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# **A global systematic review of the effects of suicide prevention interventions in Indigenous Peoples**

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## **ABSTRACT**

**Objective** Suicide rates are often higher in Indigenous than non-Indigenous peoples. This systematic review assessed the effects of suicide prevention interventions on suicide-related outcomes in Indigenous populations worldwide.

**Methods** We searched CINAHL, Embase, PubMed, PsycINFO, ProQuest Dissertations & Theses and Web of Science from database inception to April 2020. Eligible were English-language, empirical, and peer-reviewed studies presenting original data assessing the primary outcomes of suicides and suicide attempts and secondary outcomes of suicidal ideation, intentional self-harm, suicide or intentional self-harm risk, composite measures of suicidality or reasons for life in experimental and quasi-experimental interventions with Indigenous populations worldwide. We assessed the risk of bias with the Cochrane Risk of Bias Tool and the Risk of Bias Assessment for Non-randomized Studies.

**Findings** We included 24 studies from Australia, Canada, New Zealand and the United States, comprising fourteen before-after studies, four RCTs, three non-randomised controlled trials, two interrupted time-series designs and one cohort study. Suicides decreased in four and suicide attempts in six before-after studies. No studies had a low risk of bias. There was insufficient evidence to confirm the effectiveness of any one suicide prevention intervention due to a shortage of studies, risk of bias, and population and intervention heterogeneity. Review limitations include language bias, no grey literature search and data availability bias.

**Conclusion** For the primary outcomes of suicides and suicide attempts, the limited available evidence supports multi-level, multi-component interventions. However, there are limited RCTs and controlled studies.

**Systematic review registration** CRD42018085238 in PROSPERO.

**Keywords:** Systematic literature review; Indigenous; suicidal behaviour; interventions; suicide prevention

***What is already known on this subject?***

Some systematic reviews of suicide prevention interventions in Indigenous populations have not focused strictly on suicide-related outcomes (e.g., suicides, suicide attempts and suicidal ideation). Some have focused on a specific intervention (i.e., gatekeeper training) or have only searched one database and had limited search terms. Therefore, an exhaustive global systematic review was needed to assess the current state of evidence for suicide prevention interventions targeting suicide-related outcomes for Indigenous populations globally.

***What this study adds?***

For the primary outcomes of suicides and suicide attempts, the limited available evidence supports multi-level, multi-component interventions. However, there are limited RCTs and controlled studies.

## **INTRODUCTION**

Suicide rates vary substantially in Indigenous Peoples worldwide.<sup>1</sup> Suicide rate parity between Indigenous and non-Indigenous populations exists in some contexts, while in other places rates have been over 20 times higher in Indigenous peoples.[1] While First Nations Peoples share colonisation and discrimination experiences, regional differences in its impact may explain these variations.<sup>1</sup> Recent reviews of suicide prevention interventions have focused on Indigenous youth<sup>2</sup> or all ages;<sup>3</sup> Australian Aboriginal communities;<sup>4</sup> rural American Indian/Alaska Native (AI/AN) youth<sup>5</sup> or circumpolar regions.<sup>6</sup> Global systematic reviews have focused only on gatekeeper training<sup>7</sup> or have had no risk of bias assessment and limited database searches and search terms.<sup>8</sup> The only ongoing review<sup>9</sup> is of Australian-only initiatives. We reviewed records in Google Scholar citing two recent (i.e., 2014 and 2015) reviews<sup>2,4</sup> and identified six different research groups publishing subsequent interventions, indicating enough new literature to warrant an updated review. Furthermore, recent methodological developments in systematic reviews warranted an updated review, like the new Risk of Bias Assessment for Non-randomised Studies (RoBANS) tool.<sup>10</sup> This review addresses a current research question as a 2018 systematic review found higher suicide rates in Indigenous populations.<sup>1</sup> This review thus examined the effects of interventions targeting suicide-related outcomes in Indigenous Peoples.

## **METHOD**

To improve review transparency, we registered the review protocol (CRD42018085238) with PROSPERO (the International Prospective Register of Systematic Reviews), and we reported the study (See Supplementary file [SF] 1) following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) Statement.<sup>11</sup> A review protocol is accessible online.<sup>12</sup> Figure 1 depicts the study selection process.

## **Eligibility criteria and search strategy**

This systematic review sought samples with a majority ( $\geq 50\%$ ) or subgroup analyses of Indigenous populations of any age. Eligible were peer-reviewed and published studies presenting original data without study design restrictions. We included non-randomised studies as we anticipated few randomised trials,<sup>13</sup> due to some Indigenous communities expressing discomfort with RCTs.<sup>14 15</sup> We sought English-language studies without date restrictions.

Two authors (KK, SL) refined search strategies (SF 2) that a librarian further refined. We last searched CINAHL, Embase, ProQuest Dissertation and Theses Global, PsycINFO, PubMed and Web of Science Core Collection on 22<sup>nd</sup> April 2020.

## **Study selection process**

One investigator (SL) deduplicated records in Mendeley, the Systematic Review Assistant Deduplication Module,<sup>16</sup> then in Endnote,<sup>17</sup> before manually reviewing duplicates detected. Two investigators independently screened unblinded records, resolving discrepancies through discussion.

## ***Data collection process***

We piloted a data extraction form on two included papers to assess feasibility. One author extracted the data. A second author checked all extractions in Microsoft Word tables.

We extracted

- study designs, settings, and durations;
- intervention types (i.e., universal, selective or indicated) per WHO definitions;<sup>18</sup>
- the unit of allocation, sample sizes of intervention and control group(s);

- the number eligible, enrolled, randomised, and analysed;
- the eligibility criteria, age, sex, country and ethnicity of participants;
- intervention details, number of follow-up measurements, exclusions, and numbers lost to follow-up (if applicable);
- the measurement tool and analysis used (e.g., intention-to-treat [ITT], per protocol [PP]);
- effect size measures (i.e., Cohen's *d*, rate or risk ratios);
- community involvement in the study.

### ***Outcomes***

Primary outcomes were suicides and suicide attempts. Secondary outcomes included suicidal ideation, intentional self-harm, suicide or intentional self-harm risk, composite measures of suicidality, and reasons for life.

### ***Risk of bias in individual studies***

One investigator (SL) assessed risk of bias at study and outcome level unblinded. Another investigator (KK) checked all judgements. We assessed RCT risk of bias with the Cochrane Risk of Bias (CRoB) tool<sup>19</sup> and RoBANS for non-randomised studies.<sup>10</sup> Both instruments have overall ratings of 'high', 'low' or 'unclear risk' of bias. We chose the CroB tool as Cochrane developed it following extensive consultation, empirical and theoretical evidence, and it emphasises judgement transparency.<sup>20</sup> RoBANS has moderate reliability, feasibility and validity.<sup>10</sup> Both tools assess selection, performance, detection, attrition, and reporting bias.

### ***Risk of bias across studies***

One investigator (SL) extracted data, and another (KK) checked all judgements. We looked for publication bias by searching clinical trial registers and a theses and dissertations database. We assessed selective outcome reporting bias by comparing pre-specified outcomes in available protocols or methods and results sections.

### *Data synthesis*

Studies were too methodologically and clinically diverse to pool in a meta-analysis, and thus we undertook a narrative synthesis.

## **RESULTS**

We included 24 studies (See Figure 1). Studies occurred in the US ( $n=15$ ), Australia ( $n=4$ ), Canada ( $n=4$ ) or NZ ( $n=1$ ). Ten studies had follow-up periods under six months. Studies using surveillance data examined periods of seven to 27 years.

Twelve studies were targeted towards or included youth up to the age of 25. Three studies had upper age limit requirements of 35 [21] or mean ages of 31-33 [22] or 36.[23,24] Sample sizes were under 20,<sup>25 26</sup> between 50 and 100,<sup>15 21 23 27-32</sup> between 100 and 200,<sup>14 33-37</sup> or above 300.<sup>22</sup>

24 38

Supplementary files contain participant (SF 3), study methods and intervention characteristics (SF 4). Most interventions ( $n=13$ ) were selective, focusing on subgroups with increased suicide risks (SF 4). Five universal interventions targeted whole populations or communities. Three indicated interventions targeted people with risk factors or conditions putting them at very high risk of suicide. Three studies had universal, selective, and indicated strategies operating



together. Study designs included uncontrolled before-after ( $n=14$ ), RCTs ( $n=4$ ), non-randomised controlled trials ( $n=3$ ), interrupted time-series ( $n=2$ ) or cohort studies ( $n=1$ ).

### **Risk of bias**

SF 5 and 6 summarise percentages of risk of bias in different domains. All studies had a high risk of bias on one or more areas, except Cwik et al.,<sup>[39]</sup> with an unclear risk of bias overall.

### **Risk of bias within studies**

All RCTs had a high risk of bias overall (SF 7 and 8). Garcia<sup>30</sup> described a non-random component, randomisation by school grade, in the sequence generation process, and did not describe allocation concealment. However, the author and potential participants could foresee assignments, and thus introduce selection bias, as allocation was explicitly unconcealed.<sup>30</sup> Sareen et al.<sup>15</sup> did not appear to use a random component in the sequence generation process or have an allocation concealment mechanism. They conducted per-protocol analyses for both outcomes, and missing data might relate to the outcome and be sufficiently large to induce clinically relevant bias. In Tighe et al.,<sup>21</sup> the central coordinating centre did not conceal allocation from the research officer enrolling participants. Hatcher et al.<sup>22</sup> had selective outcome reporting bias, discussed further in the risk of bias across studies. All RCTs except Hatcher et al.<sup>22</sup> had a high risk of performance and detection bias due to using self-reported outcomes.

All other studies (SF 9 and 10) except Cwik et al. [39] and the non-randomised controlled trials<sup>14 29 35</sup> had high risks of selection bias due to inadequate participant selection. Remaining studies either did not have a control group or collected data retrospectively. Berman et al.<sup>33</sup> had a high risk of selection bias as they did not adjust for confounding variables. Eleven studies had

elevated risks of performance bias from using self-reported measures. The same nine studies and Cwik et al.<sup>31</sup> had a high risk of detection bias due to unblinded outcome assessors. Allen et al.<sup>14</sup> had a high risk of attrition bias from differential withdrawal across groups. Skerrett et al.<sup>27</sup> and Nathan et al.<sup>32</sup> had high risks of attrition bias as non-completers differed from completers. Eight other studies had unclear risks of bias for incomplete outcome data, as they did not report either attrition or differences between study completers and non-completers.

### **Risk of bias across studies**

Two studies<sup>22 29</sup> had high risks and another an unclear risk<sup>39</sup> of selective outcome reporting. Hatcher et al.<sup>22</sup> did not report suicidal ideation, pre-specified in the protocol, at 3- and 12-month follow-ups. LaFromboise and Howard-Pitney<sup>29</sup> did not report suicidal behaviour. Cwik et al.<sup>39</sup> evaluated a surveillance system assessing suicidal ideation, but they did not report this outcome. Despite contacting authors and reviewing institutional repositories, we could not locate the full texts of some evaluations of the Jicarilla Tribal Nation program<sup>40-42</sup> and the Zuni Life Skills Development Curriculum (ZLSDC),<sup>43</sup> making publication bias possible. These two programs and the White Mountain Apache Surveillance System<sup>31 39</sup> are all longstanding initiatives, so there might be other evaluations of them. Other studies had small sample sizes or used medical records, registries or secondary data, also indicating publication bias.<sup>44</sup>

### **Data synthesis**

SF 11 lists the results for each outcome of interest in individual studies. Substantial clinical and methodological diversity precluded meta-analysis and warranted narrative synthesis.

### **Primary outcomes**

#### *Suicides*

All studies of suicides were controlled or uncontrolled before-after studies. Three studies looked at alcohol control measures. Berman et al.<sup>34</sup> found that, in 1980-1993, more restrictive community alcohol control measures (i.e., dry – sale and importation prohibited) were associated with suicide rates 0.4 per 100,000 people lower. However, in communities with less restrictive controls (i.e., damp – importing for personal use permitted or sale allowed at a licensed store), suicide rates decreased by 55.5 per 100,000 (rate ratio [RateR]=0.54, 95% CI=0.40-0.73) in 1980-1993. Wood and Gruenewald<sup>37</sup> found that the average annual age-adjusted suicide rate per 100,000 population aged 15 years and over was 77 in wet isolated AN villages and 76 in dry, isolated AN (RateR=0.98, 95% CI=0.70-1.38). Berman[34] found that alcohol prohibited by federal law in three communities was associated with lower suicide risks in communities with dry status (risk ratio [RiskR]=0.40, 95% CI=0.17-0.93) and communities with any local option (RiskR=0.39; 95% CI=0.16-0.95).

Three other studies targeted youth. A study<sup>39</sup> of universal, selected and indicated interventions observed a 38.3% decrease in the age-standardised suicide rate (41 to 29 suicides) from 2001-2006 to 2007-2012 (RateR=0.62, 95% CI=0.53-0.72), while national rates fluctuated little. Suicides only ranged between one and two annually in 15 years of a comprehensive, multi-level (i.e., universal, selective and indicated) intervention in multiple settings (RateR 1990-2000=0.87, 95% CI=0.05-13.84).<sup>45</sup> In a multi-component universal intervention including a residential program, family outreach, community events, educational programs, traditional value promotion and native mental health workers,<sup>46</sup> suicides decreased from eight in 1975 (267 per 100,000) to four in 1976-1980 (26.7 per 100,000 annually; RateR=0.10, 95% CI=0.07-0.15).

### ***Suicide attempts***

There were no suicide attempts after interventions in both arms in the RCT by Sareen et al.<sup>15</sup> In an uncontrolled before-after study, a peer support intervention with traditional activities with AI,<sup>23</sup> suicide attempts decreased by 0.02 mean days at 6-month follow-up (Cohen's  $d=0.23$ ). Suicide attempts decreased in five uncontrolled before-after studies. Annual suicide attempts reduced from 75 in 2007 to 35 in 2012 in Cwik et al.,<sup>39</sup> an uncontrolled study of a comprehensive intervention that included psychoeducational elements, peer support programs and training. Another uncontrolled before-after study of interventions including psychoeducational and guideline-based public health programs found that suicidal behaviour (some suicides but mainly suicide attempts) decreased from 59.8 ( $n=34$ ) per 1,000 people before program implementation (1988-1989), to 8.9 ( $n=5$ ) per 1,000 people (1990-1991), with RateR=0.15 (95% CI=0.08-0.30).<sup>47</sup> A subsequent uncontrolled program evaluation found decreases in suicide attempts from 19.5 per year in 1988-1989 to four in 2002.<sup>45</sup> In an uncontrolled intervention described above,<sup>46</sup> suicide attempts decreased from 35 (11.7 per 1,000) in 1975 to 13 (3.7 per 1,000) in 1981 (RateR=0.29, 95% CI=0.17-0.52). In another uncontrolled study,<sup>24</sup> suicide attempts decreased in a long-term residential treatment group from six to zero at six-month follow-up. Nathan et al.<sup>32</sup> observed that 18 people who reported suicide attempts in the three months before program admission did not report suicide attempts in the three months post-discharge.

## **Secondary outcomes**

### ***Suicidal ideation***

Two RCTs assessed suicidal ideation. Sareen et al.<sup>15</sup> compared a two-day gatekeeper training program, Applied Suicide Intervention Skills Training (ASIST),<sup>48</sup> to a two-day resilience retreat. Although the same number at baseline reported suicidal ideation in the two groups

( $n=2$ ), seven people (25% of responders) from the ASIST group and only one person (4.5% of responders) from the retreat group reported suicidal ideation at follow-up (RiskR=5.50, 95% CI=0.73-41.44). Tighe et al.<sup>21</sup> tested an acceptance and commitment therapy intervention on an Android tablet application. Suicidal ideation decreased from pre- to post-intervention in both the intervention group (Cohen's  $d=0.37$ ) and the wait-list control group (Cohen's  $d=0.22$ ).

Two non-randomised studies reported on suicidal ideation. A pilot intervention of the ZLSDC,<sup>29</sup> a youth skills training intervention, found that mean suicidal ideation scores decreased from 16.7 at pre-test to 13.4 at post-test ( $Mdiff=4.3$ ), the latter being equivalent to the control group at post-test (pre not measured). In the full ZLSDC intervention,<sup>35</sup> suicide probability (included ideation) decreased in the intervention (Cohen's  $d=0.56$ ) and no intervention groups (Cohen's  $d=0.19$ ).

Four before-after studies reported on suicidal ideation. Suicidal ideation reduced (Cohen's  $d=0.27$ ) in youth participating in culturally appropriate traditional activities at camps.<sup>36</sup> Cwik et al.<sup>31</sup> tested a psychoeducational and psychosocial intervention and observed a decrease in participants scoring above the clinical cut-off on two suicidal ideation scales from seven of 11 (64%) at baseline to one of 11 (9%) at two-month follow-up (RiskR=7, 95% CI=1.03-47.82). A mindfulness-based before-after intervention study, including prayer and experiential activities<sup>25</sup> was associated with suicidal ideation decreasing from 44% to 0% in eight Native American youths. A program including health promotion, spiritual and intergenerational trauma elements observed reductions in the suicidal ideation mean score post-intervention (Cohen's  $d=0.41$ ) and slightly (Cohen's  $d=0.10$ ) at two-month follow-up.<sup>27</sup>

### ***Suicide or intentional self-harm risk assessment***

In a retrospective cohort study,<sup>38</sup> each day attending an Aboriginal art program (compared to not attending) reduced the rate of receiving a suicide or intentional self-harm risk assessment on average by 23.5% (RR=0.81, 95% CI=0.75-0.88) after adjusting for suicide or intentional self-harm history. However, the risk assessment could lead to a judgement of ‘no’, ‘low’, ‘medium’ or ‘high’ risk, and the study did not differentiate between these categories.

### ***Intentional self-harm***

One Zelen RCT of a multi-component intervention<sup>22</sup> used problem-solving therapy with Māori presenting to hospital with intentional self-harm. They observed fewer hospital representations for intentional self-harm in the intervention group relative to usual care at three months (RiskR=0.58, 95% CI=0.34-0.98) that persisted only slightly at 12 months (RiskR=0.92, 95% CI=0.68-1.25). A multi-component intervention in multiple settings, including traditional activities, social services, life skills development, and community education<sup>45</sup> was associated with decreased intentional self-harm, from 15 per year in 1988-1989 to eight in 2002. Little difference existed in age-adjusted rates of self-harm per 100,000 person-years in wet (223) and dry (245) villages (RateR=0.91, 95% CI=0.76-1.08) in Wood and Gruenewald.<sup>37</sup> Findings were similar for wet communities with (231) or without (209) police presence (RateR=0.91, 95% CI=0.65-1.26) and almost identical for dry communities with (245) or without (247) police (RateR=1.00, 95% CI=0.83-1.22). Nathan et al.<sup>32</sup> found that 27 of 89 participants reported self-harm at baseline, and only six reported self-harm at follow-up (RiskR=0.22, 95% CI=-0.10-0.51) in a residential treatment program.

### ***Composite measure of suicidality***

One RCT<sup>30</sup> used a scale with items assessing suicidal ideation, suicide plans, suicide attempts, and medical consequences from suicide attempts. In this values-based vocational intervention

for Native American youth, suicidality in the past year increased in the intervention group and decreased in the wait-list control group. Tu et al.,<sup>26</sup> in a study incorporating Elders into primary care, observed a 2-point decrease in suicide risk, sustained over six months. However, final scores were still slightly above elevated risk for non-suicidal samples.

### ***Reasons for life***

A before-after small sample feasibility trial of cultural engagement modules observed effect sizes approximating medium for the dose (i.e., intervention activities attended) in two separate intervention studies (Cohen's  $d=0.32$  and  $0.25$ ).<sup>28</sup> The subsequent full non-randomised controlled trial<sup>14</sup> of the same modules found a small-to-medium effect (Cohen's  $d=0.27$ ) favouring intervention in the interaction contrasting treatment and comparison arms on reasons for life.

## **DISCUSSION**

We found 24 studies of suicide prevention interventions in Indigenous populations measuring suicide-related outcomes in Indigenous Peoples; 19 more than a 2017 review.<sup>8</sup> Most studies (14) were uncontrolled before-after designs, followed by four RCTs, three non-randomised controlled trials, two interrupted time-series designs and a cohort study.

There was some limited evidence of reduced suicides associated with non-randomised controlled studies of alcohol prohibition policies and comprehensive, multi-level interventions. Alcohol prohibition findings align with a recent review.<sup>49</sup> Multi-level interventions to reduce suicide are seemingly synergistic,<sup>50</sup> thus, reductions in multi-level interventions are consistent with broader suicide literature.

For suicide attempts, the limited evidence favoured multi-level programs with universal, selective and indicated interventions operating together.<sup>39 45 47</sup> There were also reductions in long-term universal interventions<sup>46</sup> and ‘holistic’ residential treatment programs for substance use with ongoing follow-up.<sup>24</sup> These findings reemphasise the need for multi-level, long-term efforts.

Secondary outcomes were heterogeneous. In two RCTs, suicidal ideation<sup>15</sup> or scores on a composite measure assessing suicidality<sup>30</sup> increased in intervention groups and decreased in control groups. Other RCTs<sup>21 22</sup> observed decreases in both intervention and control groups, with larger reductions in intervention groups. Most studies were uncontrolled before-after designs, making it difficult to ascribe changes to interventions due to confounding. Some studies used composite measures of suicidality, making interpretation difficult.

Of studies with community development elements, most (15) had moderate to high levels (5-7 on a scale of 7) of community involvement in diagnosis, development, implementation and evaluation of interventions (SF 12 and 13).

### ***Limitations***

RCTs did not use random sequence generation methods and allocation concealment mechanisms, which are both associated with exaggerated treatment effects.<sup>51 52</sup> Investigators did not always use medical records and official statistics; however, they might prevent performance, detection and attrition biases that were common in included studies. Investigators did not always conduct attrition analyses, but they may help to understand the likelihood of attrition bias, the applicability of findings, or reasons for attrition. In terms of outcome-level



limitations, researchers did not always report rationales for not assessing or reporting on pre-specified outcomes, although this may not exaggerate treatment effects.<sup>51</sup>

Limitations of this review include lack of meta-analysis, data availability, and cultural biases. We could not locate another evaluation<sup>43</sup> of the ZLSDC or three evaluations of the Jicarilla suicide prevention program.<sup>40-42</sup> Feasibility prevented grey literature searches and two authors independently conducting risk of bias assessments. Our review did not focus on Indigenous health knowledge systems, omitting valuable Indigenous-derived outcome data.

### **Implications**

Clinicians should be cautious, given the limited available evidence for interventions, and collect and monitor outcome data for Indigenous clients to gauge treatment effectiveness. Population health efforts should focus on multi-level, multi-component interventions to prevent suicide attempts and deaths, which is consistent with the limited available evidence in this review and the broader literature.<sup>50</sup>

The primary need for future research is the inclusion of control groups or communities. Active or usual care (if existing) control groups are preferable to wait-list controls to maximise benefits to control group participants and communities, provide appropriate treatment and monitoring, minimise adverse events and benchmark against usual care. While RCTs are desirable, they may not be feasible with Indigenous populations. Therefore we recommend well-powered trials using robust methodologies that reduce the empirically-documented sources of bias (e.g., selection bias) this review identified.

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### **Competing interests**

There are no competing interests.

### **Author contributions**

EP and KK conceived the study. SL designed and ran searches. SL, KK and MG screened records, conducted risk of bias assessments and extracted data. BL and SL extracted data for Indigenous involvement and SL and MG checked these extractions. All authors made substantial intellectual contributions and revisions to the draft manuscript.

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