



Review article

Understanding the role of Indigenous community participation in Indigenous prenatal and infant-toddler health promotion programs in Canada: A realist review



Janet Smylie ^{a, b, c, *}, Maritt Kirst ^d, Kelly McShane ^e, Michelle Firestone ^f, Sara Wolfe ^{g, h}, Patricia O'Campo ^{i, b}

^a Well Living House Action Research Centre for Indigenous Infant, Child and Family Health and Wellbeing, Centre for Research on Inner City Health, Department of Family and Community Medicine, St. Michael's Hospital, Toronto, Canada

^b Dalla Lana School of Public Health, University of Toronto, Canada

^c CIHR Applied Public Health Research Chair in Indigenous Health Knowledge and Information, Canada

^d Institute of Health Policy, Management and Evaluation, University of Toronto, Canada

^e Department of Psychology, Ryerson University, Canada

^f Well Living House Action Research Centre for Indigenous Infant, Child and Family Health and Wellbeing, Centre for Research on Inner City Health, St. Michael's Hospital, Toronto, Canada

^g Seventh Generation Midwives Toronto, Canada

^h Well Living House Action Research Centre for Indigenous Infant, Child and Family Health and Wellbeing, St. Michael's Hospital, Toronto, Canada

ⁱ Centre for Research on Inner City Health, St. Michael's Hospital, Canada

ARTICLE INFO

Article history:

Received 28 June 2015

Received in revised form

8 December 2015

Accepted 13 December 2015

Available online 18 December 2015

Keywords:

Indigenous

Prenatal health promotion

Child health promotion

Program evaluation

Realist review

ABSTRACT

Purpose: Striking disparities in Indigenous maternal-child health outcomes persist in relatively affluent nations such as Canada, despite significant health promotion investments. The aims of this review were two-fold: 1. To identify Indigenous prenatal and infant-toddler health promotion programs in Canada that demonstrate positive impacts on prenatal or child health outcomes. 2. To understand how, why, for which outcomes, and in what contexts Indigenous prenatal and infant-toddler health promotion programs in Canada positively impact Indigenous health and wellbeing.

Methods: We systematically searched computerized databases and identified non-indexed reports using key informants. Included literature evaluated a prenatal or child health promoting program intervention in an Indigenous population in Canada. We used realist methods to investigate how, for whom, and in what circumstances programs worked. We developed and appraised the evidence for a middle range theory of Indigenous community investment-ownership-activation as an explanation for program success.

Findings: Seventeen articles and six reports describing twenty programs met final inclusion criteria. Program evidence of local Indigenous community investment, community perception of the program as intrinsic (mechanism of community ownership) and high levels of sustained community participation and leadership (community activation) was linked to positive program change across a diverse range of outcomes including: birth outcomes; access to pre- and postnatal care; prenatal street drug use; breastfeeding; dental health; infant nutrition; child development; and child exposure to Indigenous languages and culture.

Conclusions: These findings demonstrate Indigenous community investment-ownership-activation as an important pathway for success in Indigenous prenatal and infant-toddler health programs.

© 2015 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

As a relatively affluent country, Canada is well positioned to respond to the striking health inequities experienced by its growing population of Indigenous infants and children (Postl et al., 2010;

* Corresponding author. Centre for Research on Inner City Health, St. Michael's Hospital, 30 Bond Street, Toronto, ON, M5B 1W8, Canada.

E-mail address: janet.smylie@utoronto.ca (J. Smylie).

Smylie, 2014; Unicef, 2009). Investments in prenatal and infant-toddler health promoting programs have been demonstrated to improve maternal, infant and child health outcomes (Anderson et al., 2003; Chung et al., 2008; World Health Organization, 2014), some even when they are rooted in population specific disparities in the social determinants of health (Anderson et al., 2003; Dyson et al., 2014) which is certainly the case for Indigenous children in Canada (Anderson et al., 2003; Dyson et al., 2014; Findlay and Janz, 2012; Loppie Reading and Wien, 2009; McNeil et al., 2009). Numerous Indigenous specific and mainstream programs with significant Indigenous participation currently exist and are funded through investments at the federal, provincial/territorial, and municipal levels (Aboriginal Affairs and Northern Development Canada, 2013a, 2013b; Human Resources and Skills Development Canada, 2010).

Despite this marked health inequity and sizeable program response, there is a gap in the literature that systematically identifies, documents and evaluates the effectiveness of Indigenous prenatal and infant-toddler health promotion programs in Canada (Health Council of Canada, 2011; McNeil et al., 2009; Smylie and Adomako, 2009). Evidence indicates that health promoting approaches effective in non-Indigenous contexts will not necessarily be effective in Indigenous contexts and point towards a need for messaging and approaches that reflect local Indigenous systems of health knowledge and practice (Health Council of Canada, 2011; McNeil et al., 2009; Tipene-Leach et al., 2010). A synthesis of the evidence regarding program effectiveness specific to Indigenous contexts is therefore urgently required. In addition to the classic review of program effectiveness, a realist inquiry into how, why and in what contexts programs are working is also extremely relevant for ongoing policy and practice.

Approaches to evidence synthesis based on realism encompass a number of features which align well with existing scholarship bridging the domains of Indigenous knowledge and public health. While Indigenous and modern public health evidence assessment share a reliance on empirical observations of outcomes, there are significant differences in Indigenous and public health knowledge systems and assumptions, which can lead to faulty underlying theory if not attended to. For example, Indigenous hypothesis testing is almost always specific to a local socio-ecologic context (Youngblood Henderson, 2000) and classic biomedical hypothesis tests purposefully seek a distancing from context in a positivist quest for generalizability. Realist approaches to evidence synthesis provide an opportunity to bridge these tensions by allowing for the explicit formulation of testable theories (Pawson et al., 2005; Wong et al., 2013a) which can be constructed in alignment with Indigenous knowledge systems and assumptions. Realist reviews involve a theory-driven approach which seeks to uncover key program mechanisms and contextual factors that are linked to program success (or failure) (Pawson et al., 2005; Wong et al., 2013a). Such an approach guards against the non-explicit application of faulty Eurocentric theory, which is a common Indigenous critique of mainstream evidence synthesis (Smith, 2012; Smylie et al., 2011).

Both Indigenous and realist knowledge theorists describe a complex and inter-related reality, of which humans impartially know and describe – but with focus and rigour can come to know and describe better (Battiste and Youngblood Henderson, 2000; Kirst and O'Campo, 2012). The explanatory nature of realist review was also deemed desirable by our front line Indigenous prenatal and infant-toddler health promotion program and service provider knowledge user partners as it would support successful adaptation of best practices to local settings.

Adequate and appropriate Indigenous community engagement and participation has emerged as a policy imperative in Indigenous health research, policy, programs and services in Canada over the

past two decades. Key documents supporting this approach include the Report on the Royal Commission on Indigenous Peoples (Indian and Northern Affairs, 1996), the Health Commission of Canada Report “Understanding and Improving Indigenous Maternal and Child Health in Canada” (Health Council of Canada, 2011), the United Nations Declaration on the Rights of Indigenous Peoples (United Nations, 2008) and the updated Tri-Council Research Guidelines (Canadian Institutes of Health Research, 2010). Participatory research approaches are recommended to support Indigenous community research engagement in the Tri-Council Research Guidelines (Green et al., 1995; Macaulay et al., 1999). In a realist review of participatory research partnerships with high levels of shared decision making that included a significant number of academic-research partnerships with Indigenous communities, Jagosh et al. identified multiple benefits of participatory research (Jagosh et al., 2012). Drawing on this body of evidence, Indigenous community engagement and program participation emerges as an important part of our study method, as well as an element for consideration in our realist synthesis.

The aims of this study were two-fold. In order to bridge pressing practical gaps in existing evidence, our first aim was simply to identify Indigenous prenatal and infant toddler health promotion programs in Canada that demonstrate positive impacts on prenatal, infant or toddler health outcomes (Study Aim 1). Our second aim was to understand how, why, for which outcomes, and in what contexts do Indigenous prenatal and infant toddler health promotion programs in Canada positively impact Indigenous health and wellbeing using realist methods (Study Aim 2).

2. Methods

2.1. Overview

This study was initiated as part of an Indigenous knowledge network focused on enhancing public health and Indigenous knowledge sharing regarding Indigenous infant, child and family health between academic researchers, policy makers, program managers and front line practitioners. A key network activity was to conduct an international review of Indigenous parenting and infant-toddler health promotion programs in Australia, Canada, Hawaii, New Zealand, and the United States. The Indigenous knowledge network approach was participatory and facilitated the active involvement of front-line Indigenous health service and program providers in the formulation and refinement of the study research questions and hypotheses; inclusion/exclusion criteria; and literature appraisal and interpretation. We created country specific review teams for Australia, Canada, Hawaii, New Zealand and the United States, which were led by health researchers who were Indigenous to and/or residing in the country, in order to optimize context relevant interpretations, given the global diversity of Indigenous experiences and systems. This paper reports on the results of the Canadian study.

The study protocol was reviewed and approved by the St. Michael's Hospital Research Ethics Board, Toronto, Canada.

2.2. Preliminary literature search and realist theory development

Our larger international inquiry regarding Indigenous parenting and infant-toddler health promotion programs in Australia, Canada, Hawaii, New Zealand and the United States involved two searches of the published literature conducted in 2010, respectively focused on culture-based Indigenous parenting programs and Indigenous prenatal, infant, and toddler health promotion programs. In both searches, we included articles that evaluated a program or intervention in an Indigenous population and systematically screened

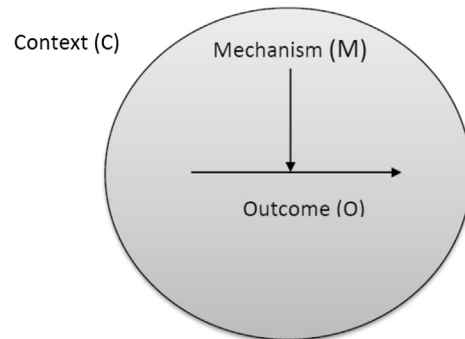
abstracts according to pre-defined inclusion criteria (available upon request). We then sorted included abstracts by geographic location of Indigenous populations and distributed retrieved articles grouped by geographies to the members of our international team most familiar with the specific domestic Indigenous context for more in-depth review. The authors of the study described in this paper comprised the Canadian review team.

Realist methods (Study Aim 2) are complex and detailed methodologic overview is beyond the scope of this article and can be found elsewhere (Pawson, 2006; Wong et al., 2013a, 2013b). Very briefly, realist reviews start with one or more preliminary theories regarding the mechanisms that drive program outcomes. Mechanisms are portrayed as the underlying processes that link program elements and activities to specific program outcomes within particular context and drive program success, changes in provider beliefs, or organizational culture (Pawson, 2006; Wong et al., 2013b). Evidence appraisal is focused on determining whether or not there is support for these initial mechanistic theories and in what contexts. Based on the evidence, preliminary theories are revised as necessary during data extraction and synthesis.

The Canadian review team started preliminary theory development using 13 articles identified by the international literature search that described culture-based parenting programs and interventions in Indigenous populations in Canadian and continental US/Alaska (References available upon request).

We began searching for potential underlying program mechanisms that could explain positive program outcomes. Initially this yielded several recurrent strategies, which are typically much more explicitly described and readily identifiable in program descriptions compared to mechanisms, which are commonly unseen as they relate to participant reasoning and beliefs and therefore need to be inferred (Wong et al., 2013b). Identified strategies included: community-based program governance and/or management; integration of program with local community infrastructure; program content and processes that reflect local community knowledge, skills, beliefs, and values; local community capacity building; and the endorsement of the program by key community stakeholders; protection and promotion of Indigenous ways of knowing and being; and the revitalization of Indigenous knowledge and kinship systems. We repeated this search using publications describing prenatal and infant-toddler health promotion programs in Canada (Chamberlain et al., 1998; Pennell and Burford, 2000; Anand et al., 2007; Kovesi et al., 2009; Lawrence et al., 2008; Gray-Donald et al., 2000; Harrison and White, 1997; Harrison et al., 2006; Banks, 2003; Macnab et al., 2008; Martens, 1999; Sawchuck et al., 1996; Verrall et al., 2006; Lawrence et al., 2004; Schroth et al., 2005; Marshall et al., 2005) and found very similar strategies.

We found that the identified strategies cut across diverse parental, child, and community level outcome groupings (i.e. specific child health outcomes, maternal health, parenting, community program participation). This is consistent with the view from Indigenous health knowledge systems and scholarship that there is an interconnection between individual, family and community level health processes and outcomes. This led to the development of an Indigenous realist framework. We superimposed the classic realist context – mechanism – outcome (CMO) pathway (Fig. 1) on a medicine wheel, to create an Indigenous CMO heuristic (Fig. 2). This supported the conceptualization of how within a given context, mechanisms might cut across program outcomes relating to children, families, and communities. The heuristic was immediately applicable to our need to build theory that was relevant to Indigenous contexts and systems as it reflected important Indigenous knowledge assumptions regarding inter-relationships among outcomes that are not adequately represented in the classic CMO



Pawson R. and Tilley N. 1997 [2006; figure 3.1] Realist Evaluation. Thousand Oaks, CA: Sage Publications.

Fig. 1. Classic realist CMO configuration.

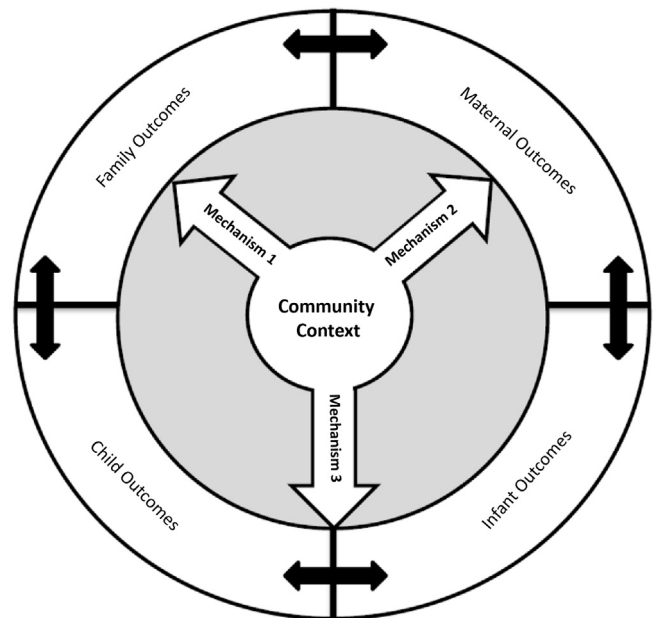


Fig. 2. Indigenous realist CMO configuration showing interrelated maternal/infant/child/family outcome groupings.

configuration (Fig. 1). Simultaneously we attempted to identify one or more potential explanatory mechanisms linked to the aforementioned strategies. We identified community leadership and participation and the core integration of local Indigenous values, beliefs, knowledge, skills, and practices as two key domains that appeared foundational to the identified strategies and also linked to health promotion program success across child, family, and community outcome groups.

We then held a two-day consultation meeting with international research team colleagues, policy makers, and service providers to review our initial evidence including identified success strategies; hypothesized underlying mechanisms; and linked program outcomes. Indigenous community leadership and participation (which we coined “community investment”), and programming that builds on and transmits Indigenous cultural knowledge and practice (which we coined “cultural integrity”) were identified as key domains to be further theorized. Building on the preliminary review of the literature, the shared results and discussions at the international meeting and the experiences of local community based Indigenous health service and program development of the Indigenous health professionals on our

Canadian research team we worked to further refine our theory and elucidate one or more specific context-mechanism-outcome pathways for these key domains, which had emerged as foundationally linked to Indigenous health program success.

The next step was to break down, document, and agree upon a set of proposed sub-processes by which “community investment” and “cultural integrity” could be achieved in an Indigenous health program. We did this by reflecting on specific exemplar Indigenous health program development processes in Canada that we were familiar with, starting with the development of an urban Indigenous midwifery practice that two team members been highly involved in and moving across contextually diverse Indigenous health program settings. We carefully deliberated on what the underlying “critical ingredient” or mechanism was, seeking a process of reasoning or belief that was generative or transformational (Jagosh et al., 2012; Wong et al., 2013b) Applying the Indigenous CMO heuristic and the findings from our preliminary literature reviews, we anticipated that within Indigenous contexts, the mechanisms linked to community investment and cultural integrity could influence multiple child, parent and community outcomes.

We started with domain of Indigenous community leadership and participation because it had been identified as foundational in both the Canadian and international literature and these preliminary reviews also suggested that there was enough evidence to pursue hypothesis testing. We defined Indigenous community investment as a contextual state in which a threshold level of personal or collective commitment and support (both attitudinal and material) to the program has been reached by Indigenous and/or allied individuals or organizations affiliated with the community in which the program is located. Drawing on the literature and our experiential knowledge of Indigenous health program and service development we operationalized the achievement of Indigenous community investment into several steps which progressively achieve individual and collective community ‘buy-in’ and participation (Textbox 1).

We hypothesized that Indigenous community investment is an essential context for the establishment of a collective understanding and valuing of the program as something that is derived from and intrinsic to local Indigenous community social systems versus something that has been more or less externally imposed. In English, this underlying mechanism could be described as the collective establishment of Indigenous community ownership – a collective sense that the program is “ours” versus “theirs”. We further hypothesized that this collective identification and valuing of the program as intrinsic to and aligned with local Indigenous ways of knowing and doing is a powerful and cross-cutting mechanism for triggering program participation across Indigenous community contexts and diverse program target health domains (Fig. 3). After centuries of historic and current colonial policies undermining Indigenous self-determination, many Indigenous peoples (both individually and collectively) have developed an acute and critical sensibility as to whether or not an intervention such as a health program has been autonomously initiated or externally imposed. Autonomously initiated activities may be perceived as acts of self-determination and decolonizing social activism, while participation in externally imposed activities may be linked with previous negative and colonizing experiences.

The foundational emergence among program participants of a belief that the program is “ours” which we termed the mechanism of Indigenous community ownership, in turn was hypothesized to trigger a sustained and high level of community program participation, which we termed Indigenous community activation (Fig. 3). In Cree, this could be conceptualized as e-miyo-mamawi-atoskamatamahk. This can be translated into English as “collectively working

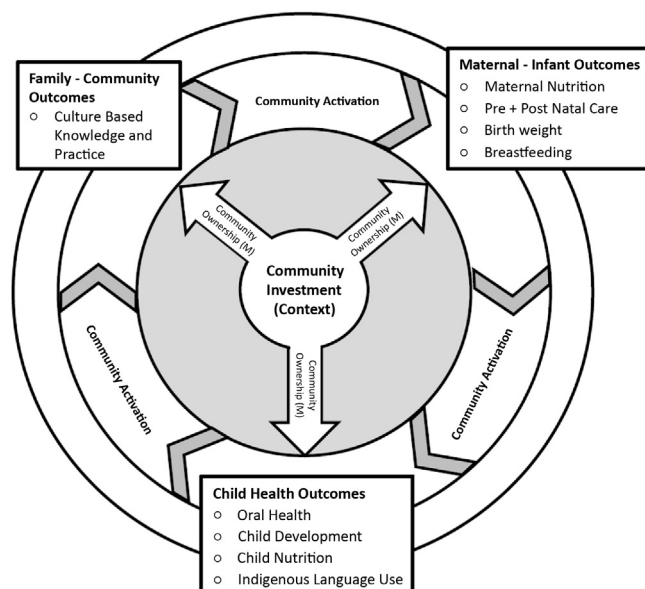


Fig. 3. Indigenous community investment (C) results in community ownership (M) in turn triggering community activation and cross-cutting outcomes (O).

together on a task in a holistically good way”. E-miyo-mamawi-atoskamatamahk is rooted in Indigenous notions of collectivity, kinship, and reciprocity in social relationships – powerful concepts that provide the foundations not only for Cree societies, but many Indigenous civilizations more broadly (MacDougall, 2010; Mcleod, 2009). Accordingly, Indigenous community activation results in cross cutting enhancements of program outcomes across diverse program target health domains and community contexts. These enhanced outcomes are the result of higher rates of participation in programs which are more relevant to participants and also more likely to motivate targeted health behaviours as a result of community investment and ownership.

In summary, the proposed CMO pathway is that when the critical context of community investment has been achieved, a belief that the program is individually and collectively “owned” (and not externally imposed) predominates, and this mechanism drives high levels of sustained community program participation and support as well as motivation to adapt targeted health behaviours. As a result, there is cross-cutting improvement across diverse program outcomes. Given the foundational Indigenous social relevance of Indigenous community investment, ownership, and activation as we defined them, we anticipated that this would be a recurrent pathway associated in a cross-cutting manner with diverse Indigenous cultural, linguistic, political, and geographic context.

Recognizing the mechanism of community ownership might be less explicitly discernible in the literature than evidence of community investment and activation, our primary hypothesis for evidence testing was that programs that have achieved a threshold of community investment will also manifest high levels of sustained community participation and linked cross-cutting improvement in program outcomes. Secondly, we would search for evidence of whether Indigenous community ownership was the critical mechanism linking community investment to sustained program participation and support. Preliminary examination revealed there was adequate information in the program descriptions in the large majority of articles and reports to test this hypothesis.

We used the same methods to refine a theory regarding “cultural integrity” that details a proposed set of linked processes that

support the foundational integration of local Indigenous values, beliefs, knowledge, skills, and practices into health programs and services, which could be a linked but discrete critical context that would result in an attitudinal synergy or resonance with existing values, beliefs, knowledge and skills, which could be a linked but discrete mechanism that also results in high levels of sustained community program participation and motivation to adapt targeted health behaviours, which in turn would result in positive changes across child, parent, and family health outcomes. The brevity of program descriptions in the literature combined with the complexity of discerning whether or not a program's underlying values, beliefs, knowledge and skills were foundationally reflective of local Indigenous worldviews and practices precluded the testing of this additional hypothesis as part of this systematic literature review.

2.3. Ongoing literature search processes

As described above, systematically searched computerized databases for published program evaluations as part of our international systematic review in June 2010. We updated our search for Canadian programs in March 2013 and January 2015. [Table 1](#) lists the included databases and original search terms are detailed in [Text Box 2](#).

In the updated search, which focused on Canadian programs, we excluded the Maori, “pacific islander” and “torres strait islander” search terms. At the time of the updated searches, we did not require any further updating of our original search terms, as they were sufficiently broad to ensure we had identified all relevant published evidence given the restricted number of indexed publications evaluating Indigenous prenatal and infant toddler health promotion programming in Canada. We did not date restrict our published literature search. To identify additional program evaluation reports that were not indexed in computerized databases, we identified at least 2 key informants in each province and territory, across relevant program funding streams and contacted them via email letter with telephone follow-up as required. While we did not quantitatively track response rates, we did ensure that at least one informant responded from each province/territory. We prioritized program reports from the past 10 years in this grey literature search.

Taking a holistic approach to infant and child outcomes, articles and program reports were included if they evaluated a prenatal or child (age six or under) health promoting program, as well as health promotion programs focused on women of childbearing age, in an

Indigenous population, and were published in English. Abstracts, and then retrieved articles and program reports, were screened by two independent reviewers using standardized screening tools which listed and defined inclusion criteria. Additional articles reporting on programs operating in Canada were identified by hand-searching included articles.

2.4. Document selection and appraisal

The relevance and rigour of each of the identified articles was evaluated using a customized quality appraisal scoring sheet that was divided into three domains: a) the local community relevance of the method and measures (criteria: did measures of success reflect local Indigenous community understandings of success?; had methods and tools been tested and validated previously in a similar Indigenous context?); b) the rigour and internal validity of the evaluation method (criteria: according to current relevant qualitative or quantitative methods standards); and c) the strength of the evidence (criteria: including adequate power and statistical significance for quantitative studies/major convincing themes, triangulation, and/or member checking for qualitative studies). Studies were critically appraised by two independent reviewers with expertise in Indigenous public health and received a rating of 0–4 for each domain based on the degree to which they were assessed to meet the criteria specified for each domain for a potential total quality appraisal score of 12. Articles scoring six or more ([Table 2](#)) were selected as relevant for both our synthesis of programs contributing to positive Indigenous prenatal/infant/toddler health outcomes (Study Aim 1) and the further refinement of our theory of Indigenous community investment-ownership-activation (Study Aim 2).

2.5. Data extraction, analysis and synthesis

Data extracted from each article and report included: program descriptions; study outcomes and results; and a systematic search of each program for evidence of Indigenous community investment-ownership-activation (Study Aim 2). Two independent reviewers systematically reviewed each program for patterns in context, mechanism and outcomes, with a specific focus on evidence of Indigenous community investment-ownership-activation across the three community investment steps of program initiation, development, implementation, and the final phase of community activation - sustained and ongoing program use ([Text Box 1](#) and [Fig. 3](#)). When there was insufficient information in the published

Table 1
Databases searched.

-
- PubMed/Medline
 - CINAHL
 - Cochrane DSR
 - Healthstar
 - PsychINFO
 - ProQuest Nursing and Allied Health source
 - American History and Life
 - ERIC
 - Social Services Abstracts
 - Sociological Abstracts
 - Sociology a Sage Full-text
 - Family Studies Abstracts
 - Social Science and Humanities Index
 - Maternity and infant care (OVID)
 - Child Care and Early Education Research Connections (OVID)
 - First Nations Periodical Index
 - Native Health Database
 - National Indigenous Studies with Portal (Iportal)
-

Table 2
Study descriptions.

Lead author or title/ location	Program name	Description of program participants (demographics, Ind id, kin lines)	Study design	Program description	Outcomes (measures and results)	Evidence of indigenous community investment (score of 3 or more across 4 stages)
Anand et al. (2007), Six Nations Reserves in Bran County, ON	No specific name but referred to as "Household based lifestyle intervention"	57 households with: male and/or female parent with at least one child living in the same household and all individuals between 5 and 70 years of age	Randomized controlled trial	3 components: dietary, provision of goods, physical activity. Included home visits by Indigenous health counsellors who assessed and set dietary/physical activity goals for each family member.	No statistically significant differences between intervention and usual care groups in household outcomes including: nutrition, physical activity, physical measures, knowledge about healthy lifestyles. Significant positive changes for intervention families: decreased consumption of fats/oils/sweets; decreased sedentary behaviours, improved child knowledge re: healthy food choices.	No
Bains et al., 2013	Healthy Foods North	Women of childbearing age (19–44 years) in six communities in Nunavik and Northwest Territories (NWT) – 3 intervention and 3 control communities	Quasi-experimental	Promotion of healthy breakfasts, healthier meal planning, and obtaining sufficient vitamins and minerals. The program was implemented in local food stores, health clinics, offices, and at community special events, such as feasts. Community media, such as radio, local television, newspapers and other community communication channels promoted program messages	Significant differences between intervention and control in vitamin A and D intake. Significant improvement in adherence to the dietary reference for vitamins A, D and K, calcium, magnesium, potassium, sodium and zinc. The program did not have a significant impact on calorie, sugar, or fat consumption.	Yes
Banks (2003), Kanesatake, ON/ QC	Ka'nistenhser Teiakotisie	Mohawk mothers who recently gave birth in Kanesatake community.	Pre-post test	Wanted to establish core group of breastfeeding women and raise community support for breastfeeding. Training a grandmother from community to discuss breastfeeding with pregnant women, she was available for free 24/7 for mothers, attended deliveries.	1995–32% babies breastfed exclusively at birth; 19% breastfed at 4 months. 2001 –75% babies breastfed for first week of life; 42% still breastfed by 4 months (increase of 43% and 23%).	Yes
Gagne et al., 2013	No specific name	Parents of children aged 1–4 years attending a childcare centre in Nunavik, Quebec	Quasi-experimental - with control group, posttest only	Four-week cycle menu of traditional and healthy store-bought foods administered in a childcare centre	Statistically significantly higher intake of omega-3 fatty acids, calcium, total iron, bioavailable iron, phosphorus, betacarotene, folate, pantothenic acid, riboflavin, and vitamin K among children attending the childcare centre during the reference period than those not attending. Higher number of children attending childcare centre met the recommended intake for total and bioavailable iron, and recommended number of servings of vegetables and fruit, grain products, and milk and alternatives than those not attending.	Yes
Gray-Donald et al. (2000), James Bay, QC (Chisasibi, Wemindji, Waswanipi, Mistissini)	No specific name, referred to as "the intervention"	Cree women using prenatal services before 26 weeks in their pregnancy from July 1995–January 1997	Quasi-experimental	Women evaluated by dietician. Nutritionists/Cree health workers led activities to promote healthy lifestyles.	General results: correlation between energy intake and weight gain; no significant differences in diet between groups Only dietary differences among intervention group - significant reduction of caffeine in pregnancy and	No

(continued on next page)

Table 2 (continued)

Lead author or title/ location	Program name	Description of program participants (demographics, Ind id, kin lines)	Study design	Program description	Outcomes (measures and results)	Evidence of indigenous community investment (score of 3 or more across 4 stages)
Harrison and White (1997), First Nations Community in B.C.	No specific name but referred to as "Infant Oral Health Promotion Campaign"	Intervention targeted mothers of infants and toddlers (i.e. Children aged 18–39 months).	Quasi- experimental	Various community projects to prevent Baby Bottle Tooth Decay (BBTD) (e.g. Cradle loan project, counselling, smokehouse); dental health of kids assessed; feedback from community taken into account for design/implementation of campaign.	increase in folate intake post partum because of intervention; birth weight similar for both groups Results not statistically significant. 1996, 78% of children in target group in project community were off the bottle by age 2 versus 63% in 1992. Only one child in evaluation group in project community was still on a bottle in 1996. Project families: nursing caries decreased rates decreased from 57 to 42%, decrease in proportion of children who slept with bottle.	Yes
Harrison et al. (2006), Hartley Bay (FN village in B.C.)	Brighter Smiles	First Nations, Large sample of parents and children aged pre- kindergarten to grade 12	Quasi- experimental	Key elements: school based daily brush-in's, weekly fluoride rinses/triannual fluoride varnish applications with incentives to participate, dental health issues (age appropriate) discussed at health clinic visits, classroom presentations on oral health	The dental hygienist informally reported noticeable improvement in oral hygiene in majority of children; significant increase in proportion of dental therapist's planned "service time" scheduled for preventive maintenance services. Significant reduction in proportion of therapist's time scheduled for extraction of primary teeth.	Yes
Harrison et al. (2012)	No specific name	Pregnant women or women who had recently given birth in 5 treatment and 4 control site communities	Cluster randomized controlled trial	Intervention group received motivational interviewing sessions on child dental care once during pregnancy and up to 6 sessions post-natally until child's second birthday; control sites received a pamphlet on child dental care practices and fluoride varnish was available to children through local clinics	No statistically significant differences in dental caries were noted between treatment and control groups. Exploratory analysis suggested that the treatment effect might be large for mothers who attended four or more motivational interviewing sessions, but a statistically significant difference in self- reported behavioural outcomes was not detected	No
Kovesi et al. (2009), Qikiqtaaluk Region, Nunavut	No specific name	Inuit children below 6 years of age	Randomized controlled trial	Heat Recovery Ventilators (HRV's) installed for winter months, released fixed dose of fresh air. Visits to community health centres for respiratory/ otitis media recorded; respiratory issues reported.	No hospitalizations during study. Intervention families: community health centre/ regional hospitalizations for lower respiratory tract infection significantly higher during non-study period, mean indoor CO ₂ -33% lower than placebo homes, mean relative humidity significantly reduced, rates of reported wheezing didn't rise, significantly reduced indoor CO ₂ , improved ventilation and reduced risk of wheezing/ rhinitis. No significant differences between groups in numbers of visits to community health centres.	No
Lawrence et al. (2004), Sioux Lookout Zone, ON	No specific name but referred to as "Prenatal Program"	Parents who participated in prenatal program and their children aged 2–5 yrs. 471 children participated.	Cross- sectional and longitudinal cohort	Oral examinations of children (assisted by community translators). Recruitment: local radio broadcasts and reminding caregiver's of appointments.	Significant impact on caregiver's knowledge, beliefs, attitudes re: infant's oral health. Caregivers (from "high intervention") did significantly better on dental knowledge	No

Table 2 (continued)

Lead author or title/ location	Program name	Description of program participants (demographics, Ind id, kin lines)	Study design	Program description	Outcomes (measures and results)	Evidence of indigenous community investment (score of 3 or more across 4 stages)
					assessment, greater proportion cleaned child's teeth at higher frequency, starting earlier (results significant in 2002), significantly lower proportion pre-chewed child's food. Dental caries remained very high in all SLZ communities (90%).	
Lawrence et al. (2008), Sioux Lookout Zone, ON	No specific name but referred to as "Flouride Varnish" Group	Children aged 6 months- 5 years, at least one primary tooth present, residing in one of FN communities in SLZ, and guardian or family member who was primary caregiver providing signed informed consent. Convenience sample- 150 non-Indigenous children.	Randomized controlled trial	Fluoride Varnish (FV) applied by dental hygienists to children (2x/yr). Oral health examination of each child. Caregivers counselled individually by dental hygienists, also received pamphlets re: FV treatments. Radio broadcasts, posters, pamphlets, health fair displays to promote project/raise ECC awareness.	18.3% reduction or (PF) in levels of ECC among FN children (vs control). Significantly reduced caries incidence by nearly two times in the overall study population. Greatest reduction for children aged 4–5 years (50.5%) and those who were caries-free at baseline (29.3%).	No
MacNab et al. (2008), Hartley Bay, B.C.	No specific name but referred to as "Oral Health Program"	26–40 children from kindergarten to grade 10 enrolled in a community school who provided signed assent, parents provided informed consent.	Pre-post test	5 components: daily school brush ins with rewards, weekly fluoride rinse, fluoride varnish applications (3x in 10 days every 4 months), dental health anticipatory guidance by pediatric residents, classroom presentations	Children assessed before/ after- significant improvement in dmfs/DMFS and dmft/DMFT. End of yr 1–41% of children- no new cavities. "Time required to treat" for restoration decreased significantly, and decreased for preventive therapy. Pediatric trainees - significant increase in insight of obstacles faced by Indigenous patients. Significant improvement in all oral health behaviours, except brushing teeth at home.	Yes
Marshall et al. (2005), Downtown Eastside Vancouver, B.C.	Sheway	For pregnant and postnatal women (up to 18 months after birth) addicted to drugs and/or alcohol. Average age mid twenties. About 60% self-identified First Nation, Inuit, Métis.	Chart review	Clients set own goals, staff introduce choices for services when client asserts problem. Interdisciplinary staff. Drop in, hot lunches, milk/food vouchers, immunizations, counselling (e.g. Addiction, nutritional).	Higher infant birth weight significantly associated with longer prenatal care and reception of food bags. Infant birth weight significantly negatively associated with maternal prenatal reports of substance use when they entered program. Recorded removals significantly associated with maternal mental illness, Hep C, HIV, drug or alcohol use, inadequate housing, and having other children in care.	No
Martens (1999), Sagkeeng First Nation,	Peer Counsellor Program (PC); Hospital Education Program (HEP); Community Breastfeeding Promotion Activities (CB)	Women who had children between November 1, 1996 –December 31, 1997 (PC); Nursing staff in Pine Falls Hospital and Arborg Hospital and mothers who gave birth 6 months before and after intervention (HEP)	Pre-post test	PC: Peer counsellor instigated contacts with mothers to offer breastfeeding support. HEP: Staff surveys and chart audits	PC: Significant breastfeeding satisfaction and duration, less problems for PC women. HEP: Intervention staff had increased breastfeeding knowledge;	Yes
Sawchuk et al. (1996), 300 miles north of Vancouver, B.C.	No specific name but referred to as "Infant Nutrition Program"	Infants aged 6–24 months born between January 1993 –August 1994 (total 37 born during this time) and 27 between September 1994 –September 1995.	Pre-post test	Parents counselled by physician/public health nurse: infant nutrition. Mothers encouraged to breast feed, iron-fortified formula sold at reduced rate. Iron deficient infants treated with ferrous sulfate drops.	Collected blood from 25/37 (68%) of infants, 52% had hemoglobin less than 100 g L. Collected blood from 24/27 (89%) of infants, only one (4.2%) had hemoglobin less than 100 g L. 1st cohort- anemia in 13 infants (35%);	No

(continued on next page)

Table 2 (continued)

Lead author or title/ location	Program name	Description of program participants (demographics, Ind id, kin lines)	Study design	Program description	Outcomes (measures and results)	Evidence of indigenous community investment (score of 3 or more across 4 stages)
Schroth et al. (2005), Garden Hill First Nation, MB	No specific name but referred to as "stosstherapy program"	First Nations on reserve residents- pregnant women and mothers of young children	Cross- sectional retrospective cohort	Mothers receive vitamin D supplementation prenatally, infants received supplement at 6 weeks. Dental examination of children, chart review to confirm if received supplementation.	2nd cohort documented anemia in less than 15%. No significant associations found between bottle feeding and duration of breastfeeding and mean deft. Mothers who didn't receive prenatal supplementation reported later eruption times than those who received it. (When "unsure" category results, became statistically significant).	No
Verrall et al. (2006), James Bay, QC	No specific name but referred to as "infant feeding project"	Cree parents of young infants, with secondary audience- parents' extended families and community members.	Pre-post test	Ten messages chosen by community circulated on posters, pamphlets, radio. Objectives: increase awareness, promote iron rich food, classes to make homemade baby food, support breastfeeding.	Statistically significant increases in the mean sales of iron-fortified foods at end of intervention. 86% reported more confidence in making their own infant food. Majority of participants indicated their intent to make infant food. Many mothers could recall a message from radio, poster or grocery store display.	Yes
Jessica Ball (2004), B.C.	Early Childhood Care and Development Program	Lil'wat Nation, Tl'azt'en Nation, six of First Nations in Treaty 8, 76 people interviewed form communities (including elders, program graduates, parents) Tribal Association	Qualitative	Two components (1) 2 yr Early Childhood and Development graduate training program (2) planning/developing child care/children's programs (e.g. AHS) to be delivered in community by grads	Four yrs after program: all grads working in child care programs within own communities, all 3 participating groups mounted child care programs. Positive changes in children: social skills, use of heritage language, improved English, larger vocab, more interest in books, attention span, school readiness	Yes
Andersson et al. (2003)	Canada Prenatal Nutrition Program	Women, youth, health providers and elders from 100 Bands across Canada	Process evaluation	Activities related to prenatal health. Could include: prenatal classes, nutrition counselling, food coupons, community cooking classes	Low participation in prenatal care and 30% did not have knowledge of prenatal services. Prenatal classes associated with reduced use of street drugs, improvement in diet and taking it easy and increased breastfeeding initiation. Mother liked: 38% learning what to expect, 24% getting food coupons, 18% learning about nutrition. Prenatal classes- 38% women attended. Nutrition Counseling- 52% women received it. 55% women received food/milk coupons during pregnancy, usually form health professional (88%). Health professionals said most effective activity offered- 30% food coupons/baskets/gifts	Yes
Health Canada (2003)	Aboriginal Head Start on Reserve	On reserve Head Start projects in 24 First Nation communities; serving children from birth to 6 years of age;	Process evaluation (mixed methods)	29–52 week, 4–5 day a week, primarily centre-based program; Six components: culture and language; education; health; nutrition; social support and parental involvement	97% of parents were satisfied with program in areas of: child social development, nutrition and healthy eating habits, and developing school readiness for the child. 80–90% of administrators, staff and community members judged the health component as successful; 74% of staff and 65% of community members	Yes

Table 2 (continued)

Lead author or title/ location	Program name	Description of program participants (demographics, Ind id, kin lines)	Study design	Program description	Outcomes (measures and results)	Evidence of indigenous community investment (score of 3 or more across 4 stages)
Highlights Report of the AHS in Urban and Northern Communities National Impact Evaluation 2003 –2005 (2008)	Aboriginal Head Start Urban and Northern Communities (AHSUNC)	Sites represented various peoples: Prince George, BC; Dauphin, MB; Val-d'Or, QC; Toronto, ON; Igloolik, NV; Alberta; Regina, SK; NF and LB; Whitehorse, YK; Ottawa, ON	Mixed methods – qualitative component and pre-post design	6 components: (1) culture and language (2) education (3) health promotion (4) nutrition (5) social support (6) parental and family involvement	judged the culture and language component as successful; 60–75% of staff and community members judged social support component to be successful; Most significant improvements on physical development and health; personal and social development domains. Changes in children's practice of Indigenous culture/ traditions, knowledge/use of Indigenous language, personal and social development, nutrition, parental involvement and social supports.	Yes
Chalmers et al., 2008 Northwest Territories	Aboriginal Head Start (AHS)	8 Northwest Territories AHS programs in Fort Smith, Hay River, Fort Providence, Bechokò, Yellowknife/Ndilo, Inuvik, Paulatuk, Fort McPherson	Quasi- experimental	Components: culture and language, education and school readiness, health promotion, nutrition, social support, parental involvement	2000-1/2003-4 Evaluation- NWT programs- good classroom quality; NWTAHS kids- significant improvement in school readiness skills. 2008 Evaluation- AHSUNC grads- maintained verbal skills, maintained level of cognitive and school readiness; no fade out effect of AHSUNC impact, stronger scores on language skills in larger urban NWT communities. NB - focus of evaluation is on mainstream child development measures	Yes
Poole (2000), Downtown Eastside, Vancouver, B.C.	Sheway	Women who are pregnant and using substances, average age- mid-20's, about 60% Indigenous, almost ¼ on social assistance, 65% had housing concerns, 79% had nutritional concerns, 78% using substances (intake)	Process evaluation	Practical services include: daily lunches, drop in, weekly food coupons, bus fare, baby stuff, outreach services. Professional services include: pre/post natal medical care, counseling (e.g. alcohol, nutrition, etc), referrals, support in developing/ improving parenting skills.	Successes: women in accessing prenatal care and wide range of other supports during pregnancy, assisted women in improving nutrition and finding adequate, stable housing during pregnancy, supported mothers in capacity as parents/caregivers	No

literature or report, attempts were made to contact the program leadership (ie. executive director). Data were extracted using a standardized form which scored each program according to whether or not each of the four steps were clearly present (1 point), maybe present (0.5 points) or partially present (0 points) and then entered onto an Excel spreadsheet. Community investment-ownership-activation was deemed present for scores of 3 or more and not present for scores of 2 or less. In cases where scoring differed between reviewers, a face to face meeting was held to achieve consensus.

3. Results

The original international literature search yielded 4018 published abstracts, from which 66 full text articles were retrieved and reviewed for inclusion. Search updates at the beginning of 2013 and 2015 resulted in an additional 3 and 4 full text articles respectively

that were retrieved and reviewed for study inclusion. Our grey literature search identified 38 program reports which were also retrieved and reviewed. Of these, 17 articles and 6 program reports describing 20 programs met both study inclusion and quality appraisal criteria (Fig. 4, Table 2).

3.1. Study Aim 1: indigenous prenatal and infant toddler health promotion programs in Canada that demonstrate positive impacts on prenatal, infant or toddler health outcomes

Table 2 summarizes the included studies with respect to program content areas, program descriptions, evaluation methods, and study outcomes. Overall there were a relatively small number of published articles and accessible reports evaluating Indigenous prenatal and infant/toddler health promotion programs in Canada. Programs addressed a range of health issues and assessed program outcomes which were broad in scope. Outcomes included:

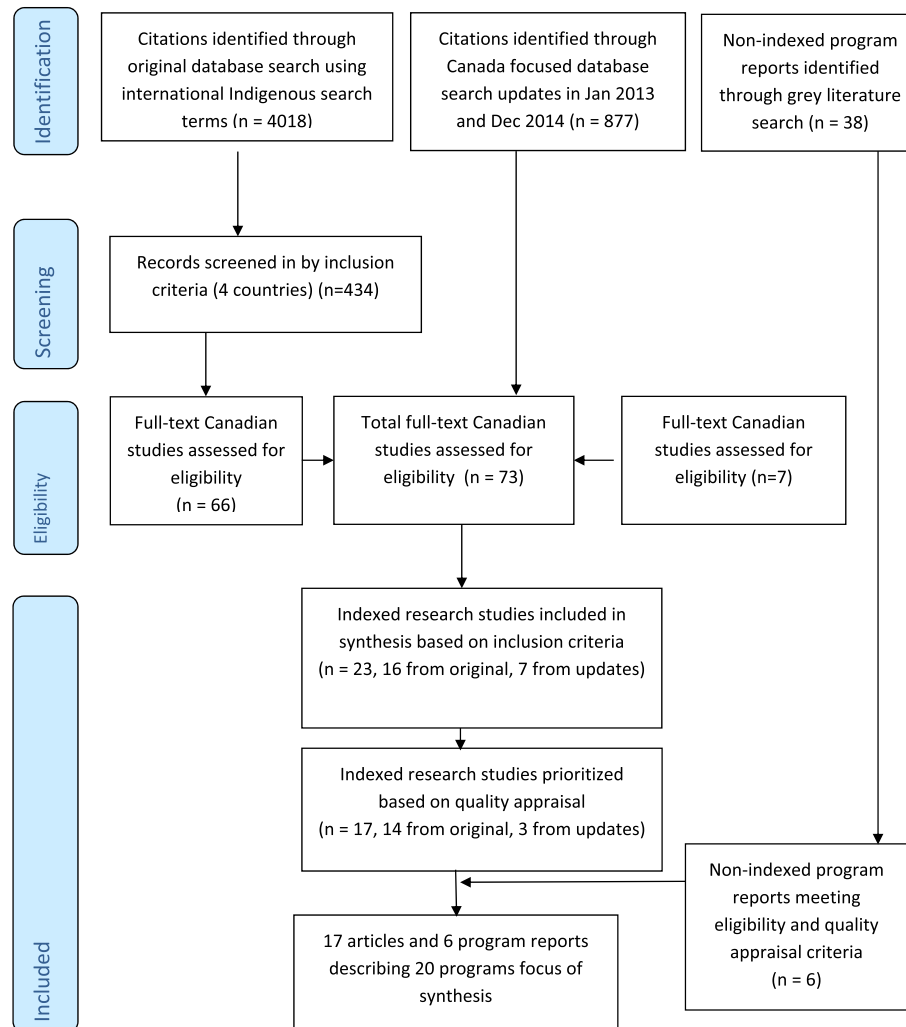


Fig. 4. Flow diagram illustrating search process and document management for prenatal-infant toddler health promotion literature.

breastfeeding, prenatal care utilization, child oral health, child/family respiratory outcomes, child/family nutrition, physical activity and healthy lifestyle knowledge, birth weight, family violence, and child development.

Study designs included: randomized controlled trials (Anand et al., 2007; Harrison et al., 2012; Kovesi et al., 2009; Lawrence et al., 2008); quasi-experimental designs (Bains et al., 2013; Chalmers et al., 2008; Gagne et al., 2013; Gray-Donald et al., 2000; Harrison and White, 1997; Harrison et al., 2006), pre-post test designs (Aboriginal Head Start, 2008; Banks, 2003; Macnab et al., 2008; Martens, 1999; Sawchuck et al., 1996; Verrall et al., 2006), cohort studies (Lawrence et al., 2004; Schroth et al., 2005), chart review (Marshall et al., 2005), process evaluations (Andersson et al., 2003; Health Canada, 2003; Poole, 2000) and qualitative evaluations (Ball, 2004). Of the 20 programs that were evaluated by the included literature, 11 programs (Poole, 2000; Marshal et al., 2005; Banks, 2003; Harrison et al., 2006; Chalmers et al., 2008; Health Canada, 2003; AHS Highlights report 2008; McNab et al., 2008; Martens, 1999; Verral et al., 2006; Andersson et al., 2003; Lawrence et al., 2008; Sawchuck et al., 1996; Ball, 2004) demonstrated quantitatively or qualitatively significant positive health impacts that were judged to be of at least moderate clinical impact. These positive program results covered a diverse range of outcomes including: pre-natal nutrition; birth outcomes; access to pre and

post-natal care for urban Indigenous women involved in substance use; street drug use during pregnancy for both urban and on-reserve Indigenous women; breast-feeding initiation and duration; childhood tooth decay; anemia in children; infant nutrition; child development; and child knowledge, and use of Indigenous languages and cultural traditions.

Six programs had evaluations that identified trends, partially significant findings and/or demonstrated relatively minor health outcome changes that were unlikely to translate into longer term life course impacts (Anand; Kovesi; Bains et al., 2013; Gagne et al., 2013; Harrison and White, 1997; Lawrence et al., 2004). Three studies reported no statistically significant or qualitatively demonstrated findings for study interventions (Harrison et al., 2012; Gray-Donald et al., 2010; Schroth et al., 2005).

3.2. Study Aim 2: realist assessment of theory of indigenous community investment-ownership-activation

To test our hypothesis that programs that have achieved a threshold of community investment also manifest high levels of sustained community participation and linked cross-cutting improvement in program outcomes, we first searched identified programs for evidence of the 3 stages of Indigenous community investment (community leadership and participation in program

initiation, development and implementation) and community activation (sustained and high local community project participation) using the standardized scoring form described in the methods. For the purposes of our review, we considered the “threshold” of community investment and activation was reached if a program scored 3 or more. This was the case for 11 of the 20 programs (Bains et al., 2013; Banks, 2003; Gagne et al., 2013; Harrison and White 1997; Harrison et al., 2006; McNab et al., 2008; Andersson et al., 2003; Aboriginal Head Start as described in Health Canada, 2003; Aboriginal Head Start, 2008; Chalmers et al., 2008). For example, Banks' (Banks, 2003) report on the Ka'nistéhshera Teiakotihnsie breastfeeding promotion program in the Mohawk community of Kanesatake describes all three stages of community investment and subsequent community activation. The program started with the identification by the community health centre staff of low rates of initiation of exclusive breastfeeding at birth (Stage 1 – community prioritizes issue). Community health staff then applied for program funding, hired a nurse researcher, conducted a literature review, considered community strengths and expertise, and analysed barriers in order to further understand and address this problem (Stage 2 – broader community engagement). This broader community knowledge engagement process revealed an inertia towards breastfeeding among caregivers and the community more broadly, that included a lack of confidence by mothers and their families in maternal breastfeeding ability. Community leaders deemed this a complex issue deeply rooted in community systems. The breastfeeding initiative therefore aimed to both empower mothers emotionally and also build community awareness and support. It purposefully built upon Mohawk maternal kin support systems and a respected grandmother was hired to be trained and then to support breastfeeding by new mothers and promote breastfeeding in the community more generally (Stage 3 – new service informed by broader engagement). This grandmother became the catalyst for cross-community buy-in and breastfeeding promotion through the vehicle of “the loving advice of the ever-present mothers, grandmothers, aunts and sisters”. Breastfeeding rates increased significantly over the course of a 6 year period, from the baseline of 19%–75% in the first week of life (Community activation: high levels of sustained local community program use and support).

The less tangible mechanism of community ownership is evidenced in statements describing how the breastfeeding promoter was known as “Auntie”; how her role allowed for a uniquely intimate connection not available to the community health nurse; and how the program participants valued the wisdom of peers and extended family over traditional prenatal classes and advice from health care professionals (Banks, 2003). Clearly this program and its staff are perceived as intrinsic to and building on local community systems, in a deliberately decolonizing fashion.

The presence or absence of Indigenous community investment-ownership-activation was not clearly linked to specific targeted program outcomes. For example, for each of the outcome categories of maternal prenatal health, child dental health outcomes, and child nutrition outcomes, there were programs both with and without evidence of community investment and activation. This supported our preliminary notions that the theory of community investment-ownership-activation cuts across diverse program outcomes and is not an exclusive mechanistic pathway.

The next step in our hypothesis testing was to explore how and in what program contexts Indigenous community investment-ownership-activation was linked or not linked to enhanced Indigenous health and wellbeing, as demonstrated by positive program outcomes. The 11 programs demonstrating community investment-ownership-activation, all showed evidence of positive program outcomes (8 were in the significant positive/moderate

clinical impact group and the remaining 3 in the trends/minor clinical impacts group described in the results of Aim 1 above). Based on this evidence, it appears that investment-ownership-activation is indeed linked to positive results, with some variation in the magnitude of the impact of this particular pathway. The variation in magnitude was not unexpected, as we anticipate that there are multiple other mechanistic pathways at work (including that of cultural integrity) and other influencing contextual factors, such as the specific health condition or behaviour being addressed, the specific intervention, and the length of the evaluation period for example.

Harrison and White (1997) is an example of a program that has good evidence of community investment-ownership-activation and mixed outcomes. Evidence of community investment in this community based intervention to improve oral health among infant and young children in a First Nations community in British Columbia includes: the interviewing of mothers and Elders prior to the intervention; resultant implementation strategies that drew on these consultations and included traditional infant care practices; and a local community program implementation working group. This working group was chaired by the project research assistant, a community “layworker” hired for the project, and included interested community mothers, the Public Health Nurse, and the Community Health Representative. While there is good evidence of community investment in the project development and implementation, it is less clear whether or not the mechanism of community ownership was fully achieved. The success and sustainability of the cradle loan component of the program, which built on the recommendations of local community elders and draws on intrinsic community childcare practices represents an arm of project activity that appears to be derived from local community social systems and embraced by the community. However, even though baseline community interview responses indicated the program should focus on community mothers, “given the importance of the community's Public Health Nurse in influencing child care it was felt ... that she should also play a role in delivering counselling.” In contrast to the program in Kanesatake, where a community “auntie” led breastfeeding promotion, this program in a First Nations community in BC was less successful - in fact, the proportion of breastfed children decreased. Overall, in the BC program there were mixed outcomes with improved trends (not statistically significant) in the reduction of harmful bottle-feeding practices, decreased dental caries, and this decrease in breastfeeding. It is possible that this program achieved a partial but not full collective sense of community ownership, which in turn resulted in mixed levels of community activation and therefore mixed program success. It is also likely that additional mechanisms and contextual factors were at play.

One example which yielded positive results despite an absence of evidence of Indigenous community investment-ownership-activation was Sawchuck et al.'s (1996) study of an intervention to reduce risk of anemia and improve infant nutrition through the provision of iron-fortified formula and counselling. This may have occurred because the intervention providers were selling the iron-fortified formula at a discounted rate to community members, thus manipulating the community economic structure.

Overall, the 9 programs that did not demonstrate evidence of community investment-activation were less likely to have positive health impacts, compared to those that did. The 3 study interventions with no significant outcome improvements were found to have little evidence of Indigenous community investment-ownership-activation.

4. Discussion

With respect to Study Aim 1, just over half (11) of the 20 programs identified in our review demonstrated positive impacts that were deemed to be of at least moderate clinical impact. Six programs documented relatively minor health outcome changes and the remaining three programs were not linked to any positive health impacts. Given the large number of existing Indigenous prenatal, infant, and toddler health promotion programs in Canada, there is a relative paucity of publically available program evaluation reporting and room to further develop evaluation methods and tools specifically for Indigenous contexts.

Regarding Study Aim 2, our review demonstrates a middle range theory of Indigenous community investment-ownership-activation as an important causal pathway linked in a cross-cutting manner to successful Indigenous prenatal and infant toddler health promotion programs. Programs that built in local Indigenous community investment and thus achieved a sense of local community program ownership and subsequent sustained local program participation were successful in positively impacting a diverse range of prenatal and child health outcomes across a range of Indigenous populations and settings including: birth outcomes; access to pre and post-natal care for urban Indigenous women involved in substance use; street drug use during pregnancy for both urban and on-reserve Indigenous women; breast-feeding initiation and duration; childhood tooth decay; infant nutrition; child development; and child knowledge and use of Indigenous languages and cultural traditions. Our study also demonstrates that programs with evidence of Indigenous community investment-ownership-activation are more likely to have significant positive program outcomes compared to those without.

The vital importance of Indigenous community leadership and participation as a key factor linked to Indigenous health program success was validated by the international findings of the broader literature review, which included country specific syntheses of Indigenous parenting and infant toddler health promotion programs for Australia, Hawaii, New Zealand and the United States which were presented at our broader project international consultation meeting. Recent literature reviews highlight the importance of Indigenous community leadership and participation to program success for a diverse range of health issues and Indigenous populations, including physical activity promotion among Native Americans (Teufel-Shone et al., 2009); chronic disease management among Indigenous in Australia (Liaw et al., 2011); and mental health promotion among the Maori (Durie, 2011). A recent realist evaluation of community-based participatory research by Jagosh et al. found that trust in academic-community relationships is a key process for sustainability of partnerships, expansion of programs and resources and systemic transformation including cultural shifts and new policy implementation (Jagosh et al., 2015). In the experience of the lead author, the concepts of Indigenous community investment, ownership, and activation are easily understood and recognized across diverse Indigenous community audiences. This is achieved by asking community members to think about a community program or event that they have attended and that they knew was going to be a success within the first few minutes of walking through their observations of participant attitudes, activities and interactions, and compare it to an event that they knew would be a failure when they walked in.

Foundational public health theories regarding health behaviour, such as the Theory of Health Behaviour (Janz and Becker, 1984) and the Theory of Planned Behaviour (Ajzen, 1985) centre on the importance of beliefs and attitudes as drivers of behaviour. There is good evidence demonstrating that it is much easier to influence beliefs and attitudes regarding health behaviours with strategies

that fit with the knowledge and social systems of the population of interest (Merzel and D’Afflitti, 2003). A common concern identified by Indigenous prenatal and infant toddler health promotion program managers, workers, and clients is that resources that have been developed external to the local community context are not appropriate or relevant (Health Council of Canada (2011)). Our theory emphasizing the role of Indigenous community investment-ownership-activation increases the likelihood that programs will be well aligned with local Indigenous knowledge and social systems, since local health workers and community members have led program development and implementation. In accordance with these mainstream public health behaviour theories, the local program alignment that results when there is Indigenous community investment-ownership-activation will increase program success with respect to behavioural outcomes not only because of increased participation in the program but also because of the increased efficacy of locally aligned messaging in influencing behaviour. The findings of our Indigenous specific study may be relevant to non-Indigenous contexts as well, particularly for socially excluded population groups that may experience health promotion programming as something that is primarily developed externally to them.

Indigenous community and organizational political leaders, policy makers, knowledge keepers, and health practitioners have been asserting for decades that Indigenous community leadership and participation is critical to Indigenous success not only in the domain of health, but with respect to all aspects of Indigenous social and political affairs. This study’s significance thus lies not in the originality of the underlying theory regarding the critical nature of substantive Indigenous community involvement with respect to program success, but rather in its systematic demonstration of this hypothesis using the rigorous application of public health synthesis methods to Indigenous health program review.

It is worth noting that academically derived best practice evidence is not always deemed necessary or relevant by Indigenous community knowledge keepers, who might instead point towards the value of the centuries of experiential trial and error within specific socio-ecologic contexts. This Indigenous experiential type of proof provided a very practical evidence base for Indigenous approaches to health and healing historically and allowed for innovation and adaptation within dynamic and complex local environments. These traditional Indigenous methods share many features with developmental evaluation approaches (Patton, 2011), which have emerged much more recently on the horizon of mainstream public health evaluation.

A common Indigenous critique when mainstream health and public health approaches are applied in Indigenous contexts is that there are unresolved epistemological assumptions. This typically results in a marginalization of and missed opportunity to build on local health Indigenous knowledge and practice (Smith, 2012; Smylie, 2011, 2014). As we anticipated, realism provided us an opportunity to avoid this pitfall by allowing for the explicit formulation of testable theories, which we were able to construct in alignment with the base of critical Indigenous knowledge theory that has been developed by our research team over the past decade and the local Indigenous community health practice experiences of the front line Indigenous community health policy makers and practitioners in our study. We found the practical and contextual knowledge of community stakeholders critical in the development and refinement of our theory.

The challenges in developing methods of Indigenous health program evaluation that are both rigorous and aligned with Indigenous knowledge systems have been recognized by the Public Health Agency of Canada. The newly released “Indigenous Ways Tried and True” section of the Canadian Best Practices Portal (Public

Health Agency Of Canada, 2014) draws on an Indigenous framework to evaluate the success of submitted public health interventions. Evaluation criteria include: basis in the community, wholistic approach, integration of Indigenous cultural knowledge, building on community strengths and needs, partnership/collaboration and demonstrated effectiveness. We note that these evaluation criteria overlap heavily with the initial list of strategies that we identified as linked to program success, from which we further formulated our theory of Indigenous community investment.

Gladwell's popularized theory defined the "tipping point" as "the moment of critical mass, the threshold, the boiling point" (Gladwell, 2006), which results in an epidemic of social change in which an idea, product or behaviour spreads exponentially like a virus. Social scholars have also used critical mass theory and epidemic modelling to explain non-linear neighbourhood effects on social problems such as youth school non-completion (Crane, 1991). Key to these theories is the importance of peer influence. Drawing on this work the critical state of Indigenous community ownership we have theorized as necessary for Indigenous community activation could be considered an "Indigenous tipping point". There is resonance between epidemic theories of social change and Indigenous knowledge translation scholarship regarding the contributing importance of networks of friends and family as key sources of health information (Smylie et al., 2009), culturally relevant knowledge leaders (Smylie et al., 2009), strategic messaging, local context, and quality social relationships to achievement of the tipping point (Gladwell, 2006; Smylie et al., 2014, 2009).

Study limitations included our primary reliance on published literature and program reports, the majority of which did not have adequate program and context details for full exploration of our hypothesis of community investment-ownership-activation and precluded completely our investigation of cultural integrity. We were also limited by the overall shortage of published studies and program reports in the area of Indigenous health promotion and substantive methodological deficiencies in the overall quality of program evaluation reporting that was available. For example, evaluation tools had not always been validated for use with Indigenous populations; outcomes measures did not always appear to match with local Indigenous community definitions of success; and/or small numbers may have precluded detection of program impacts. Finally, there was no comprehensive index of Indigenous prenatal and infant toddler health promotion programs and/or program reports at the time we conducted our review. We therefore were required to systematically contact key informants in regions across the country, which was time and resource consuming. A comprehensive index with up to date list of contact persons would facilitate a more iterative search for evidence and better accommodate evolving theories.

5. Conclusions

In summary, our findings support the foundational importance of processes that support local Indigenous community leadership and participation in Indigenous prenatal and infant toddler health promotion programs. Thicker program descriptions, that explicitly detail how local Indigenous community members are involved in program development and implementation, as well as the degree of alignment of programs with local Indigenous values, beliefs, knowledge, skills, and behaviours will allow for an enhanced understanding of how and in what contexts Indigenous participation and alignment with Indigenous ways of knowing and doing contribute to programs success in different local contexts. The further development of Indigenous program evaluation and evidence synthesis methods that are both scientifically rigorous and

reflective of Indigenous understandings of success will facilitate the identification of programs that are culturally relevant and effective in Indigenous communities. Initiatives such as the PHAC "Indige-

Text Box 1

Stages of Community Investment (Context).

Stage 1 (Initiation): Health issue identified as a priority for action by local Aboriginal community health workers/community members.

Stage 2 (Development): Aboriginal community workers/leaders engage the broader Aboriginal community to gather, share and mobilize resources regarding this issue.

Stage 3 (Implementation): Initiation of new local community service informed by this broader Aboriginal community engagement and aligned with local ways of knowing and doing.

Text Box 2

Search Terms.

Health promotion OR wellness program* OR health campaign* OR health information OR preventive program* OR patient education OR health behavior* OR health behaviour* OR prevent* OR population health OR primary health care OR prenatal care OR postnatal care OR family plan*) AND (Aborigin* OR eskimo* OR inuit OR inuk OR metis OR "first nation" OR maori OR "pacific islander" OR "north american Indian" OR "American Indian" OR "Alaska native" OR "Native American" OR "Native Hawaiian" OR Hawa* OR Indian OR "torres strait islander" OR Indigenous) AND (Child* OR Infant* OR infancy OR newborn OR neonatal OR neonate* OR baby OR babies OR Preschool* OR Toddler* OR School age* OR fetus).

nous Tried and True" section of the Canadian Best Practices Portal, which index existing programs, need to be supported and expanded upon.

References

- Aboriginal Affairs and Northern Development Canada, 2013a. First Nations Child and Family Services Program [WWW Document]. Gov. Canada. URL. <https://www.aadnc-aandc.gc.ca/eng/1100100035204/1100100035205>.
- Aboriginal Affairs and Northern Development Canada, 2013b. Health Canada — First Nations and Inuit Health Programs: Programs Funded by Set Contribution Funding — 2014/2015 [WWW Document]. Gov. Canada. URL. <http://www.aadnc-aandc.gc.ca/eng/1385657895653/1385657980462>.
- Aboriginal Head Start, 2008. Highlights Report of the Aboriginal Head Start in Urban and Northern Communities National Impact Evaluation 2003–2005.
- Ajzen, I., 1985. From intentions to actions: a theory of planned behavior. In: Kuhl, J., Beckmann, J. (Eds.), *Action Control: From Cognition to Behavior*. Springer-Verlag, Berlin, Heidelberg, New York, pp. 11–39.
- Anand, S.S., Davis, A.D., Ahmed, R., Jacobs, R., Xie, C., Hill, A., Sowden, J., Atkinson, S., Blimkie, C., Brouwers, M., Morrison, K., de Koning, L., Gerstein, H., Yusuf, S., 2007. A family-based intervention to promote healthy lifestyles in an aboriginal community in Canada. *Can. J. Public Health* 98, 447–452.
- Anderson, L.M., Shinn, C., Fullilove, M.T., Scrimshaw, S.C., Fielding, J.E., Normand, J., Carande-Kulis, V.G., 2003. The effectiveness of early childhood development programs: a systematic review. *Am. J. Prev. Med.* 24, 32–46. <http://dx.doi.org/>

- 10.1016/S0749-3797(02)00655-4.
- Andersson, N., Milne, D., Martin, T., Nowgesic, E., Mitchell, S., Caldwell, D., 2003. AFN-CPNP Evaluation: Evaluation of the Canada Prenatal Nutrition Program in First Nations Communities.
- Bains, A., Pakseresht, M., Roache, C., Beck, L., Sheehy, T., Gittelsohn, J., Corriveau, A., Sharma, S., 2013. Healthy Foods North improves diet among Inuit and Inuvialuit women of childbearing age in Arctic Canada. *J. Hum. Nutr. Diet.* 175–185. <http://dx.doi.org/10.1111/jhn.12134>.
- Ball, J., 2004. Early Childhood Care and Development Programs as Hook and Hub: Promising Practices in First Nations Communities. Victoria BC.
- Banks, J.W., 2003. Ka'nistenhsera. Teiakotihnsie's. A native community rekindles the tradition of breastfeeding.[Erratum appears in AWHONN Lifelines. 2003 Dec-2004 Jan;7(6):493]. *AWHONN Lifelines* 7, 340–347.
- Battiste, M., Youngblood Henderson, J. (Sákéj). 2000. Protecting Indigenous Knowledge and Heritage: A Global Challenge. Purich Publishing Ltd., Saskatoon.
- Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada, 2010. Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans.
- Chalmers, J.H., Cayen, L., Saghatoleslami, M., Bradbury, C., 2008. Aboriginal Head Start Making a Difference in the Northwest Territories: Longitudinal Evaluation of Aboriginal Head Start in the Northwest Territories: 2000 to 2008.
- Chamberlain, M., Nair, R., Nimrod, C., Moyer, A., England, J., 1998. Evaluation of a midwifery birthing center in the Canadian North. *Int. J. Circumpolar Health* 57 (Suppl. 1), 116–120.
- Chung, M., Raman, G., Trikalinos, T., Lau, J., Stanley, I., 2008. Interventions in primary care to promote breastfeeding: an evidence review for the U.S. preventative services task force. *Ann. Intern. Med.* 565–582.
- Crane, J., 1991. The epidemic theory of Ghettos and neighborhood effects on dropping out and teenage childbearing. *Am. J. Sociol.* 96, 1226. <http://dx.doi.org/10.1086/229654>.
- Durie, M., 2011. Indigenous mental health 2035: future takers, future makers and transformational potential. *Australas. Psychiatry Bull. R. Aust. New Zeal. Coll. Psychiatr.* 19, S8–S11. <http://dx.doi.org/10.3109/10398562.2011.583058>.
- Dyson, L., McCormick, F.M., Renfrew, M.J., 2014. Interventions for promoting the initiation of breastfeeding. *Sao Paulo Med. J.* 132, 68. <http://dx.doi.org/10.1590/1516-3180.2014132111>.
- Findlay, L., Janz, T., 2012. Health of first nations children living off reserve and Metis children younger than age 6. *Health Rep. Stat. Canada Can. Cent. Heal. Inf.* 23, 31–39.
- Gagne, D., Blanchet, R., Vaissiere, E., Lauziere, J., Vezina, C., Vinet-Lanouette, C., O'Brien, H.T., 2013. Impact of a childcare centre nutrition program on nutrient intakes in Nunavik Inuit children. *Can. J. Diet. Pract. Res.* 74, e311–7.
- Gladwell, M., 2006. The Tipping Point: How Little Things Can Make a Big Difference. Little, Brown.
- Gray-Donald, K., Robinson, E., Collier, A., David, K., Renaud, L., Rodrigues, S., 2000. Intervening to reduce weight gain in pregnancy and gestational diabetes mellitus in Cree communities: an evaluation. *C. Can. Med. Assoc. J.* 163, 1247–1251.
- Green, L.W., George, M., Daniel, C.J., Frankish, C.P., Herbert, W.R., Bowie, W.R., O'Neil, M., 1995. Study of participatory research in health promotion. *R. Soc. Can.* 43–50.
- Harrison, R.L., White, L., 1997. A community-based approach to infant and child oral health promotion in a British Columbia first nations community. *Can. J. Community* 12.
- Harrison, R.L., MacNab, A.J., Duffy, D.J., Benton, D.H., 2006. Brighter smiles: service learning, inter-professional collaboration and health promotion in a first nations community. *Can. J. Public Health Rev. Can. Sante Publique* 97, 237–240.
- Harrison, R.L., Veronneau, J., Leroux, B., 2012. Effectiveness of maternal counseling in reducing caries in Cree children. *J. Dent. Res.* 91, 1032–1037. <http://dx.doi.org/10.1177/0022034512459758>.
- Health Canada, 2003. Summary of the Evaluation: Aboriginal Head Start on Reserve Program. Ottawa ON. <http://dx.doi.org/10.1007/s13398-014-0173-7.2>.
- Health Council of Canada, 2011. Understanding and Improving Aboriginal Maternal and Child Health in Canada: Conversations about Promising Practices across Canada. Health Council of Canada, Toronto.
- Human Resources and Skills Development Canada, 2010. Public Investments in Early Childhood Education and Care in Canada. Quebec.
- Indian and Northern Affairs, 1996. Report of the Royal Commission on Aboriginal Peoples (RCAP).
- Jagosh, J., Macaulay, A., Pluye, P., Salsberg, J., Bush, P., Henderson, J., Sirett, E., Wong, G., Cargo, M., Herbert, C., Seifer, S., Green, L., Greenhalgh, T., 2012. Uncovering the benefits of participatory research: implications of a realist review for health research and practice. *Millbank Q.* 90, 311–346.
- Jagosh, J., Bush, P.L., Salsberg, J., Macaulay, A.C., Greenhalgh, T., Wong, G., Cargo, M., Green, L.W., Herbert, C.P., Pluye, P., 2015. A realist evaluation of community-based participatory research: partnership synergy, trust building and related ripple effects. *BMC Public Health* 15, 725. <http://dx.doi.org/10.1186/s12889-015-1949-1>.
- Janz, N., Becker, M., 1984. The health belief model: a decade later. *Health Educ. Behav.* 11, 1–47.
- Kirst, M., O'Campo, P., 2012. Realist review methods for complex health problems. In: *Rethinking Social Epidemiology: Towards a Science of Change*. Springer, pp. 231–246.
- Kovesi, T., Zaloum, C., Stocco, C., Fugler, D., Dales, R.E., Ni, A., Barrowman, N., Gilbert, N.L., Miller, J.D., 2009. Heat recovery ventilators prevent respiratory disorders in Inuit children. *Indoor Air* 19, 489–499.
- Lawrence, H.P., Romanetz, M., Rutherford, L., Cappel, L., Binguis, D., Rogers, J.B., 2004. Effects of a Community-based Prenatal Nutrition Program on the Oral Health of Aboriginal Preschool Children in Northern Ontario. *Probe (08341494)* 38, 172–172–82, 184–6, 188 passim.
- Lawrence, H.P., Binguis, D., Douglas, J., McKeown, L., Switzer, B., Figueiredo, R., Laporte, A., 2008. A 2-year community-randomized controlled trial of fluoride varnish to prevent early childhood caries in Aboriginal children. *Commun. Dent. Oral Epidemiol.* 36, 503–516.
- Liaw, S.T., Lau, P., Pyett, P., Furler, J., Burchill, M., Rowley, K., Kelaher, M., 2011. Successful chronic disease care for aboriginal Australians requires cultural competence. *Aust. New Zeal. J. Public Health* 35, 238–248.
- Loppie Reading, C., Wien, F., 2009. Health Inequalities and Social Determinants of Aboriginal Peoples' Health.
- Macaulay, M., Commanda, L., Freeman, W., Gibson, N., McCabe, M., Robbins, C., Twohig, P., 1999. Participatory research maximises community and lay involvement. North American primary care research group. *Br. Med. J.* 18, 7212–7774.
- MacDougall, Brenda, 2010. One of the Family: Metis Culture in Nineteenth-Century Northwestern Saskatchewan. UBC Press, Vancouver.
- Macnab, A.J., Rozmus, J., Benton, D., Gagnon, F.A., 2008. 3-year results of a collaborative school-based oral health program in a remote first nations community. *Rural Remote Health* 8, 882.
- Marshall, S., Charles, G., Hare, J., Ponzetti Jr., J.J., Stokl, M., 2005. Sheway's services for substance using pregnant and parenting women: evaluating the outcomes for infants. *Can. J. Commun. Ment. Health* 24.
- Martens, P.J., 1999. Evaluating the Effectiveness of a Breastfeeding Promotion Community Strategy in Sagkeeng First Nation. University of Manitoba.
- McLeod, N., 2009. Cree Narrative Memory: From Treaties to Contemporary Times. Purich Publishing Ltd., Saskatoon.
- McNeil, D., Rikhy, S., Johnston, A., Siever, J., Goitom, M., Tough, S., 2009. Recent Promising Practices to Improve the Health and Well-being of Aboriginal Women and Children, Healthy Moms, Babies, and Children: Improving the Health of Aboriginal Populations in Canada. Edmonton.
- Merzel, C., D'Afflitti, J., 2003. Reconsidering community-based health promotion: promise, performance, and potential. *Am. J. Public Health* 93, 557–574.
- Patton, M.Q., 2011. *Developmental Evaluation: Applying Complexity Concepts to Enhance Innovation and Use*. Guilford Press.
- Pawson, R., 2006. *Evidence-based Policy: A Realist Perspective*. Sage Publications, Thousand Oaks, CA.
- Pawson, R., Greenhalgh, T., Harvey, G., Walshe, K., 2005. Realist review – a new method of systematic review designed for complex policy interventions. *J. Health Serv. Res. Policy* 10, 21–34.
- Pennell, J., Burford, G., 2000. Family group decision making: protecting children and women. *Child Welf.* 79, 131–158.
- Poole, N., 2000. Evaluation Report of the Sheway Project for High Risk Pregnant and Parenting Women. <http://dx.doi.org/10.1007/s13398-014-0173-7.2>.
- Postl, B., Cook, C., Moffatt, M., 2010. Aboriginal child health and the social determinants. *Healthc. Q.* 14, 42–51.
- Public Health Agency of Canada, 2014. Canadian Best Practices Portal: Aboriginal Ways Tried and True [WWW Document]. Gov. Canada. URL <http://cbpp-pcpe.phac-aspc.gc.ca/aboriginalwtt/aboriginal-ways-true/>.
- Sawchuck, P., Rauliuk, M., Kotaska, A., Townsend, S., Wilson, E., Starr, M., 1996. Infant nutrition program effectively prevents iron-deficiency anemia in a first nations community. *Circumpolar Health* 96.
- Schroth, R.J., Lavelle, C.L., Moffatt, M.E., 2005. Review of vitamin D deficiency during pregnancy: who is affected? *Int. J. Circumpolar Health* 64, 112–120.
- Smith, L., 2012. *Decolonizing Methodologies: Research and Indigenous Peoples*, second ed. Zed Books Ltd.
- Smylie, J., 2011. Knowledge translation in context: indigenous, policy, and community settings. In: Leadbeater, B.J.R., Banister, E.M., Marshall, E.A. (Eds.), *Knowledge Translation in Community-based Research and Social Policy Contexts*. University of Toronto Press.
- Smylie, J., 2014. Indigenous child well-being in Canada. In: Michalos, A.C. (Ed.), *Encyclopedia of Quality of Life and Well-being*. Springer, Toronto, ON. <http://dx.doi.org/10.1007/978-94-007-0753-5>.
- Smylie, J., Adomako, P., 2009. *Indigenous Children's Health Report: Health Assessment in Action*. Toronto.
- Smylie, J., Kaplan-Myrth, N., McShane, K., 2009. Indigenous knowledge translation: baseline findings in a qualitative study of the pathways of health knowledge in three indigenous communities in Canada. *Health Promot. Pract.* 10, 436–446. <http://dx.doi.org/10.1177/1524839907307993>.
- Smylie, J., Lofters, A., Firestone, M., O'Campo, P., Campo, P.O., 2011. Population-based data and community empowerment. In: O'Campo, P., Dunn, J.R. (Eds.), *Rethinking Social Epidemiology: Towards a Science of Change*. Springer Netherlands, Toronto, pp. 67–92. <http://dx.doi.org/10.1007/978-94-007-2138-8>.
- Smylie, J., Olding, M., Ziegler, C., 2014. Sharing what we know about living a good life: indigenous approaches to knowledge translation. *J. Can. Health Libr. Assoc.* 35, 16–23. <http://dx.doi.org/10.5596/c14-009>.
- Teufel-Shone, N.L., Fitzgerald, C., Teufel-Shone, L., Gamber, M., 2009. Systematic review of physical activity interventions implemented with American Indian and Alaska native populations in the United States and Canada. *Am. J. Health Promot* 23, S8–S32.
- Tipene-Leach, D., Hutchison, L., Tangiora, A., Rea, C., White, R., Stewart, A., Mitchell, E., 2010. SIDS-related knowledge and infant care practices among

- Maori mothers. *N. Z. Med. J.* 123, 88–96.
- Unicef, 2009. *Aboriginal Children's Health: Leaving No Child behind*. Can. Suppl. To State World's Child. 2009.
- United Nations, 2008. *United Nations Declaration on the Rights of Indigenous Peoples*, United Nations.
- Verrall, T., Napash, L., Leclerc, L., Mercure, S., Gray-Donald, K., 2006. Community-based communication strategies to promote infant iron nutrition in northern Canada. *Int. J. Circumpolar Health* 65, 65–78.
- Wong, G., Greenhalgh, T., Westhorp, G., Buckingham, J., Pawson, R., 2013a. RAMESES publication standards: realist syntheses. *BMC Med.* 11, 21. <http://dx.doi.org/10.1186/1741-7015-11-21>.
- Wong, G., Westhorp, G., Pawson, R., Greenhalgh, T., 2013b. *Realist Synthesis RAMESES Training Materials*. [WWW Document]. URL www.ramesesproject.org/media/Realist_reviews_training_materials.pdf.
- World Health Organization, 2014. *Nutrition Counselling during Pregnancy* [WWW Document]. World Heal. Organ. URL www.who.int/elena/titles/nutrition_counselling_pregnancy/en/.
- Youngblood Henderson, J. (Sákéj). 2000. *Ayukpachi: empowering aboriginal thought*. In: Battiste, M. (Ed.), *Reclaiming Indigenous Voice and Vision*. UBC Press, pp. 248–278.