Systematic review of interventions addressing suicide among Indigenous adults and reporting Indigenous-specific content and involvement in the interventions

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Abstract

Indigenous peoples experience high rates of suicide from historical and ongoing colonization. This systematic review examines the effectiveness, involvement of Indigenous peoples, and cultural content of interventions addressing suicide among Indigenous adults in Canada, the United States, New Zealand, and Australia. Through a systematic search of scholarly articles and grey literature, 10 articles met the inclusion criteria. In nine studies, Indigenous people made decisions at the study design level and implemented and delivered research activities, and eight studies included cultural content. There were statistically significant reductions in suicide outcomes in four studies, and in self-harm and hopelessness in two studies each. Study quality was largely weak (n = 9) or moderate (n = 1). There is a paucity of high-quality data on interventions addressing suicide among Indigenous adults and strengthened reporting of health research involving Indigenous peoples in interventions.

Keywords

indigenous peoples, intervention, suicide, systematic review

Introduction

In Canada, the United States, New Zealand, and Australia, suicide rates are disproportionately higher for Indigenous populations than general population rates (Anderson et al., 2016; Australian Bureau of Statistics, 2018; Indian Health Service, 2019; Kumar & Tjepkema, 2019; Ministry of Health – Manatū Hauora, 2019b; Pollock et al., 2018). Suicide is a product of complex and interacting personal, familial, and social variables (Harlow et al., 2014). Among Indigenous populations, these variables are compounded with broader narratives of settler colonialism, racism, white supremacy, discrimination, land dispossession, and cultural disruptions (King et al., 2009; Pollock et al., 2018; Reading & Wien, 2009). These factors manifest in poverty, lower educational attainment, overcrowded housing, and reduced social control and opportunity (Reading & Wien, 2009; Walls & Whitbeck, 2011).

Despite these issues, there have been powerful movements of cultural revitalization, resilience, and resistance to policies that limit access to appropriate mental health services for Indigenous communities (Department of Health and Ageing, 2013; Dudgeon et al., 2020; Indian Health Service, 2011; Inuit Tapiriit Kanatami, 2016; Ministry of Health—Manatū Hauora, 2019a). Interventions aimed at improving mental health outcomes for Indigenous people are elements of these movements (Department of Health and Ageing, 2013; Indian Health Service, 2011; Ministry of Health Manatū Hauora, 2019a—; Substance Abuse and Mental Health Services Administration, 2017; Wexler & Gone, 2012). Health research detailing suicide among Indigenous populations focuses largely on risk and protective factors, epidemiological trends, and cultural perceptions, rather than intervention effectiveness (Harder et al., 2012; Harlow et al., 2014; Pollock et al., 2018). Two previous systematic reviews evaluated suicide prevention interventions targeting Indigenous populations in Canada, the United States, New Zealand, and Australia in studies
published until 2012 (Clifford et al., 2013; Harlow et al., 2014). These countries share similar historical and present-day colonialism, state provisions of health and social services, and cultural and holistic worldviews of health and wellbeing. A third systematic review was recently conducted indicating cultural biases as limitations and omitting valuable Indigenous-derived data (Leske et al., 2020). A thorough review of the studies to assess methodological quality and Indigenous knowledges is needed including a critical discussion on Indigenous governance in intervention health research. Our objective was to conduct a systematic review to examine the effectiveness, involvement of Indigenous peoples, and cultural content of interventions addressing suicide among Indigenous adults in Canada, the United States, New Zealand, and Australia.

**Methods**

**Search strategy**

Our review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). A search strategy developed with a librarian included subject headings and keywords that addressed: Indigeneity, mental health and suicidality, and intervention type (Supplementary Table 1). We searched MEDLINE, EMBASE, PsycINFO, CINAHL, the Cochrane Database, Scopus, Native Health Database, Bibliography of Native North Americans, Sociological Abstracts, Circumpolar Health Bibliographic Database, First Nations Information Connection, Indigenous Studies Portal, and Journal of Indigenous Wellbeing, from the earliest available record until June 1, 2020. Grey literature was searched from governmental and non-governmental websites listing Native American/First Nations/Aboriginal related information.

**Selection criteria**

We included experimental, quasi-experimental, and observational study designs. Studies were required to include Indigenous adults, with a mean age of 16 years and older, located in Canada, the United States, New Zealand, or Australia; examine psychological, psychosocial, educational, and/or alternative interventions addressing suicide; and be written in English or French. The conceptualization and measurement of suicidality outcomes varies internationally (Mental Health Commission of Canada, 2018). As such, we broadly included suicidal ideation meaning suicidal thoughts or plans, suicide attempts as potentially self-injurious behaviour with suicidal intent, and suicide completions. We also included self-harm, which can include non-suicidal self-injury described as self-injurious behaviour without suicidal intent and hopelessness, typically measured with the Beck Hopelessness Scale, which assesses negative expectations of the future and can be predictive of suicide (Beck et al., 1974).

**Data extraction and management**

Titles and abstracts were reviewed separately by two authors, and disagreements were resolved by a third reviewer. Full-text articles were then retrieved and screened using the same process. Data extraction was conducted separately by two authors using an adapted Cochrane data extraction form in accordance with the Template for Intervention Description and Replication (TIDieR) checklist (Cochrane Developmental Psychosocial and Learning Problems, 2014; Hoffmann et al., 2014).

**Cultural assessment**

An assessment of Indigenous involvement and content was completed by two authors. Based on prior literature (Huria et al., 2019), we assessed whether Indigenous individuals or groups had decision-making responsibilities at the study design level, and were involved in implementing the research or intervention. We also assessed whether studies were specific to an Indigenous population(s) and had considered the population’s diversity and if general or localized Indigenous-specific knowledge was in the intervention content or research processes.

**Quality assessment**

Critical appraisal was conducted independently by two authors using the Effective Public Health Practice Project (EPHPP) quality assessment tool (Armijo-Olivo et al., 2012). Discrepancies were adjudicated by a third reviewer (Supplementary Table 2). Studies were given a global rating of strong, moderate, or weak, based on the EPHPP ratings on selection bias, study design, confounding, blinding, data collection methods, and withdrawals and dropouts. Sex, age, socio-economic status, and co-morbidities were considered confounders *a priori*. Overall ratings were strong for studies with no weak ratings, moderate for those with one weak rating, and weak for those with two or more weak ratings.

**Data synthesis**

A narrative synthesis approach was used to report study outcomes given the heterogeneity of study populations, interventions, and outcome measures.

**Results**

**Study characteristics**

The search yielded 67,155 records (Supplementary Figure 1). Following removal of duplicates, 57,826 titles and abstracts were screened, of which 57,523 articles were excluded. Subsequently, 303 articles were retrieved and assessed for eligibility, of which 10 articles met the inclusion criteria (Supplementary Table 3).

They were from the United States (*n* = 5), Australia (*n* = 3), New Zealand (*n* = 1), and Canada (*n* = 1). The US studies targeted White Mountain Apache, Zuni, Salish and...
Kootenai, Western Athabascan, and American Indian and Alaskan Native populations broadly (Bowen et al., 2020; Cwik et al., 2016; LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; May et al., 2005). The New Zealand study focused on Maori populations (Hatcher et al., 2016), while the Australian studies targeted Aboriginal and Torres Strait Islanders, and Australian Aboriginal peoples only (Nathan et al., 2020; Rasmussen et al., 2018; Tighe et al., 2017). The Canadian study targeted Indigenous peoples broadly (Tu et al., 2019). Randomized controlled trials (RCTs) \( (n = 2) \) (Hatcher et al., 2016; Tighe et al., 2017), pre–post studies with \( (n = 1) \) (LaFromboise & Howard-Pitney, 1995) and without comparison groups \( (n = 4) \) (Bowen et al., 2020; Le & Gobert, 2013; Nathan et al., 2020; Tu et al., 2019), and retrospective cohort studies \( (n = 3) \) were included (Cwik et al., 2016; May et al., 2005; Rasmussen et al., 2018). Three studies included participants aged 16 years or under, but the average age was at least 16 years, making the studies eligible (LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; Nathan et al., 2020). Six included participants aged 18 (Bowen et al., 2020; Hatcher et al., 2016; Rasmussen et al., 2018; Tighe et al., 2017), 19 (May et al., 2005), and 20 (Cwik et al., 2016) years and over. One study included adults without specifying the age, but the mean (range) age at baseline was 49 (25–76) years. Sample sizes were fewer than 100 participants \( (n=3) \) (Le & Gobert, 2013; Tighe et al., 2017; Tu et al., 2019), between 100 and 500 \( (n=5) \) (Bowen et al., 2020; Hatcher et al., 2016; LaFromboise & Howard-Pitney, 1995; May et al., 2005; Rasmussen et al., 2018), greater than 500 \( (n=1) \) (Nathan et al., 2020), and not reported \( (n=1) \) (Cwik et al., 2016).

Four studies did not actively recruit participants, and data were from a clinic’s patient disease management registry (Bowen et al., 2020), surveillance systems (Cwik et al., 2016; May et al., 2005), and students enrolled in a required course (LaFromboise & Howard-Pitney, 1995). Two studies recruited participants from clinical settings (Hatcher et al., 2016; Tu et al., 2019), one from an educational institution (Le & Gobert, 2013), two from justice systems (Nathan et al., 2020; Rasmussen et al., 2018), and two from Indigenous communities (Nathan et al., 2020; Tighe et al., 2017). Recruitment strategies in five studies were referrals (Nathan et al., 2020; Tighe et al., 2017), word-of-mouth (Tighe et al., 2017) and information sessions (Rasmussen et al., 2018; Tighe et al., 2017), and large-scale notifications (i.e., flyers, posters, social media, and announcements) (Le & Gobert, 2013; Tighe et al., 2017; Tu et al., 2019). One study recruiting from the clinical setting did not describe its strategy (Hatcher et al., 2016). Among the studies recruiting participants, five had response rates ranging from 32.2% to 100% (Hatcher et al., 2016; LaFromboise & Howard-Pitney, 1995; Nathan et al., 2020; Rasmussen et al., 2018; Tighe et al., 2017), and two did not report response rates (Le & Gobert, 2013; Tu et al., 2019). Seven studies had follow-up rates ranging from 36% to 100% (Bowen et al., 2020; Hatcher et al., 2016; LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; Nathan et al., 2020; Tighe et al., 2017; Tu et al., 2019).

Three had follow-up periods of 1, 3, and 6 months (Tu et al., 2019), 3 months (Nathan et al., 2020), and 12 months post-intervention (Hatcher et al., 2016). A fourth study characterized follow-ups as less than or equal to 4 weeks and having two or more contacts with a service provider (Bowen et al., 2020). Three studies did not report a follow-up period beyond the immediate post-intervention period (LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; Tighe et al., 2017).

### Intervention descriptions

Interventions were heterogeneous in rationale, content, and delivery (Supplementary Table 4). Three studies were clinic-based, including a collaborative care management programme in rural health centres (Bowen et al., 2020), a problem-solving therapy programme in hospital emergency departments (Hatcher et al., 2016), and an Indigenous Elders programme in a health clinic (Tu et al., 2019). Two studies located within Indigenous communities were high school-based interventions with a mindfulness curriculum (Le & Gobert, 2013) and a life skills training programme (LaFromboise & Howard-Pitney, 1995). Two other interventions located in institutionalized spaces included therapeutic community approaches to care within a substance treatment centre (Nathan et al., 2020) and an Aboriginal art programme in a maximum security prison (Rasmussen et al., 2018). One intervention used a mobile health intervention and evaluated an acceptance-based therapy programme (Tighe et al., 2017). Finally, two studies in Indigenous communities included multi-tiered population approaches to suicide prevention through combinations of public education, community-based suicide prevention programmes and curriculums, school-based interventions, and clinical and social service interventions (Cwik et al., 2016; May et al., 2005).

Tailoring and modifications of interventions were largely not reported (Supplementary Table 5). Two studies reported intervention tailoring as part of the design (Bowen et al., 2020; Tighe et al., 2017) and two reported modifications during the study (May et al., 2005; Tighe et al., 2017). Six studies optimized fidelity (Cwik et al., 2016; Hatcher et al., 2016; LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; May et al., 2005; Tighe et al., 2017) and five reported intervention adherence (Bowen et al., 2020; Hatcher et al., 2016; Nathan et al., 2020; Tighe et al., 2017; Tu et al., 2019).

### Quality assessment

Nine studies had a weak global rating, and one a moderate global rating (Supplementary Table 6). For selection bias, five studies were rated weak due to response rates less than 60% (Hatcher et al., 2016; Nathan et al., 2020; Rasmussen et al., 2018) or recruitment being self-referral (Le & Gobert, 2013; Nathan et al., 2020; Rasmussen et al., 2018; Tighe et al., 2017; Tu et al., 2019). Four studies were rated moderate because participants were only likely representative of a specific population meaning they were not randomly
selected, referred from a clinic or service provider (Bowen et al., 2020; Cwik et al., 2016; May et al., 2005). One study rated moderate had a 100% response rate, but inclusion in a required course meant that participants were only somewhat likely representative of the target population (LaFromboise & Howard-Pitney, 1995). For study design, five pre–post study designs (Bowen et al., 2020; LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; Nathan et al., 2020; Tu et al., 2019) and three observational studies (Cwik et al., 2016; May et al., 2005; Rasmussen et al., 2018) were rated moderate, and two RCTs strong (Hatcher et al., 2016; Tighe et al., 2017). For confounders, three studies had a weak rating for controlling for 50% or less of the confounders defined a priori (Cwik et al., 2016; LaFromboise & Howard-Pitney, 1995; May et al., 2005). Two RCTs with no differences between experimental and control groups (Hatcher et al., 2016; Tighe et al., 2017) and one retrospective cohort study received strong ratings (Rasmussen et al., 2018). Controlling for confounders was not applicable in four pre–post studies with no comparison group (Bowen et al., 2020; Le & Gobert, 2013; Nathan et al., 2020; Tu et al., 2019). Blinding was weak in nine studies because participants and assessors were not blinded to the research question and outcome, respectively (Bowen et al., 2020; Cwik et al., 2016; LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; May et al., 2005; Nathan et al., 2020; Rasmussen et al., 2018; Tighe et al., 2017; Tu et al., 2019). One RCT was rated moderate because the assessor was blinded, but not the participants (Hatcher et al., 2016). For data collection, one study was rated weak for using self-reported data (Nathan et al., 2020). Three received a moderate rating since face and content validity of the tools were ascertained (Cwik et al., 2016; May et al., 2005; Rasmussen et al., 2018), and six studies strong as their measurement tools were both valid and reliable (Bowen et al., 2020; Hatcher et al., 2016; LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; Tighe et al., 2017; Tu et al., 2019). Withdrawals and dropouts were rated weak in two studies because follow-up was less than 60% (Bowen et al., 2020; Nathan et al., 2020). Among the three studies with a moderate rating, two had follow-up rates between 60% and 79% (Hatcher et al., 2016; LaFromboise & Howard-Pitney, 1995), and one study despite a follow-up of 80% or greater did not report reasons for withdrawal (Le & Gobert, 2013). Two studies rated strong, had 80% or greater follow-ups and reported withdrawal reasons (Tighe et al., 2017; Tu et al., 2019). Follow-up ratings were not applicable for the retrospective cohort studies (Cwik et al., 2016; May et al., 2005; Rasmussen et al., 2018).

Indigenous individuals or groups with decision-making responsibilities in the study design

Nine studies described Indigenous representation in decision-making roles at a system, organizational, or individual level in the study design (Supplementary Table 7) (Bowen et al., 2020; Cwik et al., 2016; Hatcher et al., 2016; LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; May et al., 2005; Nathan et al., 2020; Tighe et al., 2017; Tu et al., 2019). Five studies involved community or tribal involvement (Cwik et al., 2016; LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; May et al., 2005; Tighe et al., 2017). Five described engagements of Elders and other community leaders and stakeholders (Cwik et al., 2016; LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; May et al., 2005; Tu et al., 2019). Five studies incorporated an advisory board, committee, or council (Cwik et al., 2016; Hatcher et al., 2016; Le & Gobert, 2013; May et al., 2005; Nathan et al., 2020) and two included working groups and planning forums (Tighe et al., 2017; Tu et al., 2019). Four studies involved health or social service entities and service providers (Bowen et al., 2020; Le & Gobert, 2013; May et al., 2005; Tu et al., 2019). Three studies received Indigenous-specific ethics reviews (Le & Gobert, 2013; Nathan et al., 2020; Tighe et al., 2017).

The greatest number of Indigenous partners or leaders with roles in the design stage was the school-based mindfulness intervention by Le and Gobert (2013) (Supplementary Table 7). It involved Tribal Elders, three cultural committees, a key tribal stakeholder, a Tribal Council, the Tribal Social Service, the Native American College ethics board, and the broader community. The life and skills school-based intervention (LaFromboise & Howard-Pitney, 1995) involved community leaders, school personnel, and the broader community. The two community-based interventions involved several community individuals and groups in their multi-tiered prevention interventions (Cwik et al., 2016; May et al., 2005). The three clinic-based studies involved fewer partnerships or leaderships in the design stages, but Hatcher et al. (2016) involved an advisory board, Tu et al. (2019) involved an advisory committee and a team of Elders, and Bowen et al. (2020) included a clinic managed by the local community. The online intervention (Tighe et al., 2017) involved community members, and Indigenous artists and designers in developing the intervention app. Finally, in Nathan et al. (2020) an advisory committee guided the intervention at the residential treatment centre, which included young people who had completed the programme.

Indigenous peoples’ involvement in research activities and intervention implementation

Five studies involved Indigenous peoples in setting the study aims (Cwik et al., 2016; Hatcher et al., 2016; LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; May et al., 2005), five in recruitment (Le & Gobert, 2013; May et al., 2005; Nathan et al., 2020; Tighe et al., 2017; Tu et al., 2019), and six in data collection, analysis, or sharing (Supplementary Table 8) (Cwik et al., 2016; Hatcher et al., 2016; LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; Tighe et al., 2017; Tu et al., 2019). Eight studies described Indigenous people facilitating the intervention and having administrative responsibilities (Bowen et al., 2020; Cwik et al., 2016; Hatcher et al., 2011; Hatcher et al., 2016; LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013; May et al., 2005; Tighe et al., 2017; Tu et al., 2019), while four had research training opportunities for Indigenous peoples (LaFromboise & Howard-Pitney, 1995; Le et al., 2013;
May et al., 2005; Tighe et al., 2017). One study did not describe Indigenous involvement in such activities (Rasmussen et al., 2018).

**Specificity and diversity of Indigenous populations and Indigenous-specific content in the intervention and research process**

In terms of the specificity and diversity of Indigenous populations, three US studies included specific communities (Cwik et al., 2016; LaFromboise & Howard-Pitney, 1995; Le & Gobert, 2013) while two others included broader geographic regions (Bowen et al., 2020) and a nation (May et al., 2005) (Supplementary Table 9). The diversity of the Maori population was difficult to assess as the study location was New Zealand (Hatcher et al., 2016). Similarly, the Canadian study did not acknowledge diversity between the 14 nations (Tu et al., 2019). Among three studies from Australia (Nathan et al., 2020; Rasmussen et al., 2018), only one listed the participating communities (Tighe et al., 2017).

Eight studies described Indigenous-specific content (Supplementary Table 9). Two school-based studies tailored their curriculums to their respective cultures. The mindfulness curriculum was informed by Elders and delivered in council style (Le & Gobert, 2013). The life and skills curriculum had a historical view of how the community coped with stress, understood and experienced suicide, and incorporated American Indian ways of imparting and reinforcing knowledge (LaFromboise & Howard-Pitney, 1995). Among the community-based studies, one included Elder-led activities such as field trips to sacred sites (Cwik et al., 2016), and the second included culturally based programme components such as traditional dancing (May et al., 2005). Among the two clinic-based interventions, one included an Elders-led programme with cultural teaching sessions and land-based ceremony (Tu et al., 2019), and a second incorporated cultural beliefs and values in a welcoming ceremony and cultural assessments and services (Hatcher et al., 2016). The online intervention had one module with cultural activities (Tighe et al., 2017). Finally, one study included visits from local Elders and an Aboriginal art programme in a maximum security prison (Rasmussen et al., 2018). Among the 10 studies, none used Indigenous-specific measures of suicide, self-harm, or hopelessness.

**Intervention effectiveness**

Three studies found statistically significant reductions in suicide-related outcomes associated with their interventions, including suicide risk or self-harm in a combined measure immediately post-intervention (Rasmussen et al., 2018), suicide attempts at 3 months post-intervention (Nathan et al., 2020), and suicide risk at 1, 3, and 6 months post-intervention (Tu et al., 2019) (Supplementary Table 10). A fourth study reported statistically significant reductions in suicide gestures and attempts, but only in a 19 to 24 year age group (May et al., 2005). One study reported a reduction in suicide deaths following unadjusted analyses (Cwik et al., 2016). Self-harm (Nathan et al., 2020) and repeat self-harm (Hatcher et al., 2016) were significantly reduced in two studies at 3 months post-intervention. Hopelessness was significantly reduced in one study immediately post-intervention (LaFromboise & Howard-Pitney, 1995) and a second study at 3 months post-intervention (Hatcher et al., 2016). Three other studies reporting reductions in suicide ideation (Bowen et al., 2020), suicidal vulnerability (LaFromboise & Howard-Pitney, 1995), and suicidality (Le & Gobert, 2013) did not calculate p-values (Bowen et al., 2020; Le & Gobert, 2013), or calculated p-values were not statistically significant (LaFromboise & Howard-Pitney, 1995). One study did not reduce suicide ideation with the intervention (Tighe et al., 2017).

**Discussion**

**Summary of findings**

Our systematic review of 10 studies examined the effectiveness of suicide prevention interventions for Indigenous adults in Canada, the United States, New Zealand, and Australia. There was substantial methodological diversity in terms of study design, location, and types of intervention. All but one study included Indigenous content in the intervention (Rasmussen et al., 2018). Indigenous people were involved in the study design and implementing the research or intervention. Six studies reported statistically significant reductions in suicide-related outcomes associated with the intervention (Hatcher et al., 2016; LaFromboise & Howard-Pitney, 1995; May et al., 2005; Nathan et al., 2020; Rasmussen et al., 2018; Tu et al., 2019). However, most studies were rated weak.

**Comparison with previous research**

Two previous reviews evaluated suicide prevention interventions in our four countries of interest (Clifford et al., 2013; Harlow et al., 2014). Clifford et al. (2013) examined Indigenous populations of all ages in 9 studies, while Harlow et al. (2014) focused on Indigenous youth in 11 studies. Clifford et al. (2013) largely included pre-post and cohort studies, with two studies overlapping with our review (LaFromboise & Howard-Pitney, 1995; May et al., 2005). We did not include the seven other studies because six did not measure suicide behaviours and instead measured knowledge, empowerment, or confidence, and the seventh study did not report participants’ average age (Clifford et al., 2013). These studies were primarily educational, gatekeeper training, and community-based interventions. Among the 11 studies reviewed by Harlow et al. (2014), 2 were in our review because the average age of the youth was 16 years or older (LaFromboise & Howard-Pitney, 1995; May et al., 2005). The studies were comprised of multi-component strategies in school-based settings, located in rural or remote communities, and measured outcomes such as service provider feedback and knowledge. Both reviews reported that all (Harlow et al., 2014) or most (Clifford et al., 2013) of the interventions were culturally adapted, consistent with our review. Clifford et al. (2013) suggested that cultural adaptations or tailoring...
may increase acceptability to Indigenous peoples, and in our review, we observed varying degrees of cultural adaptations or centering, but also tailoring to increase study feasibility. Among our 10 studies, 9 were included in the review by Leske et al. (2020) which had 24 studies. Our tenth study was published in 2020. Other differences were that we included interventions addressing suicide as an articulated goal, and individuals with an average age of 16 years or older. We also included hopelessness measures. Our analysis also included a table describing tailoring, modifications, and fidelity to the interventions. Leske et al. (2020) reviewed studies for community involvement in diagnosis, development, implementation, and evaluation of interventions using ranking and participation levels. As outlined in our results, it was critical in our review to include a detailed assessment to avoid a pan-Indigenous analysis and support Indigenous-specific reporting (Huria et al., 2019). As in our review, Clifford et al. (2013), Harlow et al. (2014) reported favourable outcomes and limited high-quality evaluations of such interventions, with few studies employing experimental designs suggesting a need for more high-quality evidence to demonstrate intervention effectiveness. Similar conclusions were drawn by Leske et al. (2020).

**Limitations**

We observed substantial methodological heterogeneity across the studies in our review. This meant we were unable to conduct a meta-analysis. Furthermore, we did not address sex or gender differences. When possible, such analyses may inform how participants of different sex and gender expressions experience interventions (Canadian Institutes of Health Research, 2019), which is important given the under-representation of women in some clinical trials (Office of Policy and International Collaboration, 2013; Pinnow et al., 2014). Finally, although we had a thorough search strategy and screening processes, we may have missed some suicide prevention interventions for Indigenous adults. For example, the outcome concept in our search strategy did not include the term “self-harm.” As such, we may have missed studies that only examined self-harm outcomes. It is also important to note that Indigenous involvement, self-determination, and governance or the cultural aspects of the research studies may not be accurately reflected due to journal restrictions.

**Implications and recommendations**

Continued efforts are needed to advance Indigenous health intervention development and evaluation. Such research is strengthened and equitable when it is Indigenous-led, involves Indigenous stakeholders throughout the research process, and prioritizes Indigenous interests (Huria et al., 2019). This ethical responsibility ensures that research is congruent with Indigenous methodologies, and that systemic inequities are not perpetuated (Bull, 2010; Chambers et al., 2018; Huria et al., 2019). These efforts are important in the context of interventions to have a broader impact on the determinants of health which are downstream factors that impact suicide and other mental health and wellbeing concerns. Indigenous governance and self-determination have been shown to act as protective factors against suicide for Indigenous populations (Chandler & Lalonde, 1998). Furthermore, cultural continuity and connectedness, determinants of health, are more likely to be centred and sustained with Indigenous involvement at community and individual levels within health research (Auger, 2016). Furthermore, 9 of the 10 studies we reviewed had a weak global rating. Indigenous involvement may have improved study retention and response rates or even enhanced the collection of information on withdrawals or drop-outs improving the rating for some of the quality assessment domains.

Notably, the criteria used to assess study quality in our review were based on a western scientific understanding of methodological rigour, which prioritize RCTs as the gold standard (Glover et al., 2015; Rosen et al., 2006). However, barriers to participating in RCTs exist for some Indigenous populations due to distrust or unfamiliarity with the research process (Glover et al., 2015). Study designs such as interrupted time-series (Paul et al., 2010) or Zelen designs (Hatcher et al., 2016; 2017; Torgerson & Roland, 1998) may help overcome some of the limitations of RCTs. Interrupted time-series designs allow for the implementation of whole community interventions, while trials with a Zelen design may improve participant recruitment since randomization occurs prior to consent. In this context, Hatcher et al. (2016) suggest that discussing complex concepts such as randomization or equipoise are not needed, which may be more appropriate for persons in crisis. Also, double consent may support research engagement since participants who decline the treatment to which they were randomized may opt to be in the other treatment arm (Hatcher et al., 2016; Torgerson & Roland, 1998). Such alternative rigorous study designs may improve the overall quality assessment of the studies.

The benefits of interventions may be enhanced in long-term studies permitting continued support for participants, and longer follow-up times to better understand whether the impacts of the intervention can sustain positive outcomes given only four studies had statistically significant reductions in suicide. For example, young adults engaged in interventions may carry positive changes into later adulthood (Cwik et al., 2016). There is a payoff for substantial financial investments in multi-tiered, community-wide intervention strategies as evidenced by changes in health-related outcomes at population levels (Sanson-Fisher et al., 2006). Although interventions that engage or build Indigenous people’s research capacities may be associated with increased cost, time, and effort, it is an essential component for self-determination and can maximize intervention relevancy and sustainability beyond the life of any given study (Harlow et al., 2014; Hatcher et al., 2017; Huria et al., 2019).

Finally, reducing suicide in Indigenous communities cannot be achieved solely through individual and community-level interventions. Structural changes are
needed, such as the improvement of social conditions, which necessitate broad social transformation based on principles of equity (Hatcher et al., 2017; Kirmayer et al., 2003; May et al., 2005; Pollock et al., 2018). National suicide prevention strategies have the potential to yield further information on effective systems-level Indigenous-led suicide prevention interventions in Indigenous communities (Calma et al., 2017; Commonwealth of Australia, 2017; Hatcher et al., 2017; Health Canada, 2019; Indian Health Service, 2011; Inuit Tapiriit Kanatami, 2016; Substance Abuse and Mental Health Services Administration, 2020; Te Rau Ora, 2020).

Conclusions
Several studies report on the effectiveness of culturally tailored or grounded suicide prevention interventions for Indigenous adults in Canada, the United States, New Zealand, and Australia. However, there remains a paucity of sustainable community-wide interventions evaluated with rigorous study designs among Indigenous populations, despite disproportionally higher suicide rates compared to non-Indigenous populations. Transformative changes in strategies against suicide must include prevention prior to and during suicide crises and periods after a crisis called postvention (Andriessen et al., 2017; Goebert et al., 2018; Hanssens, 2016). Indigenous communities have been vocal that suicide is symptomatic of the intergenerational impacts of colonization. Although short-term interventions can lead to promising changes, these are insufficient if additional resources are not dedicated for long-term changes at individual, family, and community-levels as standards of care to disrupt the impacts of colonization on the risk of suicide in Indigenous populations.

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