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**REVIEW**

**A systematic narrative review of the effectiveness of behavioural smoking cessation interventions in selected disadvantaged groups (2010-2017)**

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**Abstract**

**Introduction:** Tobacco remains the key modifiable risk factor for the development of a number of diseases, including cardiovascular disease, cerebrovascular disease, lower respiratory infections, chronic obstructive pulmonary disease, tuberculosis and cancer. Among priority populations, smoking prevalence remains high, smokers tend to relapse more often and earlier and fewer are able to sustain quit attempts. This systematic review provides an update on the literature.

**Areas covered:** Twenty-four randomized controlled trials published from 2010–2017, in English language, were identified after searching on Medline, Ovid, Embase and PsycINFO databases. Studies reported on the effectiveness of smoking cessation interventions among six disadvantaged groups known to have high smoking rates: (i) homeless, (ii) prisoners, (iii) indigenous populations, (iv) at-risk youth, (v) people with low income, and (vi) those with a mental illness. Narrative review and assessment of methodological quality of included papers was undertaken.

**Expert commentary:** There is a growing evidence base of methodologically robust studies evaluating a variety of behavioural smoking cessation interventions for priority populations. Multi-component interventions and those examining behavioural interventions incorporating mindfulness training, financial incentives, motivational interviewing and extended telephone-delivered counseling may be effective in the short-term, particularly for smokers on low incomes and people with a mental illness.

**Keywords:** smoking cessation, review, homeless persons, indigenous populations, low income population, mentally ill, prisoners

## 1. Introduction

In Australia, general adult smoking prevalence has fallen to less than 15%,[1] largely due to substantial advances in tobacco control. However, in priority populations and clinical groups (e.g. those in drug and alcohol treatment) smoking prevalence remains high, ranging from 23% to 92% (9-15). This is a pattern repeated in most high-income countries.[2] Furthermore, tobacco use is increasing in low and middle-income countries.[3]. This disparity in smoking rates between higher and lower socioeconomic groups has increased over time [4], and among certain vulnerable populations, smoking rates have not changed in over 30 years. For example, comparable data from the large-scale Australian Study of High Impact Psychosis (SHIP) shows that smoking prevalence stayed constant from 1998 (65%) to 2010 (67%). [5, 6] Similar patterns are evident in other high-income countries. [2, 3] Many high-income countries have set new national policy goals for reducing smoking in priority populations including people from low socioeconomic backgrounds, indigenous populations, people with mental illness, prisoners and those with substance abuse issues. [7] Smokers in priority populations smoke more cigarettes per day and are more heavily nicotine dependent, than in the general population. [8]

Nearly six million people die from tobacco related disease worldwide each year, and $157 billion in health-related economic losses are directly attributable to smoking. [9] Tobacco remains the key modifiable risk factor for the development of a number of diseases, including cardiovascular disease, cerebrovascular disease, lower respiratory infections, chronic obstructive pulmonary disease (COPD), tuberculosis and cancer. [10] Compared with the general Australian population, the life expectancy of smokers with severe mental illness is 25 years shorter [11]. Smokers with alcohol and other drug (AOD) disorders [12] or who are homeless [13] die around 10 years earlier than the general Australian population. The primary causes for this shorter life expectancy are tobacco-related diseases including cardiovascular disease, cancer, chronic respiratory disease and diabetes [14]. Smoking is the leading cause of avoidable mortality (20%) in Australian Aboriginal and Torres Strait Island and NZ Māori populations [15].

Strong evidence, from as early as Sir Richard Peto's Doctors Study[16] has irrefutably established that stopping smoking has substantial benefits in reducing mortality and morbidity and leads to significant economic savings in health care costs. Other benefits of cessation include personal monetary savings, [17] improved mental health, [18] and reduced stress. [19] For communities and children, exposure to second-hand-smoke is reduced and role modelling smoking behaviour is eliminated. [20] Adult smoking cessation plays a leading role in challenging the social and cultural context of smoking by de-normalising smoking – this is particularly relevant to priority populations where smoking rates are high. [21] Cessation is more effective at preventing uptake of smoking among children than other prevention strategies targeting children. For example, children in households where parents quit smoking have a 40% reduced likelihood of daily smoking. [22]

Tobacco control is the single-most important strategy in the World Health Organization's (WHO) target of a 25% relative reduction in global non-communicable disease (NCD) mortality by 2025. [23] The Lancet NCD Action Group and the NCD Alliance have called for a tobacco-free world 2040. [24] To achieve such an ambitious goal, strong tobacco control policies are required, together with support for people to quit smoking and to remain quit. Despite this, there is little high-quality evidence on smoking cessation treatments in priority populations.[25-27] While most smokers would like to quit [28], those from priority population groups tend to relapse more often and earlier, and are unable to sustain a quit attempt even when provided with current best evidence treatments [29].

This paper is an update of a systematic review [30] of the effectiveness of behavioural smoking cessation interventions among six disadvantaged groups known to have high rates of smoking; (i) homeless, (ii) prisoners, (iii) indigenous populations, (iv) at-risk youth, (v) people on low income and (vi) those with a mental illness. That review included 32 studies from 34 papers that were either randomized controlled trials (RCTs) or clinical controlled trials (CCTs) published between 1997 and 2010. The review found that methodological quality was generally poor with small sample sizes and high rates of attrition, and most failed to report on blinding of participants and assessors. Meta-analysis showed a significant increase in cessation for behavioural support interventions

targeted at low-income female smokers at short-term follow-up [relative risk (RR) 1.68, confidence interval (CI) 1.21–2.33], and behavioural support interventions targeted at individuals with a mental illness at long-term follow-up (RR 1.35, CI 1.01–1.81). Narrative review showed several promising interventions that increased cessation rates at six-months or longer follow-up however, overall, the findings were inconsistent. There were few well-controlled trials on smoking cessation strategies for highly disadvantaged groups, especially among the homeless, indigenous smokers and prisoners. It was recommended that increased sample size and power, and improved methodology were required to conduct worthwhile research in these high-risk groups.

## 2.  Method

### 2.1 Literature search

Medline, Ovid (Medline(R) Epub Ahead of Print), Embase and PsycInfo databases were searched for relevant studies published from 2010 to 2017. The MeSH terms [smoking OR smoking cessation OR smoking prevention OR smoking program OR smok* (cessation OR cease OR quit)] were combined with the following terms using the AND command; [psychotherapy OR counseling OR ((behave*) or (incentive* or self-help or motivation* or counsel*)). These terms were further combined with the following terms using the AND command: prison* OR homeless OR indigenous OR aboriginal OR disadvantaged OR vulnerable OR "drug use*" OR "drug abuse*" OR "substance use*" OR "substance abuse*" OR poverty OR "mental* ill*" OR "mental health" OR depression OR anxiety OR schizophren* OR "at risk" OR socioeconomic* OR socio-economic*. The search was limited to English language and excluded books or books series, conference abstracts, papers, proceedings and reviews, editorials, letters and notes, chapters, comments and dissertations.

### 2.2 Inclusion and exclusion criteria

RCTs evaluating a behavioural smoking cessation intervention with smoking abstinence as an outcome, published between October 2010 and January 2017 were included. To minimize heterogeneity, only studies conducted in in full OECD countries (United States, Canada, Australia, New Zealand, United Kingdom and Western Europe) were included. All types of behavioural

interventions were considered for inclusion and the control or comparison condition could include another behavioural intervention or usual care. Studies that included pharmacotherapy as a component of a behavioural intervention were included if the effectiveness of the therapy was not an outcome. Studies with interventions for multiple health issues, such as cardiovascular disease and smoking, were excluded due to the difficulty of distinguishing the impact of the smoking intervention alone.

## 2.3 Data extraction

One reviewer (AG) assessed itles and abstracts of all identified papers for relevance against inclusion/exclusion criteria. The full text of relevant studies were then assessed against the inclusion and exclusion criteria by two reviewers (AW and BB). Studies that met all criteria were retained for full review. The characteristics of each study including setting, country, participants, gender, age, intervention, follow-up period and study outcome measures were extracted using a data extraction form.

## 2.4 Assessment of methodological quality

Included studies were assessed for methodological quality using the Effective Public Health Practice Project Quality Assessment Tool for quantitative studies.[31, 32] Study quality was assessed by AW and AD, and any disagreements were resolved through discussion. Studies were assessed on six domains: selection bias (the likelihood that participants were representative of the target population and consent rate), study design, control of confounders, blinding (of assessors and participants), data collection methods (the validity and reliability of data collection tools) and withdrawals and dropouts. Each study was given a rating of 'strong', 'moderate' or 'weak' in methodological quality for each domain [31, 32] and an overall global rating: no 'weak' ratings were rated as 'strong'; one 'weak' rating was rated 'moderate'; and two or more 'weak' ratings were rated as 'weak'.

## 2.5 Outcome measures

The primary outcome measure was smoking abstinence six months or longer after starting the intervention. Short-term abstinence at three months or less was also assessed. Biochemically validated

quit rates were preferred to self-reported quit rates, with cotinine confirmed measures (urine or saliva) preferred over carbon monoxide (CO) measures. Seven (7) day point prevalence abstinence (PPA) rates were the preferred outcome measure, although continuous abstinence rates were also used.

## 3. Results

### 3.1 Search results

The initial search yielded 2713 titles, of which 64 relevant articles were retained for further review. A flow chart describing article retrieval is provided in Figure 1. In total, 24 studies reported in 24 separate papers were included in the review. Study populations were all smokers. One study targeted homeless, two targeted prisoners, two assessed Australian indigenous populations, two targeted at-risk adolescents/youth, nine studies included low-income participants and eight studies targeted smokers with a mental illness.

### 3.2 Description of included studies

A detailed description of the included studies is provided in Table 1. Included studies were published between October 2010 and January 2017 in peer-reviewed journals. All studies were RCTs and most were conducted in the community or health centres. Half (12/24) of the studies incorporated some form of pharmacotherapy, either nicotine replacement therapy (NRT; 9 studies), bupropion (2 studies) or nortriptyline (1 study). The majority of studies (17/24) were conducted in the United States of America (USA), four in Australia, and one each in the United Kingdom, Switzerland and France. Of the 24 studies, seven showed significant differences in cessation rates between the intervention and comparison groups however each of the studies used different time points, populations and outcome measures which meant the data were not comparable. Outcomes reported included: carbon monoxide validated quit rates and self-report; carbon monoxide and saliva cotinine; carbon monoxide or peer-report; self-report only; and, carbon monoxide and urinary cotinine.

### 3.3 Methodological quality assessment

Individual ratings for each study against the six methodological criteria and the assigned global rating

are reported in Table 2. Overall, 9/24 studies were rated as having a 'strong' methodological quality, nine (12/24) were rated as 'moderate', and three (3/24) as 'weak'. Attrition rates were relatively low and varied from 29% - 97%, where reported.

### 3.4 Outcome measures

The majority of studies (19/24) used biochemical verification to confirm smoking cessation including carbon monoxide testing (11/19), saliva cotinine (3/19), urinary cotinine (2/19) and three studies using both carbon monoxide and cotinine testing. Three studies did not use biochemical verification and relied on self-report of smoking status. One used biochemical verification (carbon monoxide) but accepted report of abstinence from family or friends if the participant did not provide a sample. Biochemical verification samples were generally collected by trained researchers during study visits, however one study accepted biochemical verification from participants via mail or from home recorders.

### 3.5 Narrative review

#### 3.5.1 Homeless smokers

One study recruited participants from transitional housing and homeless shelters [33]. *Okuyemi et al [33]* used an intervention of six sessions of motivational interviewing counselling focusing on increasing adherences to NRT and motivation smoking cessation. The control group received one session of brief advice to stop smoking. All participants received 8-weeks of NRT patches. No significant difference was found between the groups (9.3% versus 5.6%, p=0.15).

#### 3.5.2 Indigenous smokers

Two studies recruited indigenous Australians smokers [34, 35]. Marely et al [34] examined the impact of tailored intensive smoking cessation counselling during face-to-face visits (up to 12 visits over 12 months) on top of usual care with indigenous Australians recruited from two remote Aboriginal health care settings. The visits included motivational interviewing, dealing with smoking triggers, smoking actions plans and referrals for pharmacotherapy. The control group received routine

smoking cessation care from the local primary health care service. While smoking cessation was higher in the intervention group, it was not significantly different (11% versus 5%, p=0.13). Eades et al [35] recruited pregnant Aboriginal and Torres Strait Islander women from three community-controlled health services. Participants were randomized into two groups: a high-intensity quit-smoking intervention in which they received tailored advice and support from health care workers, and a usual care group. Follow-up measures were taken between 36 weeks gestation and delivery. There was no difference between intervention and control groups in self-reported smoking status, which was further validated by urinary cotinine measurements (p=0.212). The authors reported significant contamination of the intervention across groups, which may account for some of the outcome. Additionally, the authors acknowledged the study was underpowered to detect the differences observed between groups (89% in the intervention vs 95% in the comparison group).

### 3.5.3  Prisoners

Two studies, one in the USA [36] and one in Australia [37], recruited participants from correctional institutions. Cropsey et al [36] used participants who were part of the criminal justice system but lived in the community. All participants were provided with 12-weeks of bupropion and brief cessation advice by a psychiatrist that were consistent with smoking cessation guidelines. The intervention group then received four weekly sessions (20-30 minutes) of counselling focused on cognitive and behavioural strategies for smoking cessation. These participants also received a workbook and homework to refer to between sessions. The control group only received the bupropion and initial cessation advice. Participants received financial compensation for each visit, with the intervention group receiving up to $270 however, this was reimbursement for time and not viewed as incentive to quit. There was no significant difference in cessation rates between the two groups (9.3% versus 9.5%, p=0.92).

Richmond et al [37] recruited inmates from 17 prisons across two states of Australia. All participants received a 10-week tapering dose of NRT patches, brief CBT and access to quitline, while the intervention group additionally received a tapering dose of nortriptyline (NOR) over this period.

There was no significant difference between the groups at the three, six or 12-month time points. However, the authors noted that the participant cessation rates were comparable to the general community, and that most participants in both groups reduced smoking by at least half compared to their baseline levels.

### 3.5.4    Youth

Two studies targeted youth smokers. One study recruited young adult smokers who were also binge drinkers from USA community colleges [38] and another recruited Alaskan native adolescent smokers from eight Alaskan villages [39].   Pattern et al [39] provided all participants with culturally and youth-specific written self-help for quitting smoking.  Four villages were randomly assigned to an intervention consisting of a weekend of group-based counselling involving sessions on tobacco use, triggers, coping strategies and prevention of relapse, along with cultural social activities to engage the participants. This was followed up with five weeks of newsletters.  Four control villages received the written material only.  Davis et al [38] conducted a pilot study recruiting participants from local community colleges.  Participants were randomised to either Mindfulness Training for Smokers which involved mindfulness meditation, compared to Interactive Learning for Smokers in the control group which incorporated walking.  All participants received reading material and a full day Quit Retreat which involved intensive instructions of the interventions. Neither Davis et al (20.0% versus 4.0%, p=0.08) nor Pattern et al (10% versus 0%, p=0.15) demonstrated significant difference in cessation rates. Both studies were limited by small sample sizes.

### 3.5.5    Low Socioeconomic Status

The nine studies with participants from low socioeconomic backgrounds were recruited from a variety of settings, including online, [40-44] primary health care practices, [45, 46] an urban 'safety net' hospital, [47] and Salvation Army sites [48].  The interventions were varied with two using mindfulness training [42, 43], two using motivational interventions [41, 46] and others using financial incentives [44], brief counselling [48], proactive outreach [45], DVD with smokers' stories [47], and a website [40].  Four studies showed significant differences in cessation rates for their intervention

groups [42, 44-46]. Davis et al [42] compared mindfulness training to a control group given access to a phone quit line and found a significant difference in abstinence between groups (38.7% versus 20.6%, p=0.05) at four and 24 weeks. Etter et al [44] using financial incentives, found a significant difference between the intervention and control group for rates of continuous abstinence between months 6 and 18 (9.5% versus 3.7%, p=0.001). Rates of 7-day abstinence were also significantly higher in the incentive group at 3 months (54.9% versus 11.9, p=0.001), 6 months (44.6% versus 11.1, p=0.001) and 18 months (18.2% versus 11.45, p=0.006).

Fu et al [45] used a large sample (2406) of people attending publically funded health care programs for low-income populations. The intervention group was provided with access to free NRT and intensive, telephone proactive behavioural counselling and a quit smoking manual. The primary outcome of six months prolonged abstinence was significantly higher in the intervention group (16.5% versus 12.1%, p=0.006). However, this was based on self-report with no bio-verification. Haas et al [46] used a similar design with an intervention of telephone counselling and free NRT for six weeks for participants with low incomes versus usual care for the control group. Participants in the intervention group had a significantly higher likelihood of reporting they had quit smoking than the control (17.8% versus 8.1%, p=0.001) however this was not biochemically verified.

### 3.5.6 *People with a mental illness*

Eight (8/24) studies recruited participants with mental health issues.[49-56] Diagnoses included depression, severe mental illness, acute psychiatric diseases including schizophrenia, schizoaffective disorder and bipolar disease, and post-traumatic stress disorder. Most studies recruited from outpatient health centres [49, 50, 54, 56] (4/8) or hospital inpatients [52, 53, 55] (3/8) with one (1/8) recruiting from a YMCA [51]. The interventions included: multifaceted behavioural versus supportive group (control); exercise and counselling plus smoking cessation plan versus smoking cessation plan; exercise versus education - all participants received behavioural cessation counselling and NRT; motivational cessation with NRT versus usual care; phone counselling versus a quit line; motivational interviewing versus interactive education; motivational cessation intervention with psychological and

pharmacological support versus usual care; and a four arm study with contingency management versus reinforcement with or without BUP (versus placebo).

Three studies demonstrated significantly higher levels of abstinence among intervention versus comparison groups. Rogers et al. found participants receiving specialised telephone counseling were more likely to report 30-day abstinence at six months than participants in the quitline control group (26% vs 18%, $p<0.05$) [53]. Stockings et al. found that participants receiving self-help materials and a motivational interview upon discharge,coupled with a 12-week course of NRT and telephone counselling over a four month period, had significantly higher 7-day PPA at four months compared to those receiving routine inpatient care only. However, significant differences were not detected at the one-week, two or six-month follow-up timepoints [55]. Finally, Prochaska et al. demonstrated significantly higher 7-day PPA at three months (13.9% vs 3.2%), six months (14.4% vs 6.5%) and 18-months (20% vs 7.7%) (all $p<0.05$) when participants received a computer-delivered tailored motivational program (repeated at three and six months) together with a cessation counseling session and a 10-week course of NRT [52].

## 4. Discussion

Of the priority populations assessed in this review, there were more studies conducted that targeted people with a mental illness and low-income individuals. These studies included a range of approaches that had significant impact in increasing smoking abstinence among people with a mental illness. Of the five studies that demonstrated significant effect, three utilized multi-component interventions (1. Online program + NRT + smoking cessation advice [52]; 2. Motivational interview + printed materials + 12-weeks NRT supply + 4-months telephone counseling [55]; 3. Contingency management + bupropion [56]), while the other two studies used single strategies (4. Enhanced telephone counseling [53]; 5. Motivational interview [54]). Not all studies listed cessation as their primary outcome; one examined an increase in quit-related behaviour (quit attempt) [54] and another aimed to reduce CO and cotinine biochemical verification measures over time [56]. The variety of outcome measures may reflect a recognition of the need for harm reduction approaches among

particularly vulnerable groups.

Of the nine studies conducted among low-income populations, four demonstrated significant impact on increased abstinence [42, 44-46], while one significantly increased help-seeking behaviour (calls to quitline) [48]. Of the four studies targeting abstinence, one study utilized a mindfulness training course coupled with NRT [42], one used financial incentive [44], one used telephone counseling along with NRT and tailored mail-outs [45], while the other employed telephone counseling alone [46]. All demonstrated effects at six-month follow-up time-points and beyond suggesting that behavioural interventions incorporating mindfulness training, financial incentives, and extended telephone delivered counseling may be effective for this group.

A smaller number of studies was conducted among the other high priority groups included as part of this review. Two studies apiece were conducted with indigenous smokers [34, 35], at-risk youth [38, 39] and those in prison [36, 37]. Only one RCT conducted with homeless smokers was identified [33]. This pattern of study numbers is reflective of the previous review, which also identified higher numbers of studies conducted with low-income smokers and individuals with a mental illness. This pattern may be due to the difficulty in recruiting and engaging other groups. Particularly among mental health settings, there has been a recent effort to implement smoking policy and care within services.

In terms of intervention types trialed, half of all studies included pharmacotherapy as part of the intervention. Pharmacotherapy was never used alone but generally coupled with some form of face-to-face counseling or telephone contact. Of the 12 studies using pharmacotherapy, nine opted for traditional forms of NRT [33, 35, 41-43, 45, 51, 52, 55], two used bupropion [36, 56] and one trialed the use of nortriptyline [36]. No studies trialed varenicline, even though Cochrane reviews indicate that when combined with behavioural counseling, varenicline is equally as effective as NRT, and both of which are more effective than burpropion [57].

Two studies, both with conducted with participants with mental illness, trialed exercise group interventions [50, 51] however neither study found significant effect. Three studies employed financial incentives [44, 49, 56]. When combined with cessation support and education, incentives were successful in increasing continuous abstinence among low-income smokers over multiple follow-up periods (OR: 2.72; between-group difference in quit rates: 5.76%) [44]. While another study combined the use of financial incentives with burpropion among people with mental illness and found EC condition achieving significantly more smoking abstinence during weeks 3–12 than those in the EN condition (46.7 and 23.5% abstinent samples, respectively) [55]. Four studies successfully used telephone counseling (26% vs 18%, OR=1.62, 95% CI=1.24, 2.11), (16.5% vs 12.1%, OR 1.47, 95% CI 1.12 to 1.93), (17.8% vs 8.1%; odds ratio, 2.5; 95%CI, 1.5-4.0), (11.5% vs 2%, $OR = 6.46$, $p = .01$). [44,45,52,54]. Two studies implemented tailored online programs (one effective with significantly higher 7-day PPA at 3 months (13.9% vs 3.2%), 6 months (14.4% vs 6.5%) and 18-months (20% vs 7.7%) [51], the other not [39]) Another study used DVDs containing personal quit stories of smokers but with no effect [47].

The methodological quality of the studies was significantly higher than those identified in the Bryant et al. [30] review. The majority of studies were rated as either strong or moderate for quality and only three (3/24) were rated as weak. The most common area of weak quality was the lack of information regarding blinding of participants, researchers and assessors. The rise in methodological quality is probably the result of more stringent requirements for studies and the competition for publication.

In just over six years, there have been a large number of RCTs examining the impact of behavioural interventions on smoking cessation in vulnerable populations. The number included in this review, 24 studies, was comparable to the number found in any time before October 2010. This reflects the recognition of the high rates of smoking in these populations and the need to find effective strategies of addressing this health concern. While this increase in research shows progress since the 2011 Bryant et al review, there is still a gap in knowledge of which interventions are most effective. Significantly more research is needed to answer the critical questions in this area. It is unclear whether

interventions need to be tailored to priority population, or if they are generalizable across all priority populations. For example, are interventions that are effective for people with a mental illness also be effective for Indigenous people? It is also unclear whether existing smoking cessation approaches with evidence of effectiveness in the general population are effective for smokers in priority populations or whether novel targeted interventions need to be developed and trialed. The mixed results observed in this review suggests that novel targeted approaches are needed as well as increasing the reach of existing evidence based smoking cessation interventions.

### 4.1 Implications

The large number of trials conducted since the previous review is encouraging. Of the 24 studies included in this review, nine demonstrated significant effect, most measured as 7-day point prevalence abstinence at short-term follow-up. It continues to prove difficult to effect long-term abstinence among high priority and disadvantaged groups, although a variety of approaches assessed in this review show promise. Further research that addresses the barriers to sustaining cessation for smokers attempting to quit in priority populations is needed. Barriers such as the social context and environment of smoking, as well as heavy nicotine dependence, and low reported social support for quitting lead to disproportionately high relapse rates [58]. Notably, few of the studies in this review incorporated intervention components which may have addressed these barriers such as long-term and combination NRT and other forms of pharmacotherapies to address dependence to nicotine, and social support buddies, community-based or peer-based interventions to address the lack of social support and environmental factors. These elements deserve greater attention and testing in future trials.

Most studies conducted with these hard-to-reach and engage groups continue to be hampered by small sample sizes, which impacts the ability to measure effect. Future research should strive to undertake large-scale RCTs. This is difficult, but may be achieved by partnering with industry or community-based sector organisations to gain the access and reach needed for well-powered trials. This type of recruitment is beginning to happen, with most study samples recruited through healthcare or social/community service settings.

*4.2 Limitations*

A meta-analysis would provide a higher level of evidence than a narrative review. However, the wide range of heterogeneous interventions, populations, outcomes and measurements prohibited pooling and meta-analysis in this review. There are disadvantaged populations with high prevalence rates of smoking not included in this review, such as Lesbian, Gay, Bisexaul and Transexual (LGBT) and People Living with HIV (PLWH). These groups should be included in future reviews.

## 5. Conclusions

There is a growing evidence base of methodologically robust studies evaluating a variety of behavioural smoking cessation interventions for priority populations. Multi-component interventions and those examining behavioural interventions incorporating mindfulness training, financial incentives, motivational interviewing and extended telephone delivered counseling may be effective in the short term, particularly for smokers on low incomes and those with a mental illness. Mental health may improve when people quit smoking. Helping people with mental illness find alternative ways of coping may be an important element of smoking cessation in this group. In order to achieve sustained abstinence in smokers in priority populations, further research is needed with interventions that address barriers such as long-term and combination use of NRT and other forms of pharmacotherapies, social support buddies and community-based or peer-based interventions.

## 6. Expert Commentary

The World Health Organization's Framework Convention on Tobacco Control provides structure and strategies for addressing the "tobacco epidemic". Fifty years of progress since the first Surgeon General's report on smoking and health have resulted in significant advances in tackling tobacco in high-income countries, saving eight million lives globally. Countries like Australia lead the world in the development of tobacco control policies, provision of treatments and assistance to quit. Generally, quitting without any assistance results in 2-3% of successful sustained abstinence at 12 months follow-up. Even brief advice from a health professional can double that rate, and behavioural

counselling together with combination NRT (fast-acting plus sustained release) can increase smoking cessation by to up to 35%. Behavioural counselling can be delivered through individual face-to-face counselling sessions, group counselling, online programs, or telephone Quitlines, all with Cochrane-level evidence of effectiveness. Research shows that smokers from disadvantaged populations make as many quit attempts as smokers from more advantaged groups, but they less success in  converting a quit attempt into sustained abstinence. There is an urgent need for the development of effective smoking cessation for smokers in disadvantaged groups. There is also an urgent need to improve delivery of evidence-based smoking cessation care in settings with reach into populations that have high smoking prevalence, such as community social services, mental health services, drug and alcohol treatment centres, and Aboriginal Medical Services. Until very recently, health systems have supported smoking among people within mental health facilities, substance use treatment centres and homeless shelters, by using cigarettes to strengthen therapeutic bonds, to relieve boredom in the absence of other care options, and as a reward; while smoking cessation support was rarely provided.

Research in this field is critically important to increaseour understanding of why disadvantaged smokers find it more difficult to quit, and to design effective smoking cessation interventions. We are just beginning to understand why smokers in disadvantaged groups do not achieve sustained abstinence, how best to reach priority population smokers with existing evidence-based treatments, and what targeted interventions are most effective at achieving smoking cessation in priority populations. The next five years should bring significant developments in answering these questions. The ultimate goal is to reduce smoking prevalence rates in disadvantaged populations.

Disadvantaged groups are those who experience multiple, overlapping problems, such as unemployment, poor health and inadequate education, which limit their ability to participate meaningfully in society. Disadvantaged groups include people living with mental illness and substance use disorders, people who are socioeconomically disadvantaged, Indigenous peoples, and people experiencing physical comorbidities. Our research shows that barriers to staying smoking free for a range of disadvantaged groups includes heavier nicotine dependence, more cigarettes smoked

per day, lower self-efficacy, lower use of evidence-based cessation aids including pharmacotherapies, pro-smoking social contexts and networks, stress and financial stress, and cultural factors. Designing effective behaviour change interventions means addressing these comorbidities and complex needs.

While smoking cessation is important, for smokers who repeatedly attempt to quit, but have trouble sustaining abstinence, tobacco harm reduction approaches must be considered. Long-term use of nicotine replacement therapy, alternative forms of nicotine products, such as vaporised nicotine, and reductions in smoking, are strategies that deserve increased consideration in disadvantaged groups. Tobacco harm reduction approaches not only reduce tobacco related harm to the smoker, but to those people closest to the smoker.

## 7. Five-year View

Significant progress will be made in decreasing smoking rates among disadvantaged groups in the next five years. This review shows that the number of trials conducted in this field has grown substantially in the seven years since 2010. The evidence base on what is effective and what is not effective, is growing and this will shape the development of multi-component smoking cessation interventions for smokers in disadvantaged groups. The results of this review suggest that more research is needed into novel targeted approaches tailored for these populations. This includes the use of vaporised nicotine to address heavy nicotine dependence. More studies testing pharmacotherapies such as varenicline, cytisine, bupropion in conjunction with behavioural support should also be conducted in these priority groups. Addressing the support structures of these groups is imperative to change their ability to cope with external stressor without tobacco. This should include peer-based interventions to address low social support and more intensive cognitive and behavioural strategies to address low self-efficacy. At a community level, we need to involve care settings for many of these priority groups, such as mental health facilities, and training staff and address the cultural barriers in these setting to the delivery of tobacco dependence treatment.

Tobacco harm reduction approaches also need more testing with priority populations. One likely

mechanism for the lower success rates in disadvantaged populations is the combination of many stressors, few resources and a paucity of other rewards in their lives, making the transitory 'pleasures' of smoking and the challenges of nicotine withdrawal more salient. For those who find 'loss of smoking' is too great, tobacco harm reduction approaches, such as switching to non-smoked nicotine products, should be considered. We accept some find this approach challenging, but it requires objective consideration and testing with priority populations. Australian research shows that vaporised nicotine products are acceptable to smokers from priority populations. Data from a New Zealand trial of vaporised nicotine for smoking cessation suggests that for people with mental illness and for Indigenous Māori, vaporised nicotine may be at least as effective and safe as nicotine patches.

In 2015, Public Health England and other UK medical bodies estimated that E-cigarettes are 95% less harmful than combustible cigarettes. This figure comes from research undertaken in 2014 by the Independent Scientific Committee on Drugs using a Multi Criteria Decision Analysis (MCDA) model to estimate the relative harm of using different types of nicotine-containing products. In this study, an International Expert Panel defined 14 harm criteria and scored all identified nicotine-delivery products on each criterion about their average harm (to both users and others) using a scale of zero (no harm) to 100 (most harmful). On this basis, combustible cigarettes emerged as the most harmful nicotine-containing product (scoring 100), while e-cigarettes were judged to be far less harmful (scoring 4).

**Key issues**
- Tobacco remains the key modifiable risk factor for the development of a number of diseases, including cardiovascular disease, cerebrovascular disease, lower respiratory infections, chronic obstructive pulmonary disease, tuberculosis and cancer.
- Among priority populations and clinical groups (e.g. homeless persons, prisoners, indigenous populations, at-risk youth, people with low-income, and those with a mental illness) smoking prevalence remains high and these smokers tend to relapse more often and earlier and fewer are able to sustain quit attempts.

- In the past six years, there has been an increased focus on this area of research, with a large number of methodologically rigorous RCTs examining the impact of behavioural interventions on smoking cessation in vulnerable populations. However, significantly more research is needed, for example it is still unclear whether interventions need to be tailored to priority populations, or whether they are generalizable across all priority groups.

- Multi-component interventions using pharmacotherapy and those examining behaviour interventions incorporating mindfulness straining, financial incentives, motivational interviewing and extended telephone-delivered counseling may be effective in the short-term, particularly for smokers on low incomes and people with a mental illness.

**Declaration of Interest**

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

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