, Bredin SSD, Warburton DER. The effectiveness of community-based physical activity interventions with Aboriginal peoples. *Prev Med* 2011;53:411–16.
- Ho LA, Gittelsohn J, Rimal R, et al. An integrated multi-institutional diabetes prevention program improves knowledge and healthy food acquisition in North-western Ontario first nations. *Health Educ Behav* 2008;35:561–73.
- Rosecrans AM, Gittelsohn K, Ho LS, et al. Process evaluation of a multi-institutional community-based program for diabetes prevention among first nations. *Health Educ Res* 2008;23:272–86.
- Mead EL, Gittelsohn J, Roache C, et al. A community-based, environmental chronic disease prevention intervention to improve healthy eating psychosocial factors and the behaviors in indigenous populations in the Canadian arctic. *Health Educ Behav* 2012;40:592–602.
- Sharma A, Gittelsohn J, Rosol R, Beck L. Addressing the public health burden caused by the nutrition transition through the healthy foods north nutrition and lifestyle intervention program. *J Hum Nutr Diet* 2010;23(Suppl. 1):120–7.
- Tobe S, Vincent L, Wentworth J, et al. Blood pressure 2 years after a chronic disease management intervention study. *Int J Circumpolar Health* 2010;69:50–60.
- McGibbons EA. Oppression: A social determinant of health. Black Point: Fernwood Publishing, 2012.
- Rimal RN. Closing the knowledge-behaviour gap in health promotion: The mediating role of self-efficacy. *Health Com* 2000;12:219–37.
- Jagosh J, Maccaulay AC, Pluye P, et al. Uncovering the benefits of participatory research: Implications of a realist review for health research and practice. *Milbank Q* 2012;90:1–41.
- Cargo M, Mercer SL. The value and challenge of participatory research: Strengthening its practice. *Annu Rev Public Health* 2008;29:325–50.
- Czyzweski K. Colonialism as a broader social determinant of health. *Int Indigenous Policy J* 2011;2:1–14.