

SYSTEMATIC REVIEW

Effectiveness of Smoking Cessation Interventions among Indigenous Populations: A Systematic Review

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ABSTRACT

Background: Indigenous populations globally experience disproportionately high smoking rates compared to non-indigenous groups, underscoring the need for tailored cessation interventions. This systematic review evaluates the effectiveness of smoking cessation strategies specifically designed for Indigenous populations. **Methods:** A systematic review was conducted following PRISMA guidelines, assessing trials published from 2014 to 2024. Databases searched included the Web of Science, Cochrane Library, SCOPUS, PUBMED, and Google Scholar with a predetermined filter, yielding 2,733 titles and abstracts. Eligible studies included: i) randomised controlled trials (RCTs) and quasi-randomised controlled trials published from 2014 to 2024, ii) involved Indigenous active smokers, and iii) focused on specific smoking cessation interventions. The risk of bias was evaluated via the Cochrane Risk of Bias Tool for RCTs (RoB 2.0), and the Risk of Bias in Non-randomised Studies of Interventions (ROBINS-I). **Results:** 14 studies met the inclusion criteria, encompassing pharmacological, behavioural, cultural, and combined interventions. Interventions incorporating cultural adaptation, community engagement, and early involvement with Indigenous populations demonstrated greater effectiveness. **Discussion:** Findings suggest that successful cessation strategies for Indigenous populations are those that integrate holistic, culturally safe, and community-driven approaches. However, this study is limited by the lack of longitudinal studies assessing long-term cessation maintenance and tobacco use outcomes. **Impact:** This review highlights the importance of culturally relevant smoking cessation strategies, providing a framework for future interventions and research aimed at Indigenous groups, thereby addressing health disparities in smoking-related outcomes.

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INTRODUCTION

Specific definitions of the term 'Indigenous' vary among different regions and demographic groups, and these definitions are often subjects of intense debate and not universally accepted or adopted (1). Examples of such variations include designations like 'Aboriginal Australians' or 'Torres Strait Islanders' for the Indigenous people of Australia, 'First Nations' occasionally used for the Indian, Metis, and Inuit communities Indigenous to the United States of America (USA) and Canada, 'Native Hawaiians' for the Indigenous inhabitants of Hawaii, and 'Tangata Whenua' or 'People of the land' for the Māori of New Zealand (2). Each of these Indigenous populations has faced colonisation and displacement

from their ancestral lands and cultural heritage after living in their country for thousands of years (2)

Tobacco smoking, a significant risk factor for chronic conditions such as cardiovascular disease, type 2 diabetes, and cancer (3,4), is more prevalent in Indigenous communities worldwide than in non-indigenous populations. In countries such as New Zealand, USA, and Australia, these disparities are striking: Māori adults have a smoking prevalence of 19.9%, compared with 8.0% for the general adult population in New Zealand; American Indians and Alaskan Natives have a smoking rate of 27.1%, whereas the overall USA adult population sits at 12.5%; and among Indigenous Australians, the smoking rate is 37%, versus 11.6% for the broader Australian population (5–7). In South Asia, tobacco use remains disproportionately high among Indigenous populations, with one study in India reporting smoking and smokeless tobacco use at 25% and 36%, respectively, markedly higher than the 18%

and 19% observed among non-indigenous groups (8). In Southeast Asia, data from Malaysia similarly indicate elevated tobacco use, with a 25.8% prevalence among Indigenous populations, surpassing the 2015 national average for other Bumiputera groups (9).

The smoking behaviours among Indigenous people vary based on the specific community and geographical region. As indicated by West (2017) and Johnston & Thomas (2008) (10,11), smoking is frequently perceived as a social activity among men, serving to establish and maintain community relationships. Studies have also suggested that smoking may be viewed as a coping mechanism for stress or boredom, and as a symbol of masculinity (12–14). Some Indigenous tribes utilise traditional tobacco products for ceremonial purposes, such as in parts of Australia, British Columbia, Canada, and among American Indians and Native Alaskans (15–17). While traditional tobacco used in rituals and ceremonies is considered natural, non-addictive, and lacking additives, it is crucial to recognise that both traditional and commercial tobacco usage pose significant health risks. In fact, many Indigenous societies discourage smoking because of its adverse health effects (18–20).

Inhibition of the beginning or continuing smoking habit may be achieved by providing treatments for smoking cessation, which will lower the smoking prevalence (21). Efforts to curb smoking rates within Indigenous populations must consider the unique cultural role of tobacco. Smoking cessation interventions designed for the general public often overlook this traditional perspective, potentially creating an incongruent and negative perception of tobacco among Indigenous individuals (22–27).

The rationale for undertaking this study lies in the imperative need to comprehensively understand and address the complexities surrounding smoking cessation interventions within Indigenous populations. Given the distinct cultural perspectives on tobacco use and the unique challenges faced by Indigenous communities, there is a compelling need to bridge existing gaps in knowledge. The disparities in smoking prevalence, along with the limitations of generic cessation strategies in addressing the cultural significance of tobacco, highlight the need for targeted interventions tailored to Indigenous populations. While cessation interventions tailored to Indigenous populations have gained attention in the past two decades (28,29), there remains a significant knowledge gap regarding the effectiveness of multifaceted behavioural, community, and pharmaceutical interventions in addressing smoking prevalence among Indigenous people (30).

Earlier systematic reviews by Carson et al. (2014) (31) have evaluated tobacco cessation interventions for Indigenous populations; however, they are currently

dated (included studies up to 2014). More recent evidence by Rusk et al. (2023) (22) highlighted the growing emphasis on culturally adapted interventions, but it included only the population from North America. Therefore, this review, as a continuation from Carson et al.'s study, seeks to address these gaps by systematically assessing smoking cessation interventions designed for Indigenous populations globally, consolidating these findings to guide future cessation programmes and research initiatives. This review could contribute vital insights into the efficacy of multifaceted approaches specific to Indigenous populations, including behavioural, community-based, and pharmaceutical interventions.

METHODS

The study protocol was designed following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA) guidelines (32). The research was registered with the University of York's Prospective Register of Systematic Reviews (PROSPERO) under the registration number CRD42024510014. The PICO model was used to select research articles based on the objective of this systematic review. For this review, the following PICO [P (Population), I (Intervention), C (Comparison between experimental and control groups), and O (Outcomes)] was formulated:

P: Indigenous smokers (adult and adolescent)
I: Smoking cessation intervention or program
C: Experimental vs. control group
O: Smoking cessation or behaviour alteration

Search Methods

A comprehensive electronic search was conducted via SCOPUS, Web of Science, PUBMED, the Cochrane Library, and Google Scholar (Supplementary File). NLR and NFF independently and systematically searched each database using the following keyword combinations:: (("aborigin*" OR indigenous OR native* OR "Native Hawaiian" OR "Pacific Islander" OR "Asian Pacific Islander" OR "Native American Indian" OR "American Indian" OR "oceanic ancestry group" OR "Alaska Native*")) AND ((smok* OR tobacco OR cigarette) AND (counsel* OR advice OR prevention* OR intervention* OR treatment* OR program*)) AND (cessation OR abstin* OR quit* OR stop* OR reduction OR reduce*)). The search terms "smok*" and "abstin*" were intentionally truncated to capture all possible word variations (e.g. "smoke", "smoker", "smoking", "smokers", "abstinence" and "abstinent"). A predetermined search filter was implemented, restricting the results to English publications, published between 2014 and 2024. The outcomes of each database's search (as of 7 December 2024) were exported and merged using the Mendeley reference management software. Duplicate entries were identified and removed within Mendeley prior to the screening process. Backward

citation chaining (screening reference lists of included articles) and forward citation tracking (via Scopus, PUBMED, Web of Science and Google Scholar) were conducted to identify any additional relevant studies not captured in the initial search. However, hand-searching of journals was not undertaken due to time and resource limitations, a constraint commonly acknowledged in the methodology of many published systematic reviews (33).

Eligibility Criteria

This review included RCTs and quasi-randomised controlled trials published from 2014 to 2024. The participants included adolescents and adults Indigenous to their country, irrespective of age or sex, and were active smokers participating in a smoking cessation programme. Studies among pregnant women were excluded. To maximise study inclusivity while ensuring a reasonable focus on interventions targeting Indigenous groups, studies incorporating a sample size of 25% or more for a specified Indigenous group (or less if corresponding data were available for their respective Indigenous groups) were considered for inclusion (based on a criteria set by Carson et al. (31)). If subgroup data were not disaggregated and the intervention effects could not be attributed specifically to Indigenous participants, those studies were excluded to maintain the review's focus on Indigenous-specific outcomes and to ensure validity in interpretation. The tobacco used for this review included all combustible products, including cigarettes, cigars, pipes and hookahs (34).

The included interventions were pharmacotherapies, behavioural therapies, alternative therapies (such as acupuncture, hypnotherapy, and aversion therapy (31)), public policy, culturally tailored therapies, and combination therapy (including a combination of at least two therapies from the above four categories). The culturally tailored tobacco cessation intervention was defined as per Rusk et al. (2023) (22), which included: i) any existing cessation intervention modified to include Indigenous beliefs, language, or specific tribal stories or ii) a novel cessation tool created with integrated Indigenous beliefs, language, or specific tribal stories. Interventions involving Indigenous personnel were also included as culturally tailored tobacco cessation interventions. The controls assessed included usual practice, no intervention, placebo, co-interventions or reduced intervention (31).

This review examined cessation from smoking tobacco products or smoking behaviour alterations among Indigenous smokers as the primary outcome measure. Smoking cessation was defined as complete abstinence from the use of commercial cigarettes for a minimum of 24 hours (22,35,36). Patient self-reports, provider-collected cessation information, and biochemical confirmation (exhaled carbon monoxide, salivary cotinine, urine cotinine, and other evidence-based

biological markers) were all valid methods for defining smoking cessation.

Study Selection and Data Extraction

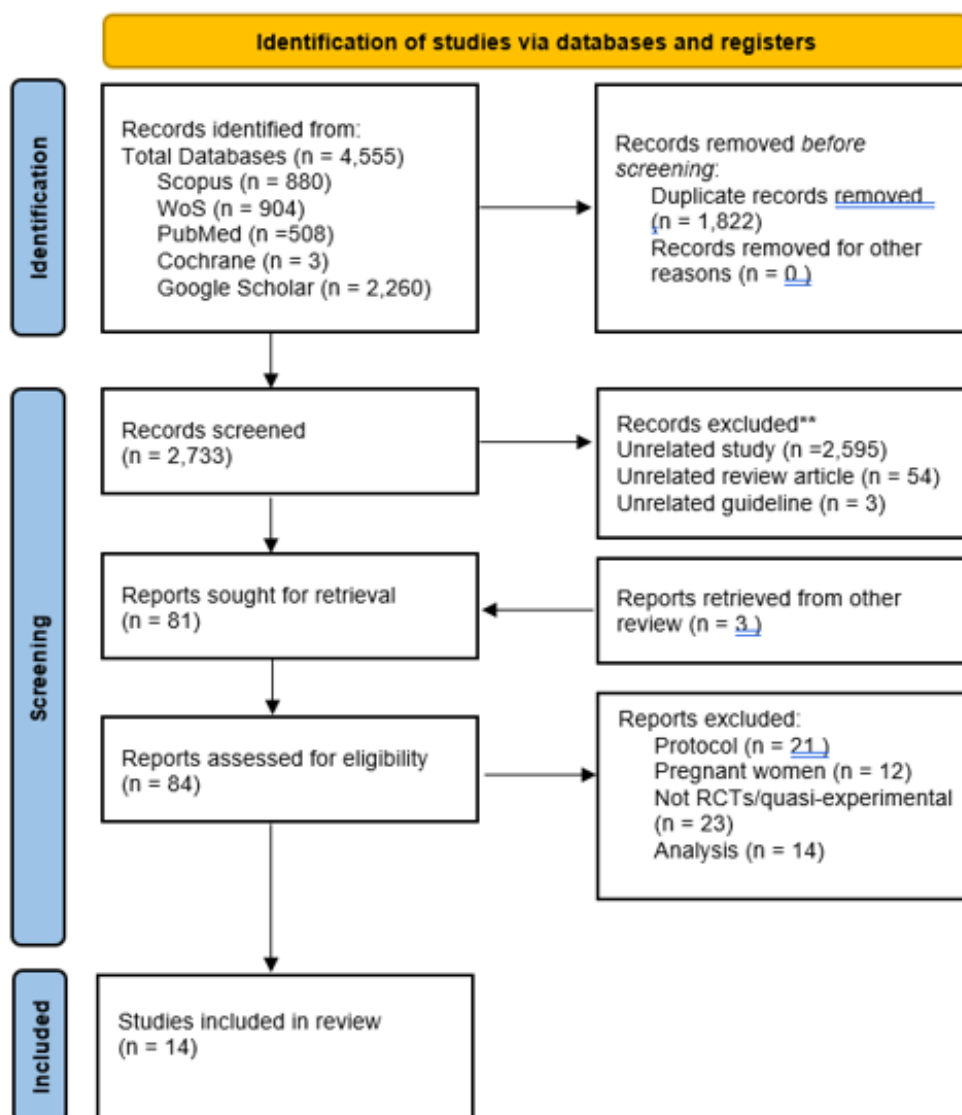
The titles and abstracts of all identified papers were independently assessed for relevance by two reviewers (NLR and NFF). All relevant studies were independently evaluated in full against the inclusion and exclusion criteria by the same reviewers (NLR and NFF). A third reviewer (AAM) resolved any conflicts between the two initial coders. A data extraction form was developed and included the following: authors, study design, country, demographics, sample size, population of interest, intervention (and control) details, outcome measures and follow-up duration. The outcome measures were grouped into comparable categories (e.g., point prevalence abstinence, continuous abstinence, reduction in smoking frequency) to facilitate comparison. Studies lacking comparable metrics were described narratively. This approach enabled synthesis while respecting methodological diversity across studies. NLR conducted the data extraction, which was verified by two other review authors (AAM and NRY) to reach a consensus.

Methodological Quality Assessment

The studies were assessed for risk of bias using the Cochrane assessment tools: Risk of Bias 2 for RCTs (RoB 2.0) (37) and the Risk of Bias in Non-Randomised Studies of Interventions (ROBINS-I) for non-randomised trials (38). The RoB 2 tool presents a systematic approach to evaluating the risk of bias in the outcomes of various randomised trials, including individual and cluster RCTs. On the other hand, the ROBINS-I tool is designed to assess the risk of bias in the outcomes of non-randomised studies of interventions (NRSIs) where randomisation was not used to allocate individuals or clusters to comparison groups (38). Both the RoB 2.0 and ROBINS-I tools assess multiple specific criteria, categorising responses as "Yes/Probably Yes," "No/Probably No," or "No Information" based on the available data. Then, the overall risk of bias for each study was determined. For RCTs evaluated using RoB 2.0, studies were classified as having either "Low," "Some Concerns," or "High" risk of bias. Meanwhile, studies assessed with ROBINS-I were categorised as having a "Low," "Moderate," or "High" risk of bias. To maintain a thorough and rigorous evaluation, NLR and NFF independently conducted these assessments, resolving any disagreements through discussion with NRY and AAM.

RESULTS

The search yielded 2,733 titles and abstracts without duplicates, with 84 studies included in the full-text review. 14 studies met the inclusion criteria. The exclusion criteria can be found in the PRISMA flow diagram (Fig. 1). Details of the included studies are outlined in Table 1.



*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

Fig 1: PRISMA flow diagram.

Table II: Description of included studies.

Authors, country and study design	Population	Sample size	Intervention	Outcome and duration	Findings	Risk of bias
Campbell et al., 2014 (48), Australia <i>Cluster RCT</i>	Aboriginal and Torres Strait Islander populations aged ≥ 15	Recruited (n=449) Completed (n=418)	Intervention: 6-component intervention program was developed by the Indigenous Health Promotion Team (Tropical Public Health Unit, Queensland Health) 12 months Control: No intervention, survey only	Self-reported daily tobacco use	- Intervention site: Prevalence of daily smokers declined significantly between baseline and follow-up: from 43.6% (39, 48.3) to 35.2% (30.6, 40) ($p < 0.011$) - Control communities: Non-significant decline in the number of daily smokers between baseline and follow-up: from 44.7% (38.6, 51.2) to 36.5% (30.1, 43.4) ($p < 0.075$) - Significant ($p < 0.001$) overall decline of 16.8% in the mean number of cigarettes smoked weekly in the intervention sites, from an average of 113.2 (98.9, 140.3) to 94.2 (82.6, 101.3), compared to a non-significant ($p < 0.143$) 6.7% decline in control sites.	Moderate
Choi et al., 2017 (39), USA <i>Cluster RCT</i>	Rural or reservation-based American Indian smokers aged 18 years.	Recruited (n=624) Completed (n=463)	Intervention: culturally tailored All Nations Breath of Life (ANBL) – in-person and group counsellings through phone or face-to-face, culturally tailored educational curriculum, pharmacotherapy, and incentives Control: non-tailored current best practices (CBP)	- Salivary cotinine-verified 7-day point prevalence smoking abstinence 6 months	- Self-reported point prevalence abstinence rates at 12 weeks: 27.9% in the ANBL arm and 17.4% in the CBP arm ($p=0.028$). - Statistically significant difference in self-reported 6-month point prevalence abstinence rates between ANBL (20.1%) and CBP (12.0%) arms ($p=0.029$). - None of the cotinine-verified results were statistically significant.	Moderate
Dignan et al., 2019 (40), USA <i>Individualised RCT</i>	American Indians aged 18 years or older	Recruited (n= 254) Completed (n=16)	- Participants were assigned to 1 of 15 groups, each receiving different combinations of four intervention strategies: i) Nicotine Replacement Therapy (NRT), ii) Pre-cessation Counselling, iii) Post-cessation Counselling, and iv) mHealth text messages. - The control aspect of the study was represented by the minimal intervention groups, which received less intensive versions of the same strategies.	- Self-reported abstinence from smoking verified by carbon monoxide measurement 18 months	- At the quit date, 61% of participants who remained in the study were abstinent 18 months post-quit date: 88% (14/16) participants were abstinent (Fisher exact $p=.049$). - Receiving NRT was associated with increased odds of quitting smoking at the 18-month follow-up - The use of mHealth text messaging as a form of social support did not show a direct association with smoking cessation outcomes.	Moderate

CONTINUE

Table II: Description of included studies. (CONT.)

Authors, country and study design	Population	Sample size	Intervention	Outcome and duration	Findings	Risk of bias
Livingston et al., 2018 (41)a community organizing intervention designed to reduce youth alcohol access, and CONNECT, an individual-level screening and brief intervention approach—on other drug use outcomes. Methods. We conducted a community intervention trial with quarterly surveys over 3 years (2012–2015, USA) <i>Cluster RCT</i>	High school students (Grade 9 & 10) of the Cherokee Nation (American Indians), Oklahoma	n= 1,623	Intervention: - Communities Mobilising for Change on Alcohol (CMCA) only (established community environmental change intervention), - community organising intervention designed to reduce youth alcohol access (CONNECT) only (individual-level screening and brief intervention approach) - both interventions combined Control: Delayed intervention	Self-reported use or misuse in the past 30 days of cigarette 3 years	Both interventions were associated with statistically significant decreases in the number of nonalcohol drugs used in the past 30 days. Students in the CONNECT-only condition reported lower cigarette use (8%) compared with other conditions (approximately 14%; $c2 = 8.03$; $p = .046$)	High
Marley et al., 2014 (49), Australia <i>Individualised RCT</i>	Adult Australian Aboriginal and Torres Strait Islander smokers aged ≥ 16 years	n = 163	Intervention: Tailored smoking cessation counselling delivered by Aboriginal researcher during face-to-face visits. Control ("usual care"): routine care relating to smoking cessation at their local primary health care service.	Self-reported smoking cessation with urinary cotinine confirmation 12 months	Smoking cessation rate for participants in the intervention group ($n = 6$; 11%) was double that of usual care ($n = 5$; 5%), but not statistically significant ($p = 0.131$).	Moderate
Patten et al., 2014 (50), USA <i>Cluster RCT</i>	Alaska Native (AN) adolescents aged (12–17 years)	Recruited ($n=68$) Completed ($n=63$)	Intervention: culturally and youth-specific counselling and written self-help materials for quitting tobacco Control: Delayed intervention (6 month) vary cotinine	Self-reported tobacco abstinence verified with salivary cotinine 6 months	The 7-day point-prevalence self-reported tobacco abstinence rates for intervention and control participants were 10% (4/41) and 0% (0/27) at both week 6 and 6 months ($p = .15$). Only 1 adolescent in the intervention condition was biochemically confirmed abstinent at week 6 and none at 6 months.	High
Patten et al., 2023 (51), USA <i>Individualised RCT</i>	Alaska Native (AN) adults smokers aged ≥ 19 years	Recruited ($n=61$) Completed ($n=35$)	Intervention: Secret (entirely private and non-searchable) Facebook group moderated by two Alaska Native Trained Tobacco Specialists + Evidence-based cessation treatments (EBCTs) referral by postal mail (printed materials) and e-mail. Control: EBCT referral information	7-day point-prevalence abstinence smoking abstinence verified by salivary cotinine 6 months	Smoking abstinence was higher for intervention than control participants at 3 months (6.5% vs. 0%, $p = .16$) but comparable at 6 months (6.4% vs. 6.7%, $p = .97$)	Moderate
Peiris et al., 2019 (42), Australia <i>Individualised RCT</i>	Current Aboriginal smokers aged ≥ 16 years old	Recruited ($n=49$) Completed ($n=46$)	Intervention: Android or iOS app comprising a personalised profile and quit plan, text and in-app motivational messages, and a challenge feature allowing users to compete with others Control: Usual cessation support services.	Self-reported continuous smoking abstinence verified by carbon monoxide breath testing 6 months	At baseline, 23/49 (47%) of participants had tried to quit in recent weeks. At 6-month follow-up, only 1 participant (intervention arm) was abstinent.	Moderate

CONTINUE

Table II: Description of included studies. (CONT.)

Authors, country and study design	Population	Sample size	Intervention	Outcome and duration	Findings	Risk of bias
Prochaska et al., 2025 (52)51.5 % male, 60.5 % Inupiat USA <i>Individualised RCT</i>	Alaska Native men and women, ages 19 or older, smoking 5 or more cigarettes daily	Recruited (n=299) Completed (n=240)	Intervention (Group 1): tobacco cessation and physical activity inclusive of – 30-min telemedicine, motivational counselling - Workbook & personal report - Pedometer - Script for 12-wks NRT Control (Group 2): traditional diet and medication adherence promotion – 30-min telemedicine, motivational counselling - Workbook & personal report - Native Cookbook - Medication bag	7-day point prevalence abstinence verified with urine anabasine 18 months	40.5% of participants in the intervention group and 32.5% in the comparison group reduced their smoking by half or more from baseline (no significant difference) - NRT Use: 53.6% of participants in Group 1 used NRT during the trial compared to Group 2 (28.4%), which was statistically significant (OR = 2.92, $p < 0.001$) - Quit Attempts: 70.2% in Group 1 and 63.5% in Group 2, reported making a 24-hour quit attempt during the trial (no significant difference) - By the end of the study, 10.8% of Group 1 and 7.9% of Group 2 reported being biochemically verified as abstinent from smoking, with no significant group effect ($p = 0.325$)	Moderate
Santiago-Torres et al., 2022 (43), USA <i>Individualised RCT</i>	American Indians or Alaska Natives adults	n=165	Intervention: iCanQuit smartphone application – teaches Acceptance and Commitment Therapy (ACT) skills for coping with smoking urges, staying motivated, and preventing relapse Control: QuitGuide smartphone application – US Clinical Practice Guidelines (USCPG)-based smartphone application	- Self-reported 30-day point-prevalence abstinence 12 months	- iCanQuit participants had greater odds of quitting smoking compared with those in the QuitGuide arm: 30% versus 18% at 12 months (odds ratio [OR] = 1.96; 95% confidence interval [CI]: 0.90 to 4.26) 25% versus 11% at 6 months (OR = 2.62; 95% CI: 1.06 to 6.45), 15% versus 6% at 3 months (OR = 2.93; 95% CI: 0.90 to 9.59)	High
Smith et al., 2014 (44), USA <i>Individualised RCT</i>	Adult American Indian/Alaska Native (AI/AN) smokers	Recruited (n=103) Completed (n=44)	Intervention: Culturally-Tailored Treatment (CTT) combining varenicline and innovative cultural intervention components Control: general cessation treatment approach utilised at the MTC	7-day carbon monoxide-verified point-prevalence abstinence (PPA) 6 months	- No statistically significant group differences in 7-day PPA. - The overall ITT abstinence rate at 6 months was 20%; the responder-only rate was 42%	Moderate

CONTINUE

Table II: Description of included studies. (CONT.)

Authors, country and study design	Population	Sample size	Intervention	Outcome and duration	Findings	Risk of bias
Walker et al., 2021 (45) given the high smoking prevalence in this population. Design Pragmatic, open-label, randomized, community-based non-inferiority trial. Setting Bay of Plenty, Tokoroa and Lakes District Health Board regions of New Zealand. Participants Adult daily smokers who identified as Maori or whanau of Maori, were motivated to quit in the next 2 weeks, were aged ≥ 18 years and were eligible for subsidized varenicline. Recruitment used multi-media advertising. Interventions A total of 679 people were randomly assigned (1 : 1, New Zealand	Adult New Zealand Māori and Whānau of Māori smokers aged ≥ 18 years	n= 679	Intervention: 12-week course of cytisineCarbon monoxide-verified continuous abstinence Control: 2-week course of varenicline prescription	12 months	Continuous abstinence rates at 6 months post-quit date: 12.1% for cytisine versus 7.9% for varenicline [risk difference 4.29%, 95% confidence interval (CI) = -0.22 to 8.79; relative risk 1.55; 95% CI = 0.97–2.46] Self-reported adverse events over 6 months occurred significantly more frequently in the varenicline group	Moderate
<i>Individualised RCT</i>						
Wimbish-Tompkins et al., 2024, Urban Native American youth (47) USA	Urban Native American youth ages 10–12	n=100	Intervention: The Urban Talking Circle (UTC) intervention – a culturally tailored co-program developed specifically for urban Native American youth. It is based on the evidence-based Talking Circle Intervention for rural Native American youth. Control: standard education program, which is the drug abuse resistance education (D.A.R.E.) program commonly used within United States school systems	Commercial Tobacco Consumption: measured using the Native American Alcohol Measure for Youth (NAAMY)	Participants who engaged in the UTC intervention showed a significant decrease in commercial tobacco consumption ($p < 0.001$).	Moderate
<i>Quasi-experimental</i>						
Wong et al., 2018 (46), New Zealand	Māori and Pacific Island patients	Recruited (n=68)	Intervention: supportive mobile phone messages, novelty scratch cards to win online prizes and \$1000 prize draw entry following 1 month smokefree + ABC (Ask smoking status, give Brief advice, and refer to/provide Cessation support) Control: ABC	Self-reported smoking status verified with exhaled CO	There was no difference in self-reported quit rates between the intervention and control groups at 1 month (13%) and 3 months (16%). Across all participants, there was an increase in quit rates between 1 and 3 months.	High
<i>Cluster RCT</i>		Completed (n=39)		3 Months		

Assessment of Study Quality

The methodological quality assessment details are available in Fig. 2, Fig 3, Fig 4, Fig 5 and Fig 6. Overall, nine randomised trials (seven individualised and two cluster RCTs) were judged to have a moderate risk of bias. In contrast, the others were in the high risk of bias category (Table 1). The bias occurred mainly in the randomisation process, where blinding among groups was almost impossible for participants, considering the nature of population interventions. We were also unable to ascertain methods for allocation sequence concealment in multiple trials (39–46).

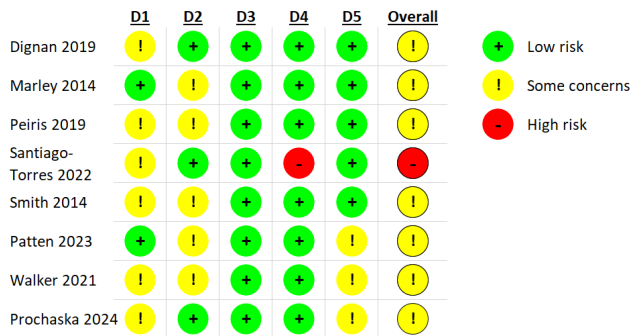


Fig 2: Risks of Bias for individualised RCTs

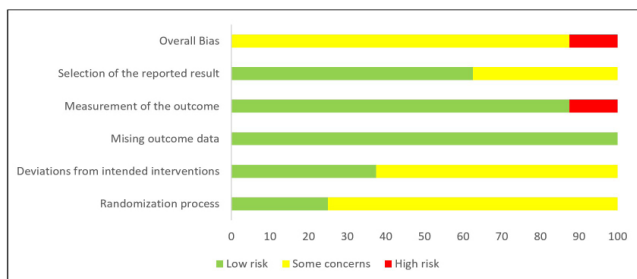


Fig 3: Risk of Bias Summary for Individualised RCTs

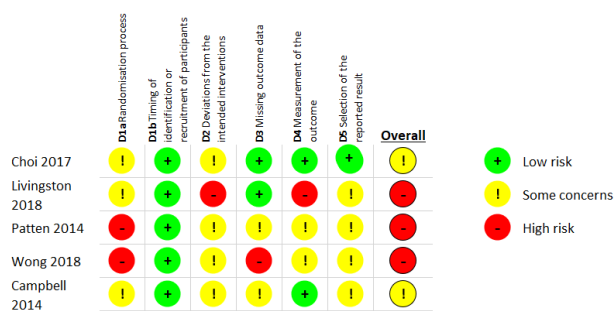


Fig 4: Risk of Bias for Cluster RCT

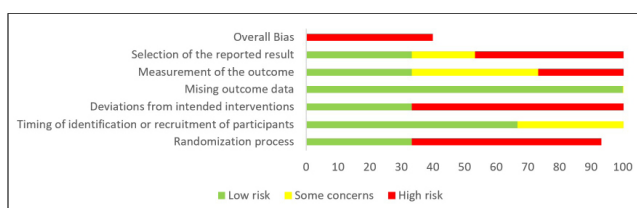


Fig 5: Risk of Bias Summary for Cluster RCT

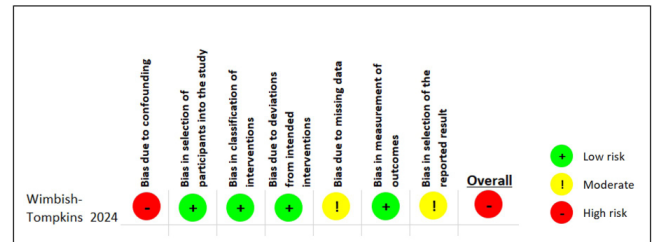


Fig 6 : Risk of Bias for Quasi-experimental Trial

Characteristics of Smoking Cessation Interventions

The reviewed studies explored various combinations of interventions for tobacco cessation, integrating pharmacological, behavioural, cultural, and digital approaches. Table 2 presents a summary of the characteristics of the studies included in this review. A total of 14 studies were identified, with 13 RCTs (eight individualised and five cluster) and a quasi-experimental study. The majority of these studies were conducted in the USA (64.3%), followed by three studies from Australia (21.4%) and two from New Zealand (14.3%). Notably, most of the research targeted Indigenous adults (78.6%), with only three studies involving adolescents (21.4%). The longest duration of study was three years (41), and the shortest was 10 weeks (47). Four studies (41,43,47,48) utilised self-reported smoking behaviours as their assessment methods, while the other ten studies (39,40,42,44–46,49–52) used the bio-verification method. Five themes of smoking cessation interventions were identified during the review: combination therapies, culturally tailored interventions, pharmacotherapy use, telehealth and behavioural change counselling.

Combination Therapies

Among the 14 studies, four individualised RCTs (40,44,51,52) and two clustered RCTs (39,46) utilised combination therapies. Dignan et al. (40) achieved notable success utilising an individualised approach that integrated nicotine replacement therapy (NRT), pre- and post-cessation counselling, and mHealth text messaging, resulting in 61% abstinence at the quit date and 88% abstinence at 18 months. However, the study had a 94% attrition rate, with only 16 participants completing follow-up. Similarly, Choi et al. (39) demonstrated the effectiveness of the All Nations Breath of Life program, which combines pharmacotherapy, culturally tailored educational curricula, and counselling for American Indian smokers. Abstinence rates were higher in the culturally adapted group, highlighting the critical role of cultural tailoring in enhancing smoking cessation outcomes. Focusing also on cultural adaptation, Patten et al. (51) targeted Alaskan Native adolescents by offering culturally specific counselling via a private Facebook group supplemented with self-help materials. While the intervention demonstrated moderate success in achieving short-term abstinence, its long-term impact remained limited.

Similarly, Smith et al. (44) assessed a culturally tailored

intervention combining varenicline with cultural components. While no significant differences in abstinence rates were observed, the study underscored the importance of cultural relevance in enhancing combination therapy acceptability. The study also highlighted that disengagement from treatment was greater than expected. As such, the addition of interventions or procedures to support continued treatment engagement will likely be an important refinement of interventions. On the other hand, Prochaska et al. (52) examined the integration of tobacco cessation with physical activity through telemedicine motivational counselling and NRT. Although biochemically verified abstinence rates did not significantly differ between groups, the study highlighted the potential benefits of lifestyle integration in smoking cessation efforts. Wong et al. (46) tested a novel approach using supportive mobile phone messages, novelty scratch cards, and prize incentives in conjunction with the ABC (ask, brief advice, cessation support) method. Although no differences in quit rates were observed between the intervention and control

groups at 1 month (13%) or 3 months (16%), the overall increase in quit rates between these periods suggested potential benefits of sustained behavioural reinforcement.

Culturally-Tailored Interventions

This review identified four studies as culturally tailored interventions, comprising one individualised RCT, two clustered RCTs and one NRSI. The components of culturally tailored interventions are summarised in Table 3. The outcomes of the individualised RCT (49) revealed non-statistically significant differences in smoking abstinence between the control and intervention groups. Similar results were observed in a clustered RCT study among Alaskan Native adolescents (50). In contrast, one of the clustered RCT studies demonstrated a reduction in smoking behaviour at the study endpoints (48), and participants who underwent the Urban Talking Circle (UTC) intervention in Wimbish-Tompkins et al.'s study (47) demonstrated a statistically significant reduction in commercial tobacco use.

Table III: Details on the culturally tailored intervention components

Study	Intervention
Campbell et al., 2014 (48)	• Intervention developed by: Queensland Health Cairns Public Health Unit (based on three years of consultation with community-based health staff working in Aboriginal and Torres Strait Islander communities in north Queensland) • Components: ○ a school-based education program 'Smokin' No Way' ○ 'SmokeCheck' tobacco brief intervention training for health workers ○ assistance to develop workplace smoke-free policies ○ Event Support Program ○ 'Smoke Rings' support group • Enforcement of tobacco sales legislation
<i>Clustered RCT</i>	
Australia	
Choi et al., 2017 (39)	• Programme: All Nations Breath of Life (ANBL) • Intervention delivered by: American Indian facilitators • Components: ○ in-person, group and telephone counselling ○ a culturally tailored educational curriculum ○ free pharmacotherapy or nicotine-replacement therapy (NRT) • participant incentives (traditional use DVD, American Indian flute music CD, Rez-Robics DVD, water bottles, pedometers, healthy snacks, quit kit, t-shirt, pen, and bracelet).
<i>Clustered RCT</i>	
USA	
Marley et al., 2014 (49)	• Programme: Be Our Ally Beat Smoking (BOABS) • Intervention delivered by: Trained Aboriginal researchers • Components: ○ Usual care: advice regarding quitting, pharmacotherapy, and self-initiated follow-up ○ Face-to-face smoking cessation counselling delivered by Aboriginal researchers ○ monthly smoking cessation peer support group
<i>Individualised RCT</i>	
Australia	
Patten et al., 2014 (50)	• Intervention delivered by: Tobacco treatment specialists, local Alaskan Native (AN) teen advisors and elder speakers • Culturally and youth-specific, written self-help materials for quitting tobacco: • Components: Certified tobacco treatment specialists ○ Group counselling ○ Role play by counsellors and teen advisors ○ Volunteer speakers talk ○ Intra-treatment support by AN elders and teen advisors
<i>Clustered RCT</i>	
USA	

CONTINUE

Table III: Details on the culturally tailored intervention components. (CONT.)

Study	Intervention
Patten et al., 2023 (51) <i>Individualised RCT</i> USA	• Intervention delivered by: Alaska Native Trained Tobacco Specialists • Components: ○ Evidence-based cessation treatments (EBCTs): ▪ referral information by postal mail (printed materials) and e-mail, including information about Alaska's Tobacco Quitline, the availability of free coaching calls and nicotine replacement therapy (NRT) ▪ URL of contact information for their regional Tribal tobacco cessation treatment program ▪ Info on National Cancer Institute's free, population-level, smokefree.gov Web site resources. ○ Access to a moderated, secret (entirely private and non-searchable) Facebook group ▪ conversation starters, questions, and polls on specific topics, posted by moderators • Motivational messages with culturally specific images and videos from the content library and prompted participant comments
Smith et al., 2014 (44) <i>Individualised RCT</i> USA	• Components: ○ Evidence-based counselling session ○ 12 weeks of varenicline ○ Collaborative, community-engaged Culturally-Tailored Treatment (CTT) ▪ Discussion of traditional vs. commercial tobacco use ▪ Cessation booklet culturally tailored for Menominee and Other AI/AN smokers ▪ Stone metaphor ▪ Traditional tobacco pouch • Culturally-tailored relaxation and affirmation CD, "Smoking Cessation – Meditations for Honoring Our Naeqnemaw"
Wimbish-Tompkins et al., 2024 (47) <i>Quasi-experimental</i> USA	• Programme: The Urban Talking Circle (UTC) • Intervention delivered by a counsellor and urban Native American cultural expert • Components: ○ 10-session (50-min each) manual-based Talking Circle intervention ○ The manual integrated cultural concepts of Native-Reliance values in English and local urban Native American tribal languages

Pharmacotherapy

One study (45) investigated the comparative efficacy of varenicline versus cytisine in promoting smoking abstinence within the New Zealand Indigenous Māori population or their extended families (whānau). Adult participants were prescribed a 12-week course of either two weeks of cytisine or varenicline, along with low-intensity cessation behavioural support provided by the prescribing doctor, community stop-smoking services, or a research assistant. The results indicated that the verified continuous abstinence rates did not differ significantly between the two groups. The authors concluded that cytisine demonstrated effectiveness comparable to that of varenicline in supporting smoking abstinence among New Zealand Indigenous Māori or their extended families (whānau), with a notably lower incidence of adverse events. Pharmacologic support for abstinence was also an effective strategy in combination therapy studies by Dignan et al. (40) and Choi et al. (39).

Telehealth

Telehealth broadly refers to all aspects of healthcare and healthcare systems that incorporate telecommunications technology (53). This review included two studies that employed digital interventions for smoking cessation via mobile apps (42,43). In addition, four studies in combination therapies incorporated text messages (40,46), a private social media group (51), and

telecounselling (52) as one of their approaches.

The overall effectiveness of telehealth interventions in smoking cessation varied across the studies. Santiago-Torres et al. (43) compared two different smartphone apps for smoking cessation and suggested that the iCanQuit telehealth intervention resulted in higher odds of smoking cessation than the QuitGuide intervention did (Table 3), with varying quit rates at 3, 6, and 12 months, and only the 6-month rates were statistically significant. Conversely, Peiris et al. (42) featured an Android or iOS app and presented a less favourable outcome, with only one participant (from the intervention arm) achieving abstinence at the 6-month follow-up, despite 47% attempting to quit at baseline.

Behavioural Changes Counselling

The behavioural cessation interventions included counselling interactions with study personnel or healthcare practitioners to promote smoking cessation. These interventions can be administered individually or in groups (22). A community trial involving American Indian high schoolers for alcohol intervention (41) revealed a statistically significant reduction in the use of non-alcoholic drugs over the past 30 days. As indicated in Table 1, students in the CONNECT-only condition reported lower cigarette use than those in the other conditions.

DISCUSSION

To the best of our knowledge, this study represents the initial examination of smoking cessation trials specifically targeting Indigenous populations worldwide. All trials were conducted in high-income countries, including the US, Australia, and New Zealand. Among the 14 studies reviewed, four demonstrated significant differences in smoking abstinence rates (39) or improved smoking behaviour (41,47,48). The remaining ten studies (40,42–46,49–52) did not show significant differences between the intervention and control groups at the study endpoint. However, in a non-significant change observed in a pharmacotherapy trial (45), both medications were proven effective in supporting smoking abstinence among the Indigenous population in New Zealand.

All the culturally tailored studies demonstrated collaborative engagement with tribal communities in the planning and implementation of interventions (39,44,47–51). However, only two of the studies reported significant improvements in smoking abstinence (39) and a reduction in smoking behaviour at the study endpoints (48). Choi et al. (39) suggested that the group counselling format may foster a greater sense of belonging, group cohesiveness, and additional social support, which aligns with similar findings among American Indian populations (54,55). Campbell et al. (48) highlighted the importance of having someone in the community or a community member support the implementation process and ensure confidentiality. This idea aligns with Minichiello et al.'s (56) statement that Indigenous tobacco control interventions should be led by community members, implemented in collaboration with non-Indigenous health workers, and offered through mainstream health services. However, this perspective contrasts with a review by Rusk et al. (22), which suggested that incorporating Indigenous study personnel as counsellors or coordinators did not yield better smoking cessation outcomes than existing best-practice interventions did. However, Rusk et al. also emphasised that collaboration with local communities was the most effective component of culturally tailored smoking cessation interventions.

Walker et al. (45) demonstrated that cytisine was at least as effective as varenicline for smoking cessation among Māori and whānau of Māori, who smoked daily and were motivated to quit. Moderate levels of medication adherence and compliance were noted, highlighting their impact on smoking abstinence rates in the population, although some bias may exist. Previous studies on cessation aid uptake have shown lower use among American Indians than among other racial/ethnic groups (57). However, 80% of American Indian smokers in a study by Choi et al. (39) chose pharmacotherapy or NRT in combination with group sessions (ANBL) or individual counselling (CBP). In addition, Indigenous

groups in studies by D'Silva and Dignan et al. claimed that the most helpful aspect of the programme was access to free pharmaceutical cessation aids (40,58).

The use of telehealth to deliver smoking cessation interventions among Indigenous populations holds promise for reaching otherwise hard-to-reach communities (43). However, despite its potential, most studies reviewed reported no significant associations between telehealth-based social support interventions and smoking cessation outcomes (42,46,51,52). For example, Patten et al. (51) evaluated the use of Facebook groups led by Alaskan Native Trained Tobacco Specialists and found no significant difference in smoking abstinence rates between the intervention and control groups at six months. In contrast, Santiago-Torres et al. (43) reported significantly higher Point Prevalence Abstinence (PPA) rates in the iCanQuit arm compared to the QuitGuide arm at the six-month follow-up. This study also addressed key methodological limitations observed in previous trials, such as high attrition rates and limited geographic diversity (39,40,59). Notably, the study achieved a remarkably low attrition rate of 7% at 12 months (43), whereas earlier studies reported attrition rates as high as 94%. While telehealth has the potential to improve access to affordable smoking cessation interventions, Peiris et al. (42) emphasised that social media applications should be considered as part of a broader strategy to enhance health-related social networks. Furthermore, a review of the Australian government's Tackling Indigenous Smoking and Healthy Lifestyle program (60) highlighted the need for comprehensive, multilevel approaches to effectively support smoking cessation within Indigenous communities.

In evaluating smoking cessation interventions, reliable outcome measures are equally important. Lin et al. (61) suggested that supplementing self-reported measures with biochemical validation is crucial to avoid biased responses in smoking behaviour assessment. While a Cochrane review revealed substantial exaggeration in self-reported quitting compared with biochemical validation (62), Santiago-Torres et al. (43) argued that expert consensus suggested that biochemical verification may be impractical in population-based studies without in-person contact (63). Moreover, previous studies have indicated strong agreement between self-reported and biochemically verified smoking statuses (64,65).

In addition to these methodological considerations, common challenges across all studies included slow recruitment, participant enrollment difficulties, and high rates of loss to follow-up. These challenges have been previously reported in Indigenous populations because of various factors, such as hesitancy to participate, travel constraints, confidentiality concerns, lack of personal experience with the studied disease, scheduling conflicts with events such as holidays or flu seasons,

and insufficient funding (39,46,56,66–69). Historical trauma and negative experiences with past research practices were noted to further impact the recruitment and retention of Indigenous participants in clinical research (22,70–72). Therefore, successful research with Indigenous communities requires a culturally sensitive approach that prioritises cultural safety, fosters respectful and reciprocal relationships, incorporates Indigenous knowledge and practices, and supports local teams through effective communication and sustained engagement (73–75).

This study could be the first review of 14 interventions in the past decade to evaluate the effectiveness of smoking cessation interventions among Indigenous populations worldwide. By avoiding conducting non-evidence-based trials, recognising effective interventions can save resources, including funds, human effort, and time. Owing to unique cultural practices, interventions that are successful in the general population may require adaptation for Indigenous communities. A recent review by Alcantara et al. (76) revealed that effective interventions often incorporate cultural tailoring, early engagement with Indigenous communities, and community-based approaches to implementation.

However, this study was limited by the absence of longitudinal studies focusing on cessation maintenance or long-term tobacco use outcomes. This review also did not assess inter-rater agreement using a statistical measure such as Cohen's kappa (77), which limits our ability to quantitatively confirm the consistency between reviewers during the selection process. However, independent screening and conflict resolution by a third reviewer minimise the potential bias in the study inclusion. Besides that, the categorisation of participants as adolescents or adults was based on the definitions used in the individual included studies. Where age groupings varied, the original classifications were retained as reported, and no re-categorisation was imposed. This approach was chosen to preserve the integrity of each study's context and methodology. Nonetheless, all studies adhered to the World Health Organization (WHO) age ranges for adolescents, generally defined from ages 10 to 19 (78). Additionally, some included studies, such as Campbell et al. (2014) (48), used minimal control conditions, which may have led participants in the intervention group to respond more positively simply because they received more attention or support, rather than because the intervention itself was more effective. Therefore, the findings from such studies should be interpreted with caution, as the observed effects may partially reflect the influence of non-specific treatment effects rather than the specific components of the intervention.

CONCLUSION

This review provides valuable insights into smoking

cessation interventions for Indigenous populations, highlighting both their potential and the challenges they face. While some interventions demonstrated significant improvements in smoking abstinence or behavioural outcomes, particularly those that were culturally tailored and community-driven, many studies showed limited or mixed effectiveness. However, these findings should be interpreted with caution due to factors such as small sample sizes, high attrition rates, and variation in study designs and intervention components. To strengthen the evidence base, future research should prioritise well-designed RCTs with adequate sample sizes and follow-up durations to assess long-term abstinence and relapse prevention. Additionally, implementation studies, co-designed interventions with Indigenous communities, and cost-effectiveness analyses are needed to inform scalable and sustainable solutions. From a policy and practice perspective, these findings highlight the importance of integrating culturally tailored cessation programmes within existing primary care or community health settings, particularly those serving Indigenous populations. Embedding these interventions into local practices and involving the Indigenous community in their delivery could enhance cultural safety, trust, and long-term engagement. This could, in turn, contribute to the broader goal of health equity for Indigenous populations.

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